$PM_{2.5}$ SIP Evaluation Report – Kennecott Utah Copper LLC-BCM and Copperton Concentrator

UTAH $PM_{2.5}$ SERIOUS SIP

Salt Lake City Nonattainment Area

Utah Division of Air Quality

Major New Source Review Section

July 1, 2018

DAQ-2018-007709

$PM_{2.5}$ SERIOUS SIP EVALUATION REPORT
KENNECOTT UTAH COPPER LLC-BCM & COPPERTON CONCENTRATOR

1.0 Introduction

The following is an updated version of the original RACT evaluation that was completed on October 1, 2013 as a part of the Technical Support Documentation for Section IX, Parts H.11, 12 and 13 of the Utah SIP; to address the Salt Lake City $PM_{2.5}$ and Provo, Utah $PM_{2.5}$ Nonattainment Areas.

1.1 Facility Identification

Name: Kennecott Utah Copper LLC (KUC)
Address: 8362 West 10200 South
Bingham Canyon, UT 84006
Owner/Operator: Rio Tinto/KUC
UTM coordinates:
402,500 m Easting, 4,486,500, m Northing, UTM Zone 12 (Bingham Canyon Mine)
406,850 m Easting, 4,493,100, m Northing, UTM Zone 12 (Copperton Concentrator)

1.2 Facility Process Summary

Kennecott Utah Copper LLC (KUC) owns and operates the Bingham Canyon Mine and the Copperton Concentrator. The Bingham Canyon Mine (BCM) is an open pit mining operation located in the southwest corner of Salt Lake County, Utah. Ore from the mine is conveyed to the Copperton Concentrator located approximately five miles north of the open pit in Copperton, Utah where it is ground and treated to produce copper concentrate solution.

The ore and waste rock at the BCM are transferred from the mining areas to other areas of the mine through a series of transfers using haul trucks and conveyor belts. Ore is transferred to the in-pit crusher with haul trucks from the shovel face and waste rock is hauled to dumping areas with haul trucks. After the ore is crushed it is transferred to the Copperton Concentrator by conveyor belts. Once the ore is processed at the concentrator, it is transferred to the smelter.

The Bingham Canyon Mine operates under Approval Order (AO) DAQE-AN105710042-18 issued January 10, 2018. Under the 1990 Clean Air Act the BCM and the Copperton Concentrator constitute an area source and are not a major Title V source. The Copperton Concentrator operates under the AO DAQE-AN105710035-13 issued on June 25, 2013. The BCM is subject to 40 CFR 60 Subpart A- General Provisions, 40 CFR 60 Subpart LL - Standards of Performance for Metallic Mineral Processing Plants and 40 CFR Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants. The emergency generators are subject to 40 CFR 60 subpart IIII, 40 CFR 60 subpart JJJJ and 40 CFR 63 subpart ZZZZ. The Copperton Concentrator is subject to 40 CFR 60 Subpart A- General Provisions, 40 CFR 60 Subpart LL - Standards of

Performance for Metallic Mineral Processing Plants.

1.3 Facility 2016 Baseline Emissions

Site-wide 2016 Actual Emissions (tons/yr) for BCM and Copperton Concentrator

$PM_{2.5}$	NO_x	SO_2	VOC	NH_3
247.58	3,899.26	2.66	193.98	1.79

1.4 Facility Criteria Air Pollutant Emissions Sources

Emission Unit	Potential to Emit				
	$PM_{2.5}$	NO_x	SO_2	VOC	NH_3
BCM					
Point Sources	3.04	4.17	0.0002	0.20	
Other Fugitive Sources	36.69			11.30	1.65
Haulroad Fugitives Inside Pit	60.18				
Haulroad Fugitives Outside Pit	48.05				
Mobile Sources	220.79	5,829	6.56	302.43	
Copperton Concentrator	13.86	10.66	0.10	4.04	0.10

<u>BCM</u>

The following emission units are not source specific. A separate BACT analysis has been conducted on these common emission units. The technical support for these sources is in the $PM_{2.5}$ Serious SIP – BACT for Small Source document ("PM2.5 Serious SIP – BACT for Small Sources.," 2017).

Disturbed Areas
Gasoline Fueling
Cold Solvent Degreasing Washers
Conveyor Transfer Points
Lime Bins
Sample Preparation Baghouse
Propane Communications Generators
Storage Piles
Diesel-Fired Emergency Generators (size)
Screens

Copperton Concentrator

The following emission units are not source specific. A separate BACT analysis has been conducted on these common emission units. The technical support for these sources is in the $PM_{2.5}$ Serious SIP – BACT for Small Source document (“PM2.5 Serious SIP – BACT for Small Sources.,” 2017).
Lime and Molybdenite Storage Bins
Closed-circuit fluid cooling towers
Molybdenite Bag Loading
Vacuum Cleaning System with Baghouse
Ore Sorting Plant with Ore Sorting Baghouse and Sample Preparation Baghouse
Metallurgical Laboratory with Two Baghouses
Cone crusher and size screen for feed preparation
Conveyor belts
Degreasing Parts Washers
Gasoline Fueling Stations
Two Lime Bins
Three Storage tanks
One Liquid Propane-fired Emergency Generator
Natural gas-fired equipment including water heaters or comfort heaters that are each individually rated at less than 5 MMBTU/hr

2.0 BACT Selection Methodology

The general procedure for identifying and selecting BACT is through use of a process commonly referred to as the “top-down” BACT analysis. The top-down process consists of five steps which consecutively identify control measures, and gradually eliminate less effective or infeasible options until only the best option remains. This process is performed for each emission unit and each pollutant of concern. The five steps are as follows:

1. Identify All Existing and Potential Emission Control Technologies: UDAQ evaluated various resources to identify the various controls and emission rates. These include, but are not limited to: federal regulations, Utah regulations, regulations of other states, the RBLC, recently issued permits, and emission unit vendors.

2. Eliminate Technically Infeasible Options: Any control options determined to be technically infeasible are eliminated in this step. This includes eliminating those options with physical or technological problems that cannot be overcome, as well as eliminating those options that cannot be installed in the projected attainment timeframe.

3. Evaluate Control Effectiveness of Remaining Control Technologies: The remaining control options are ranked in the third step of the BACT analysis. Combinations of various controls are also included.

4. Evaluate Most Effective Controls and Document Results: The fourth step of the BACT analysis evaluates the economic feasibility of the highest ranked options. This evaluation includes energy, environmental, and economic impacts of the control option.

5. Selection of BACT: The fifth step in the BACT analysis selects the "best" option. This step also includes the necessary justification to support the UDAQ's decision.

Should a particular step reduce the available options to zero (0), no additional analysis is required. Similarly, if the most effective control option is already installed, no further analysis is needed.

The final BACT evaluations for the Kennecott BCM and Copperton Concentrator sites were performed using data that Kennecott submitted,(CH2M, 2017), (CH2M, 2018) comments received from Techlaw on the Kennecott RACT submittal, comments received from EPA, comments received from the public, AOs, Title V permit, and research of available data bases including but not limited to RBLC, CARB, sources in nonattainment areas and air regulatory agencies that regulate sources in their jurisdiction.

2.1 Emission Unit (EU) and Existing Controls

<u>Bingham Canyon Mine (BCM)</u>

2.1.1 In-pit Crusher

<u>Description:</u>

The crusher is used to crush rock containing copper ore mined at the BCM. Particulate emissions that result from the in-pit crusher are currently controlled with a baghouse.

<u>Emissions Summary:</u>

The $PM_{2.5}$ potential to emit (PTE) emissions for the crusher are 2.28 tons per year.

Pollutant [$PM_{2.5}$]

The existing baghouse for the crusher is permitted at a grain loading of 0.016 grains per dry standard cubic feet (gr/dscf). KUC investigated the options of either upgrading the filter system in the baghouse or replacing the baghouse.

<u>Control Options:</u>

Baghouse (fabric filter)
Enclosures with water sprays

Technological Feasibility:

The search of databases identified specific emissions control information for copper ore crushers. Databases identified baghouses (fabric filter) and enclosures with water sprays as possible control technologies for limiting emissions from crushers. The databases did not provide needed information on copper ore crushing but they did contain information on rock crushers and the material crushed by the In-pit crusher contains less than 1% copper. Therefore, a comparison of rock crushers and ore crushers using a baghouse grain loading will be used.

Fabric filtration is the predominant control option for abatement of particulate emissions (PM, PM_{10}, $PM_{2.5}$) from any crushing application. Other particulate control options are not considered as effective as a baghouse that can control in excess of 99% of emissions.

The existing baghouse for the crusher is permitted at 1.77 lb/hr with a grain loading of 0.016 grains per dry standard cubic feet (gr/dscf). Based on the review of databases, KUC found small baghouses with the grain loading of 0.002 gr/dscf to 0.003 gr/dscf. Using the most stringent emissions rates, KUC requested vendor (CH2M, 2017) information on baghouse upgrades to meet the 0.002 gr/dscf grain loading. Based on the grain loading of the upgraded baghouse, $PM_{2.5}$ emissions from the crusher would be reduced from 2.28 tpy after the primary control to 0.28 tpy. This is a 2.0 tpy reduction in $PM_{2.5}$ emissions.

KUC is required to stack test the existing baghouse every three years (Condition II.B.1.a,b of Approval Order DAQE-AN105710042-18). The stack test results are as follows:

Year stack test was performed	Results lb/hr	Grain/dscf
2015	0.02	0.0001
2012	0.03	0.0002
2009	0.05	0.001
2006	0.11	0.001
2003	0.04	0.001
2000	0.164	0.0031

UDAQ research revealed Arizona DEQ requires the Rosemont Copper Company to replace the primary crusher control equipment with a baghouse. The cartridge filter baghouse controls the primary crusher emissions by 99.99% (Balaji Vaidyanathan, 2013).

All identified control technologies are technically feasible.

Economic Feasibility:

Based on the data provided by the vendors, the total installed costs for the upgraded baghouse would be about $608,000, this is $30,400 per year over a 20-year period. Based on the costs for the baghouse replacement and a 2.0 tpy reduction in $PM_{2.5}$, the cost per ton of $PM_{2.5}$ removed would be $15,200 per ton. Therefore, replacing the crusher baghouse is economically feasible at this time.

BACT Selection:

The replacement of the baghouse with an emission limit of 0.002 gr/dscf and 0.18 lb/hr was considered by the UDAQ as a BACT selection.

In response to the proposed BACT selection, KUC proposed a limit of 0.30 lb/hr (Cassady Kristensen, 2018). After further evaluation this initial proposal was then revised to a proposed limit of 0.78 lb/hr* (Steve Schnoor, 2018).

*Note: This change was made due to the rates of crushed ore loaded onto the conveyor belt which creates an up-flow air stream which increases the loading on the bags with heavy particles and impacts its overall performance. Airborne coarse dust from the operations as well as from the surrounding area also impact the performance of the baghouse and overall outlet grain loading. KUC was also unable to secure a vendor guarantee for the initial proposed $PM_{2.5}$ emission limitation.

Implementation Schedule:

KUC can currently meet the proposed 0.78 lb/hr of $PM_{2.5}$ limitation.

Startup/Shutdown Considerations

The In-pit crusher is designed to operate on a continuous basis. The operations are in shutdown or startup modes during scheduled maintenance, and site-wide shutdowns.

2.1.3 Waste Rock Offloading from Trucks

Description:

The act of mining involves the excavation of rock containing valuable minerals. This rock is known as ore. To access and excavate ore, sources must move and store or dispose of rock that does not contain economic mineral values. This rock is known as waste rock. (US Epa, 1995)Waste rock consists of mon-mineralized rock removed from above or within the ore body during extraction activities. Waste rock includes granular, broken rock and soils ranging in size from fine sand to large boulders, with fines content largely dependent on the nature of the formation and methods employed during mining.

Waste rock is produced at mines as a byproduct of excavating an identified economic mineral deposit. Mines design their open pit and underground operations to provide the most cost effective means for recovering the ore. Since removed waste rock is transported to location for disposal, mines attempt to limit the amount of waste rock removed as economically as possible. Haul trucks dump waste rock or overburden at the BCM waste rock disposal areas 24 hours per day.

Large-scale open pit mines move hundreds of thousands of tons of material daily, from the loading sources to the destination zones, whether these are massive mine dumps or, to a lesser extent, to the crushers or grinding mills. The stripping ratio is the amount of overburden and waste rock that must be removed for each unit of crude ore mined and varies within the mine site and the orc being mined. Depending on the nature and depth to the ore deposit, mine waste rock may constitute the largest volume waste stream generated by a mining project and can be thousands of tons per day. The quantity of waste rock generated relative to ore extracted from a mine is typically larger for surface mines than underground mine, reflecting the greater costs of underground mining operation. The ratio of waste rock to ore (i.e., the stripping ratio) at surface mines are as high as l0:l for some areas.

<u>Emissions Summary:</u>

The $PM_{2.5}$ fugitive dust emissions for the dump trucks are 8.71 tons per year.

Pollutant [$PM_{2.5}$]

<u>Control Options:</u>

Available Control Technology

Water application
Enclosures
Minimizing the drop distance during dumping.

<u>Technological Feasibility:</u>

The drop location is not static, and as such an enclosure would not be technically feasible.

Water application is similarly not technically feasible because excessive water application would create geotechnical instability on the waste rock dumps. Additionally, an installation or setup of a water irrigation system for water application is not technically feasible because of the drop location is not static. The strength of the waste rock pile may be assessed by density, particle size distribution, and water pressures within the waste pile.(Jorge Puell Ortiz, 2017) Water pressures decrease the stability of both the waste and foundation materials. With respect to shear strength, the most favorable pile materials are hard, durable rock with little or no fines and minimal water

<u>Economic Feasibility:</u>

All control options were found to be technically infeasible and as such an economic feasibility analysis was not performed.

BACT Selection:

Minimizing drop distances while the waste rock is being dumped is an effective method for reducing the emissions and has been selected as BACT.

Implementation Schedule:

Controls are already being implemented.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.4 Graders, Bulldozers and Front-end Loaders

Description:

The graders primarily operate on the haul roads, maintaining surfaces of the roads. Particulate matter is controlled by the application of water and chemical dust suppressants to the roads.

The dozers and front-end loaders operate within the pit. They are utilized for maintaining the haul roads, performing cleanup operations, and in dumping operations at the waste rock disposal areas.

Emissions Summary:

The $PM_{2.5}$ PTE emissions in tons per year for the graders inside and outside the pit are as follows:

	$PM_{2.5}$
Inside the pit	4.16
Outside the pit	4.95

Control Options:

Application of water
Application of chemical dust suppressants

Technological Feasibility:

All identified control technologies are technically feasible.

Economic Feasibility:

All of the controls are economically feasible.

BACT Selection:

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

Implementation Schedule:

Controls are already being implemented.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.5 Unpaved Haul Roads

Description:

Emissions resulting from the movement of ore and waste around the mine represent a significant portion of overall emissions at the Bingham Canyon Mine. The emissions related to material movement include fugitive dust generated from the truck travel on the haul roads and the tailpipe emissions from the haul trucks. Also on an annual basis, material movement represents 85% or greater of overall particulate emissions at the Bingham Canyon Mine.

Haul roads are used by the haul trucks to transfer ore and waste rock from the mining face to the waste rock piles and in-pit ore crusher. Dust from the haul roads is controlled by water trucks applying water and chemical dust suppressants on the roads and maintaining a good road base of coarse gravel. KUC is currently allowed a maximum total mileage of 30,000 miles per calendar day for the haul trucks to haul ore and waste rock.

The daily mileage limitation effectively limits road dust emissions, tailpipe emissions from the haul trucks and overall activity of sources at the mine. Ore processing at the Copperton Concentrator, which results in minimal emissions, is also limited through the Bingham Canyon Mine mileage activity limitations.

KUC currently uses conveyors to transport the majority of the crushed ore from the mine to the Copperton Concentrator. The use of conveyors mitigates both fugitive dust and tailpipe emissions to the atmosphere, by removing the need to use haul trucks. The use of conveyors has also allowed KUC to comply with the daily mileage limit, and still transport the ore to the Copperton Concentrator.

KUC uses a real time tracking system for both tracking haul trucks as well as for recording miles travelled. These records are used to comply with the miles per day limitation. The system may be a Global Positioning System or a system with similar tracking capabilities necessary to comply with this condition.

The minimum design payload per ore and waste haul truck will be increased from a minimum of 240 tons per truck to a minimum average of 300 tons. This will allow the use of the smaller trucks in special areas as needed.

Emissions Summary:

The $PM_{2.5}$ fugitive dust emissions for the mobile equipment and haul roads are 108.23 tons per year.

Pollutant [$PM_{2.5}$]

$PM_{2.5}$ emissions are generated from vehicular traffic on unpaved roadways and paved roadways.

Control Options:

Application of water
Application of chemical dust suppressants
Paving the unpaved roads
Limiting mileage
Routine maintenance (including the use of road base material) of haul roads

Technological Feasibility:

Watering the unpaved haul road reduces fugitive $PM_{2.5}$ emissions by binding the soil particles together, reducing free particles available to be picked up by wind or vehicles. Additional watering and application of chemical dust suppressants on certain locations of unpaved haul roads also occurs when heavy traffic is expected along the road. Water is applied on a scheduled basis and supplemented as needed based on road conditions.

Application of chemical dust suppressants is not technically feasible for some haul road locations because of the adverse effect the chemical can have on the coefficient of friction of the road surface. Given that the grade of the haul roads exceeds 10 percent in some locations, creating a slippery skin on the road inhibits the ability of mobile equipment to brake and steer safely while traveling on the steep grade.

Paving the haul roads is not technically feasible at the mine due to the rapid deterioration that would occur from the weight of the haul trucks. Additionally the frequently changing road locations make paving technically infeasible. Paving the roads is not technically feasible and will not be evaluated further.

Limiting haul road mileage

Dust is also reduced through performing regular and routine maintenance of the haul roads (through use of road base material) and limiting unnecessary traffic on roads.

Economic Feasibility:

The use of water application inside the pit influence boundary, chemical dust suppressants and water application outside of the pit influence boundary, limiting haul road mileage, and routine maintenance of haul roads are economically feasible.

BACT Selection:

The use of road base material and the application of water within the pit influence boundary and water, and chemical dust suppressants outside the pit influence boundary on unpaved roads constitute BACT.

In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in the round trips and vehicle miles traveled, thereby additionally reducing fugitive dust emissions.

Implementation Schedule:

KUC is currently limited to mileage requirements in AO DAQE-AN105710042-18.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.6 Tailpipe Emissions from Mobile Sources

Description:

UDAQ considers this a BACT/BACM requirement and provides the following analysis. Various emissions are associated with the use of haul trucks and support equipment such as graders and dozers. Tailpipe emissions from the haul trucks and support equipment meet the current required EPA standards for Nonroad equipment for tier 1 and tier 2 engines, but they do not meet the higher EPA standards for Nonroad equipment that is currently available. Komatsu has had tier 4 engines available in their 360 and 400 ton haul trucks. Caterpillar has tier 4 available in their D9, D10 and D11 dozers.

BACT/BACM Selection:

The UDAQ recommends that as KUC replaces haul trucks they are replaced with trucks that have the highest engine Tier level available which meets the mining needs. KUC shall maintain records of haul trucks purchased and [retired] replaced. . Proper operation and maintenance of all equipment and the use of ultra-low sulfur fuel that is rated at a maximum of 15 ppm sulfur is considered BACT.

The UDAQ recommends for the dozers that the tier 0, tier 1 and tier 2 dozers shall be replaced with the highest Tier level equipment which meets the mining needs. KUC should also maintain records of dozers purchased and [retired] replaced.

May 24, 2018 Air Quality Board Packet

On May 24, 2018, the revised Part H limits were submitted to the Utah Air Quality Board

j. Kennecott Utah Copper (KUC): Mine

   i. Bingham Canyon Mine (BCM)

      A. ~~[Maximum total mileage per calendar day for ore and waste haul trucks]~~ No later than January 1, 2019, combined site-wide emissions of NO_x, $PM_{2.5}$, and SO_2 shall not exceed~~[30,000 miles]~~ 5,585 tons per year and 15.3 tons per day.

      Haul truck emissions shall be calculated daily using the miles driven per haul truck. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System or equivalent. The system shall use real time tracking to determine daily mileage.

      All other emission sources shall use their respective means of emission calculation through AP-42 emission factors or associated stack testing.

On May 18, 2018 (Cassady Kristensen, 2018), KUC submitted the following changes to the Part H limits:

j. Kennecott Utah Copper (KUC): Mine

   i. Bingham Canyon Mine (BCM)

A. Maximum total NOx emissions from ore and waste haul trucks shall not exceed ~~4,624 tons per year and 12.67~~ 16.2 tons per day (calendar month average).

After January 1, 2024, maximum total NOx emissions from ore and waste haul trucks shall not exceed 15.3 tons per day (calendar month average).

Emissions shall be calculated for the calendar month using hours of operation for haul trucks. NOx emissions from the haul trucks shall be estimated using the hours of operation for each ore and waste haul truck and an emission factor based on its EPA certified tier rating. Emission factors will be obtained from the most current version of EPA approved NONROAD model, manufacturer data and/or related guidance.

On May 30, 2018 (Steve Schnoor, 2018), KUC submitted the following changes to the Part H limits:

j. Kennecott Utah Copper (KUC): Mine

i. Bingham Canyon Mine (BCM)

A. ~~Maximum total mileage per calendar day for ore and waste haul trucks]~~ Emissions at the Bingham Canyon Mine shall not exceed 6,205 tons of of NO_x, $PM_{2.5}$, and SO_2 combined per rolling 12-month period. ~~No later than January 1, 2019, combined site-wide emissions of of~~ $\cancel{NO_x}$~~,~~ $\cancel{PM_{2.5}}$~~, and~~ $\cancel{SO_2}$ ~~shall not exceed[30,000 miles] 5,585 tons per year and 15.3 tons per day.~~

B. Maximum total NO_x emissions from ore and waste haul trucks shall not exceed 16.9 tons per day (calendar month average).
~~Haul truck emissions shall be calculated daily using the miles driven per haul truck. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System or equivalent. The system shall use real time tracking to determine daily mileage.~~

~~All other emission sources shall use their respective means of emission calculation through AP-42 emission f~~actors or associated stack testing.

~~B~~C. To minimize fugitive dust on roads at the mine, the owner/operator shall perform the following measures:

I. Apply water to all active haul roads as weather and operational conditions warrant except during precipitation or freezing weather conditions, and shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.

II. Chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing weather conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.

III. Records of water and/or chemical dust control treatment shall be kept for all periods when the BCM is in operation.

IV. KUC is subject to the requirements in the most recent federally approved Fugitive Emissions and Fugitive Dust rules.

~~D~~E. Implementation Schedule

When KUC replaces [~~shall purchase new~~] haul trucks, they shall be replaced with trucks that have the highest engine Tier level available which meet mining needs. KUC shall maintain records of haul trucks purchased and [retired]replaced.

~~E. Minimum design payload per ore and waste haul truck shall not be less than 240 tons. The minimum design payload for all trucks combined shall be an average of 300 tons.~~

These changes were accepted and an addendum was made to the proposed $PM_{2.5}$ Serious SIP Part H limitations for KUC. The addendum took into consideration the 2013 Manefay slide and the revised mine plan KUC implemented to ensure safe operations. The day to day variability was included to account for the NOx emissions from the Haul and Ore trucks.

<u>Implementation Schedule:</u>

The UDAQ estimates that the Caterpillar Tier 1 trucks will have reached the end of their useful life by 2021 and the Komatsu Tier 1 trucks will have reached the end of their useful life by 2023. It is both technically and economically feasible that all Tier 1 haul trucks shall be replaced with the highest Tier trucks available when [retired] replaced.

<u>Startup/Shutdown Considerations</u>

There are no startup/shutdown operations to be considered for these sources.

2.1.7 Ore Handling

<u>Description:</u>

The mined ore is transported around the mine through the use of conveyors and trucked to the stock piles as needed. The sources include Truck Loading and Offloading, Ore Main In-pit Crusher, Ore Stockpile, End Dump Trucks, Main In-Pit Enclosed Transfer Points, Conveyor-stacker Transfer Point, Coarse Ore Stacker and Reclaim Tunnels. The most favorable material characteristics for ore handling are hard, durable rock with little or no fines present.(US Epa, 1995)

Pollutant [$PM_{2.5}$]

Emissions Summary:

The $PM_{2.5}$ fugitive dust emissions for the ore handling operations are 5.28 tons per year.

Control Options:

Material characteristics such as large size with minimal quantities of fine material
Enclosures
Inherent moisture content

Technological Feasibility:

The drop locations are not static, as such an enclosure is not technically feasible for ore stockpiles, truck loading and offloading, but is technically feasible for ore main In-pit crusher, end dump trucks, Main In-Pit enclosed transfer points, conveyor-stacker transfer point, coarse ore stacker and reclaim tunnels.

The inherent water contained in the ore is technically feasible but the use of water application is not technically feasible because excessive water application may result in geotechnical issues on the waste rock dumps.

Economic Feasibility:

The use of water application inside the pit influence boundary, chemical dust suppressants and water application outside of the pit influence boundary, limiting haul road mileage, and routine maintenance of haul roads are economically feasible.

Economic Feasibility:

All of the controls that have not been identified as being technically infeasible are economically feasible.

BACT Selection:

Material characteristics such as large ore size and presence of very small quantities of fine material, inherent moisture content and enclosures also represent BACT for the ore handling emission sources.

Implementation Schedule:

Controls are already being implemented.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.8 Road Base Crushing and Screening Plant

Description:

The mine has two semiportable plants that crush and screen rock for use for base material on the unpaved haul roads. Particulate emissions from the crushing, screening, and transfer operations are effectively controlled with water sprays and belt enclosures.

Pollutant [$PM_{2.5}$]

The $PM_{2.5}$ fugitive dust emissions for the road base crushing and screening plant are 0.24 tons per year.

Control Options:

Baghouses
Enclosures
Water Sprays

Technological Feasibility:

The road base crushing system is moved through the mine to facilitate the production of road base material to meet demands. As a result, permanent installation of a baghouse to control emissions from the plant is not technically feasible. Water Sprays and temporary enclosures are considered feasible for the plant.

Economic Feasibility:

Remaining control technologies are economically feasible. Therefore, an economic feasibility was not performed.

BACT Selection:

Water sprays and enclosures are identified as BACT for the road base crushing and screening plant.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.9 Solvent Extraction and Electrowinning Process

Description:

Tanks, mixers and settlers are used in the solvent extraction and electrowinning process. Covers are currently used to minimize emissions from these sources.

Pollutant [$PM_{2.5}$, NO_x, SO_2, and VOC]

It should be noted that potential emissions of $PM_{2.5}$ and precursors for solvent extraction and electrowinning are minimal. In 2016 the VOC emissions were 0.48 tons per year and all of the other emissions were less than 0.01 tons per year.

Control Options:

Covers on process equipment

Technological Feasibility:

Covers are the only control technology and are currently implemented at KUC, therefore no technological feasibility analysis was performed.

Economic Feasibility:

Covers are the only control technology and are currently implemented at KUC, therefore, an economic feasibility analysis was not performed.

BACT Selection:

KUC currently utilizes covers to minimize emissions associated with the solvent extraction and electrowinning operations. This is considered BACT.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Copperton Concentrator

2.2.1 Tioga Heaters

Description:

Natural gas-fired heaters are used throughout the Copperton Concentrator. The heaters are rated at less than 5 MMBTU/hr each. Specifically, the facility includes seven (7) 4.2 MMBtu/hr natural gas fired heaters and one (1) 2.4 MMBtu/hr natural gas fired heater.

Pollutant [$PM_{2.5}$, NO_x, SO_2, and VOC]

The PTE emissions, in tons per year, from the Tioga heaters are as follows:

	$PM_{2.5}$	NO_x	SO_2	VOC
Heaters	0.1	6.2	0.1	0.1

The actual NO_x emissions from the Tioga heaters are as follows:

2016 2.87 tpy

Control Options:

Low NO_x burners
Good combustion practices

Technological Feasibility:

All identified controls are considered technically feasible.

Economic Feasibility:

Based on the data provided by the vendors, the total installed cost of the eight new heaters is estimated to be $940,000 (CH2M, 2017). This is $62,667 per year when amortized over a 15 year period. The costs assume the installation costs to be 35 percent of the equipment costs. Theses heaters will be equipped with the latest burner technology. Assuming the new heaters will minimize NO_x emissions by 90% from current levels, the new heaters will reduce the annual emissions from the Tioga heaters from 6.2 tpy (based on PTE emissions for the heaters) to 0.68 tpy. This is a 5.52 tons per year reduction in NO_x emissions.

Based on the annualized costs for the new heaters over a 15 year period of $62,667, and a 5.52 tpy reduction in NO_x, the cost of additional control per ton of NO_x removed is $11,353 for the Tioga heaters. Based on this cost, it is cost effective to replace the existing Tioga heaters with new heaters.

On May 18, 2018 (Jenny Esker, 2018), KUC submitted the following modifications to the emission calculations and for the revised cost of replacing the Tioga heaters:

The annualized cost for the heaters was modified to $116,169 a year based on an amortization rate of 10%.

The emissions were recalculated so that the NO_x actual emission rate went from 2.87 tpy in 2016 to 0.56 tpy. This made the replacement of the heaters not economically feasible at $207,602.

<u>BACT Selection:</u>

BACT for the Tioga heaters is use of pipeline quality natural gas and good combustion practices as control technology for reducing NO_x emissions from the Tioga heaters.

The May 24, 2018 <u>Air Quality Board Packet included a natural gas consumption limit for the Tioga heaters in order to limit their NO_x emissions.</u>

On May 24, 2018, the revised Part H limits were submitted to the Utah Air Quality Board

j. Kennecott Utah Copper (KUC): Mine

  ii. Copperton Concentrator (CC)

    B. The eight (8) Tioga heaters shall not consume more than 70 MMCF of natural gas per rolling 12 month period.

On May 30, 2018 (Steve Schnoor, 2018), KUC submitted the following changes to the Part H limits:

j. Kennecott Utah Copper (KUC): Mine

  ii. Copperton Concentrator (CC)

    [~~The remaining heaters shall not operate more than 300 hours per rolling 12- month period unless upgraded so the NOx emission rate is no greater than 30 ppm.~~]

    B. ~~The eight (8) Tioga heaters shall not consume more than 70 MMCF of natural gas per rolling 12 month period.~~

The UDAQ ensures that the BACT emission level of 0.56 tpy is being met by effectively limiting the use of natural gas consumption to 120 MMCF of natural gas per year.

This is required through SIP Part H Condition Section IX, Part H.j.ii.B which reads as follows:

B. The eight (8) Tioga heaters shall not consume more than 120 MMCF of natural gas per year.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Pollutant [($PM_{2.5}$, SO_2, and VOC)]

Control Options:

A review of the similar sources identify the use of pipeline quality natural gas and good combustion practices as control technologies for minimizing $PM_{2.5}$, SO_2 and VOC emissions from heaters.

Technological Feasibility:

All identified control technologies are technically feasible.

Economic Feasibility:

All control technologies are economically feasible. Therefore, an economic feasibility was not performed.

BACT Selection:

The technology identified for controlling $PM_{2.5}$, SO_2 and VOC emissions from heaters is the use of pipeline quality natural gas and good combustion practices is BACT.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.12 Pebble Crushing System

Description:

The pebble crushing system includes a crusher and ore handling conveyors and transfer points. The system is placed inside a building to minimize particulate emissions to the atmosphere.

Pollutant [($PM_{2.5}$)]

Potential emissions of $PM_{2.5}$ are 0.10 tons per year.

Control Options:

Baghouses
Wet scrubbers
Water sprays
Enclosures

Technological Feasibility:

Because the emissions will be vented inside the building, wet scrubbers and fabric filters are not technically feasible. Water sprays are not feasible as the water makes the material too wet to crush.

BACT Selection:

Enclosures, or placing the source inside the building, is effective in minimizing emissions from the crusher operations and identified as BACT for the pebble crushing system.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.13 Feed and Product Dryer Oil Heaters

Description:

Natural gas-fired heaters provide heat to the feed and product dryers that are used in molybdenum process at the Copperton Concentrator. The heaters are rated at 5.7 MMBTU/hr and 2.2 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas were reviewed for this analysis.

	$PM_{2.5}$	NO_x	SO_2	VOC
Heaters	0.008	0.11	0.0006	0.006

Pollutant [(NO_x)]

Control Options:

A review of the similar sources indicate that Low NO_x burners and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 10 MMBtu/hr.

Technological Feasibility:

All identified control technologies are technically feasible.

Economic Feasibility:

All control technologies are economically feasible. Therefore, an economic feasibility was not performed.

BACT Selection:

The technology identified for controlling NO_x emissions from heaters is Low NO_x burners, use of pipeline quality natural gas and good combustion practices is BACT.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Pollutant [($PM_{2.5}$, SO_2, and VOC)]

Control Options:

A review of the similar sources identify the use of pipeline quality natural gas and good combustion practices as control technologies for minimizing $PM_{2.5}$, SO_2 and VOC emissions from heaters.

Technological Feasibility:

All identified control technologies are technically feasible.

Economic Feasibility:

All control technologies are economically feasible. Therefore, an economic feasibility was not performed.

BACT Selection:

The technology identified for controlling $PM_{2.5}$, SO_2 and VOC emissions from heaters is the use of pipeline quality natural gas and good combustion practices is BACT.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.2 Consideration of Ammonia

The only source of ammonia emissions at the BCM is the blasting operations performed to allow access to new ore bodies. The ammonia emissions were estimated in 2014 to be 1.65 tons per year.

There are several sources of ammonia emissions at the Copperton Concentrator. All ammonia emissions at the Copperton Concentrator are associated with the combustion of natural gas.

The unreacted ammonia can be treated as a $PM_{2.5}$ precursor. Although currently not being considered as a precursor pollutant in Utah's $PM_{2.5}$ Serious SIP, the source's BACT analysis did include an analysis of BACT for ammonia emissions, which is being included here for completeness

Control Options:

BCM

The only control option for blasting is minimizing the blast area and maintaining control of the blast area.

Copperton Concentrator

Good combustion practices are the only control technology for minimizing NH_3 emissions from heaters less than 10 MMBtu/hr.

Technological Feasibility:

All identified control technologies are technically feasible.

Economic Feasibility:

All control technologies are economically feasible.

BACT Selection:

BCM

The technology identified for controlling NH_3 emissions from blasting is minimizing thre blast area and maintaining control of the blast area is considered BACT.

Copperton Concentrator

The technology identified for controlling NH_3 emissions from heaters is the use of pipeline quality natural gas and good combustion practices.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

3.0 Conclusion- Emissions Reduction through BACT implementation

BCM

The In-pit crusher baghouse will be required to meet a $PM_{2.5}$ emission limit of 0.78 lb/hr.

The emissions at the Bingham Canyon Mine shall not exceed 6,205 tons of NO_x, $PM_{2.5}$ and SO_2 combined per rolling 12-month period.

Maximum total NO_x emissions from ore and waste haul trucks shall not exceed 16.9 tons per day (calendar month average).

It is estimated that all of the the tier 1 trucks will have reached the end of their useful life by 2023. It is both technically and economically feasible that as Tier 1 haul trucks are replaced, they shall be replaced with the highest engine Tier level available.
KUC shall replace the tier 0, tier 1 and tier 2 Caterpillar D10 and D11 dozers with the hightest Tier level equipment available when they have reached the end of their useful

life.

Copperton Concentrator

The eight (8) Tioga heaters shall not consume more than 120 MMCF of natural gas per year.

5.0 Implementation Schedule and Testing Requirements

BCM

The in-pit crusher baghouse shall meet the 0.78 lb/hr limitation as of the date of this document.

When KUC replaces haul trucks, they shall be replaced with trucks that have the highest engine Tier level available which meet mining needs. KUC shall maintain records of haul trucks purchased and replaced.

Copperton Concentrator

KUC shall begin tracking the fuel usage of the eight (8) Tioga heaters as of the date of this document.

6.0 New PM2.5 SIP – KUC BCM Specific Requirements

The KUC BCM specific conditions in Section IX.H.12.j address those limitations and requirements that apply only to the KUC BCM and Copperton Concentrator in particular.

IX.H.12.j.i This condition lists the specific requirements applicable to the KUC BCM.

Subparagraph A: Emissions at the Bingham Canyon Mine shall not exceed 6,205 tons of NO_x, $PM_{2.5}$, and SO_2 combined per rolling 12-month period[

Subparagraph B: Maximum total NO2 emissions from ore and waste haul trucks shall not exceed 16.9 tons per day (calendar month average).

Subparagraph C: To minimize fugitive dust on roads at the mine, the owner/operator shall perform the following measures:

I. Apply water to all active haul roads as weather and operational conditions warrant except during precipitation or freezing weather conditions, and shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.

II. Chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing weather conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.

III. Records of water and/or chemical dust control treatment shall be kept for all periods when the BCM is in operation.

IV. KUC is subject to the requirements in the most recent federally approved Fugitive Emissions and Fugitive Dust rules.

Subparagraph D: The In-pit crusher baghouse shall not exceed a $PM_{2.5}$ emission limit of 0.78 lb/hr.
$PM_{2.5}$ monitoring shall be performed by stack testing every three years.

Subparagraph E: Implementation Schedule

When KUC replaces haul trucks, they shall be replaced with trucks that have the highest engine Tier level available which meet mining needs. KUC shall maintain records of haul trucks purchased and replaced.

IX.H.12.j.ii This condition lists the specific requirements applicable to the KUC Copperton Concentrator.

Subparagraph A: Control emissions from the Product Molybdenite Dryers with a scrubber during operation of the dryers.

During operation of the dryers, the static pressure differential between the inlet and outlet of the scrubber shall be within the manufacturer's recommended range and shall be recorded weekly.

The manometer or the differential pressure gauge shall be calibrated according to the manufacturer's instructions at least once per year.

Subparagraph B: <u>The eight (8) Tioga heaters shall not consume more than 120 MMCF of natural gas per year.</u>

6.1 Monitoring, Recordkeeping and Reporting

Monitoring for IX.H.12.j.i is specifically outlined in IX.H.12.b.i.A; while IX.H.12.b.ii.A is addressed in IX.H.12.b.ii.B. Recordkeeping is subject to the requirements of IX.H.11.c and IX.H.11.f.

4.0 References

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Operating Practices.

NSR

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Steve Schnoor
Manager – Environment, Land and Water

April 27, 2017

Mr. Bryce Bird
Utah Division of Air Quality
150 North 1950 West
Salt Lake City, Utah 84114

Attn: Mr. Nando Meli

Subject: **Kennecott Utah Copper LLC**
$PM_{2.5}$ SIP Best Available Control Technology Analysis

Dear Mr. Bird:

Kennecott Utah Copper LLC (KUC) is submitting the $PM_{2.5}$ State Implementation Plan (SIP) Best Available Control Technology (BACT) analysis, as requested by the Utah Division of Air Quality. Attached are BACT determinations for emission sources at the following KUC facilities –

- Bingham Canyon Mine and Copperton Concentrator
- Utah Power Plant, Tailings and Laboratory
- Smelter, Refinery and Molybdenum Autoclave Process Plant

Should you have any questions, please feel free to contact Cassady Kristensen at 801-204-2129.

Sincerely,

Steve Schnoor
Manager – Environment, Land and Water

Enclosure

FINAL REPORT

Kennecott Utah Copper

$PM_{2.5}$ State Implementation Plan Best Available Control Technology Determinations

Submitted to

Utah Division of Air Quality

Prepared for:

Kennecott Utah Copper

Prepared by:

ch2m

April 2017

FINAL

BACT Determinations for the Bingham Canyon Mine and Copperton Concentrator

Prepared for

Kennecott Utah Copper

April 2017

Prepared by

ch2m

4245 South Riverboat Road
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Taylorsville, UT 84123

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Acronyms and Abbreviations

AO	approval order
BACT	best available control technology
BCM	Bingham Canyon Mine
CAA	Clean Air Act
CO	carbon monoxide
EPA	Environmental Protection Agency
gr/dscf	grains per standard cubic feet
GPS	Global Positioning System
KUC	Kennecott Utah Copper
MMBTU/hr	million British Thermal Units per hour
NAAQS	National Ambient Air Quality Standard
NH_3	ammonia
NOx	nitrogen oxides
PM_{10}	particulate matter less than or equal to 10 micrometers in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 micrometers in aerodynamic diameter
ppm	parts per million
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SIP	State Implementation Plan
SO_2	sulfur dioxide
TPY	tons per year
UDAQ	Utah Department of Air Quality
VOC	volatile organic compound

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SECTION 1

Introduction

Kennecott Utah Copper LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities: Bingham Canyon Mine (BCM) and the Copperton Concentrator. In addition to a BACT analysis, KUC has also documented Most Stringent Measures for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and meet any reasonable further progress requirements. As requested by the Utah Division of Air Quality (UDAQ), the BACT analysis should identify and evaluate reasonable and available control technologies for each relevant pollutant. The technical and economic feasibility of each potential technology are components of the BACT analysis that help to show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). For each emission source, the BACT analysis followed a four step process:

Step 1—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC)

Step 2—Eliminate technically infeasible options

Step 3—Eliminate economically/chronologically infeasible options

Step 4—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent Most Stringent Measures.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS were combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends that BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development standard.

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SECTION 2

Recent Permitting Actions

Current operations at the BCM are permitted under Approval Order (AO) DAQE-AN105710037-15, issued on November 10, 2015.

Emissions from the BCM are mainly limited by the following conditions:

- "Total material moved (ore and waste) shall not exceed 260 million tons per rolling 12-month period." This condition limits the total material moved at the Bingham Canyon Mine, thus limiting both fugitive and tailpipe emissions.
- "Maximum total mileage per calendar day for ore and waste haul trucks shall not exceed 30,000 miles." This condition limits daily vehicle miles travelled at the Bingham Canyon Mine, thus limiting both fugitive and tailpipe emissions.
- "Emissions of particulate matter less than or equal to 10 micrometers in aerodynamic diameter (PM_{10}), NO_x, and SO_2 combined shall not exceed 7,350 tons and emissions of $PM_{2.5}$, NO_x, and SO_2 shall not exceed 6,205 tons per rolling 12-month period."
- "KUC shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year."

KUC is required to submit an annual fugitive dust control report that provides a description of the fugitive dust control practices implemented at the BCM.

Current operations at the Copperton Concentrator are permitted under AO DAQE-AN105710035-13 issued on June 25, 2013. Potential to Emit (PTE) emissions for the Copperton Concentrator are a very small percentage of combined emissions from the mine and concentrator facilities. Emissions for the Copperton Concentrator are limited by implementation of BACT controls.

PTE emissions in tpy for the BCM and the Copperton Concentrator are shown in Table 2-1.

Table 2-1
Facility Potential to Emit Emissions (Including Fugitive and Nonroad Engine Emissions)

	PM_{10} PTEs (tpy)	$PM_{2.5}$ PTEs (tpy)	NO_x PTEs (tpy)	SO_2 PTEs (tpy)	VOC PTEs (tpy)
Bingham Canyon Mine	1,519	369	5,838	7	314
Copperton Concentrator	25.3	13.86	10.66	0.1	4.04

Notes:
PM_{10} = Particulate matter 10 microns or smaller in aerodynamic diameter
NO_x = oxides of nitrogen
SO_2 = sulfur dioxide
VOC = volatile organic compounds
$PM_{2.5}$ = Particulate matter 2.5 microns or smaller in aerodynamic diameter
PTE = potential to emit
tpy = tons per year

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SECTION 3

BACT Determinations

This section provides BACT determinations for emission sources deemed significant at the BCM and the Copperton Concentrator.

3.1 Bingham Canyon Mine

3.1.1 In-pit Crusher

Source Description: The crusher is used to crush copper ore mined at the BCM. Particulate emissions from the in-pit crusher are controlled with a baghouse.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies baghouse (fabric filter) and enclosures with water sprays as possible control technologies for limiting emissions from crusher.

Step 2—Eliminate Technically Infeasible Options. Not Applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies are feasible.

Step 4—Identify BACT. Fabric filters are the most effective in controlling emissions. Therefore, baghouse (fabric filter) constitutes BACT for the in-pit crusher.

The baghouse for the crusher is permitted at a grain loading of 0.002 grains per standard cubic feet (gr/dscf). Review of the RBLC did not identify emission rates lower than 0.002 gr/dscf for the similarly used baghouses. This emission rate therefore represents Most Stringent Measure for the in-pit crusher. Additionally, this emission rate was established by UDAQ as BACT for the BCM permitting in 2011.

3.1.2 Disturbed Areas

Source Description: Disturbed areas from mining activities. KUC current practices include application of palliatives and revegetation of the areas as soon as practical, as well as water application from passing water trucks in the operational areas to minimize dust.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies revegetation, adding moisture, and enclosures (wind screens) as possible control technologies for fugitive emissions.

Step 2—Eliminate Technically Infeasible Options.

Applying additional moisture (water) on the disturbed areas as mining occurs is not technically feasible for KUC's mine operations. The ore is transferred through a series of conveyors. Excessive moisture in the ore material causes the conveyors to foul and breakdown resulting in costly equipment repairs. Therefore, adding moisture to the ore material is not technically feasible.

Because the disturbed areas are so expansive and cover varying terrain, adding enclosures or wind screens are not technically feasible for this mine source.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 were technically infeasible or selected as BACT.

Step 4—Identify BACT. The practice of applying palliatives and revegetation is the most effective in reducing emissions. Therefore, the application of palliatives and revegetation constitute BACT.

The application of palliatives and revegetation also represent BACM for the disturbed areas. Because best available measures are in use, they also represent Most Stringent Measures.

3.1.3 Waste Rock Offloading from Trucks

Source Description: Haul trucks dump waste rock or overburden at the waste rock disposal areas while minimizing the height of the drop.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies water application and enclosures as possible control technologies for fugitive emissions from such sources of emissions.

Another possible control technology not identified, but effective in reducing emissions from batch drop transfer points, is minimizing the drop distance while the waste rock is being dumped.

Step 2—Eliminate Technically Infeasible Options.

Because the drop location is not static an enclosure is not technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable as the remaining technology of minimizing the drop distance, while the waste rock is being dumped, is selected as BACT.

Step 4—Identify BACT. Minimizing drop distances while the waste rock is being dumped is effective in controlling emissions and constitute BACT.

Minimizing drop distances while the waste rock is being dumped also represents BACM. Because best available measures are in use, they also represent Most Stringent Measures.

3.1.4 Graders

Source Description: The graders primarily operate on the haul roads, maintaining surfaces of the roads. Particulate is controlled by the application of water and chemical dust suppressants to the roads.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies the application of water and chemical dust suppressants as a possible control technology for fugitive emissions.

Step 2—Eliminate Technically Infeasible Options. Not Applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the graders. Because best available measures are in use, they also represent Most Stringent Measures.

3.1.5 Bulldozers

Source Description: The dozers operate in the pit, on the haul roads performing cleanup operations, and in dumping operations at the waste rock disposal areas.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies the application of water and chemical dust suppressants as required as a possible control technology for fugitive emissions.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the bull dozers. Because best available measures are in use, they also represent Most Stringent Measures.

3.1.6 Unpaved Haul Roads

Source Description: Haul roads are used to transfer ore and waste rock.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies potential technologies for control of fugitive emissions on unpaved haul roads as; paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance (through the use of road base material) of haul roads.

Step 2—Eliminate Technically Infeasible Options. Paving the haul roads is not technically feasible at the BCM because of the weight of the haul trucks and the rapid deterioration that would occur and the frequently changing road locations.

Application of chemical dust suppressants is not technically feasible for some haul road locations because of the adverse effect the chemical can have on the coefficient of friction of the road surface. Given that the grade of the haul roads exceeds 10 percent in some locations, creating a slippery skin on the road inhibits the ability of mobile equipment to brake and steer safely while traveling on the grade.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The remaining technologies of water application, chemical dust suppressants out of the pit influence boundary, limiting unnecessary traffic on roads, and routine maintenance of haul roads are economically and chronologically feasible.

Step 4—Identify BACT. The application of water and road-base material within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary is effective in minimizing emissions. Watering the unpaved haul road reduces fugitive $PM_{2.5}$ and PM_{10} emissions by binding the soil particles together, reducing free particles available to be picked up by wind or vehicles. Additional watering and application of chemical dust suppressants on certain locations of unpaved haul roads also occurs when heavy traffic is expected along the road. Water is applied on a scheduled basis and supplemented as needed based on dust conditions. Dust is also reduced through performing regular and routine maintenance of the haul roads (through use of road-base material) and limiting unnecessary traffic on roads.

In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in the round-trips and vehicle miles traveled, thereby reducing fugitive dust emissions.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the unpaved haul roads. Because best available measures are in use, they also represent Most Stringent Measures.

3.1.7 Tailpipe Emissions from Mobile Sources

Source Description: Tailpipe emissions from haul trucks and support equipment such as graders and dozers. Tailpipe emissions from the haul trucks and support equipment meet the required EPA standards for NONROAD equipment.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies no add on control technologies for tailpipe emissions from haul trucks and support equipment of the size used at the Bingham Canyon Mine.

Step 2—Eliminate Technically Infeasible Options. Not applicable.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable.

Step 4—Identify BACT. Haul trucks and support equipment used at the facility meet the required EPA standards for nonroad equipment. The facility uses on-road specification diesel fuel in its off-road equipment. In 2007, an EPA ruling required sulfur content in all on-road specification diesel fuels be reduced (from 50 parts per million [ppm] formerly to 15 ppm currently). Because only on-road specification diesel fuel is used in its equipment, the facility has also made a transition to ultra-low sulfur diesel fuel. All of the facility's diesel-powered equipment now runs on ultra-low sulfur diesel fuel.

Additionally, the facility periodically upgrades its haul truck fleet to also take advantage of available higher-tier-level, lower-emitting engines. In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in round-trips and truck operating hours, thereby reducing emissions.

KUC purchases newer haul trucks with higher capacity and Tier level which meet its mining needs. This also represents Most Stringent Measures.

3.1.8 Fueling Stations

Source Description: Adding gasoline and diesel to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies two control techniques for controlling VOC emissions from gasoline and diesel fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. Stage 1 and 2 vapor recovery constitutes BACT for these sources.

The use of Stage 1 and Stage 2 vapor recovery systems also represent Most Stringent Measures for the fueling stations.

3.1.9 Cold Solvent Degreasers

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.

Step 2—Eliminate Technically Infeasible Options. Not applicable as the identified control technology is technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. When not in use, the lids on the degreasers are kept closed at all times to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for degreasers.

The above identified practices also represent Most Stringent Measures for the degreasers.

3.2 Copperton Concentrator

3.2.1 Tioga Heaters

Source Description: Natural gas-fired heaters are used throughout the Copperton Concentrator. The individual heaters are rated at less than 5 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance.

3.2.1.1 NO_x BACT

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The technology identified in the RBLC for controlling NO_x emissions from heaters of good combustion practices is already in use and constitute BACT.

3.2.1.2 $PM_{2.5}$, SO_2, CO, and VOC BACT

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters and these control technologies constitute BACT.

Low NO_X burners and use of pipeline quality natural gas and good combustion practices also represent most stringent measures for the Tioga heaters.

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SECTION 4

BACT Summary

This section provides a summary of BACT for the remaining emission sources at the BCM and the Copperton Concentrator.

Table 4-1. BACT Summary

Emission Source ID/Name	Emission Source Description	BACT Summary
C6/C7 Conveyor Transfer Point	Conveyor Transfer Point	Emissions from the transfer point are controlled with a baghouse rated at 0.007 gr/dscf. With the top control technology implemented, it also represents most stringent measures.
C7/C8 Conveyor Transfer Point	Conveyor Transfer Point	Emissions from the transfer point are controlled with a baghouse rated at 0.007 gr/dscf. With the top control technology implemented, it also represents most stringent measures.
Product Molly Dryer	Natural Gas Product Dryer	Emissions are minimized with low NO_X burners and use of pipeline quality natural gas.
Lgr Product Molly Dryer	Natural Gas Product Dryer	Emissions are minimized with low NO_X burners and use of pipeline quality natural gas.
Lime Bin	Lime Storage Bin	Emissions are controlled with a bin vent filter.
Lime Bin	Lime Storage Bin	Emissions are controlled with a bin vent filter.
Sample Preparation	Sample preparation building at the mine	Emissions are controlled with a baghouse.
Molly Storage Bins	Moly storage bin	Emissions are controlled with a bin vent filter.
Molly Vacuum	Process Area	Process is enclosed to minimize emissions.
Molly Loading (Bags)	Process Area	Process is enclosed to minimize emissions.
Truck Dispatch EG at 6690	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards
Communications EG at 6190	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards
EmResp EG at Lark Gate	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards
Galena Gulch	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards
Dinkyville Hill	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards
Zelnora	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards
Prd Dryer Heater	Natural Gas Heater	Emissions are minimized with low NO_X burners and use of pipeline quality natural gas.
Prod Dryer Heater	Natural Gas Heater	Emissions are minimized with low NO_X burners and use of pipeline quality natural gas.

Table 4-1. BACT Summary

Emission Source ID/Name	Emission Source Description	BACT Summary
Truck Offloading Ore Main In-pit Crusher	Material Offloading/Loading	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
Truck Offloading Ore Stockpile	Material Offloading/Loading	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
Main In-Pit Enclosed Transfer Points 1, 2 and 3	Conveyor Transfer Point	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
In-pit Enclosed Transfer Point 4	Conveyor Transfer Point	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
Conveyor-stacker Transfer Point	Conveyor Transfer Point	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
Coarse Ore Stacker	Conveyor Transfer Point	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
Reclaim Tunnels	Conveyor Transfer Point	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
Front End Loaders		Application of water and/or chemical dust suppressants to minimize emissions.
Truck Loading	Material Offloading/Loading	Minimal emissions due to material characteristics such as large ore size and presence of very small quantities of fine material.
SXEW Copper Extraction		Mist eliminator and enclosures minimize emissions from the process.
Tertiary Crushing	Road base crushing system	Water sprays and enclosures minimize emissions from road base crushing system.
Screening	Road base crushing system	
Transfer Points	Road base crushing system	
Copper Ore Storage Pile	Ore Stockpile	Water sprays and compaction is used to minimize emissions.
Blasting with Minimized Area	Blasting operations at the mine	Water injection and controlled blasting minimize emissions from these operations.
Drilling with Water Injection	Drilling operations at the mine	
Gasoline Fueling	Fueling stations at the Concentrator	Stage 1 and Stage 2 vapor recovery systems minimize emissions.
Cold Solv. Degrease. Washers	Cold solvent degreasers at the Concentrator	Keeping the lids closed on the degreasers minimize solvent loss and emissions.
Pebble Crushing in Crusher CR-01	Pebble crushing system at the Concentrator	Water sprays and enclosures minimize emissions from pebble-crushing system.
Pebble Crushing in Crusher CR-02	Pebble crushing system at the Concentrator	
Transfer from CNV CV-04 onto CNV CV-05	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-05 into Crushed Pebble Surge Bin BN-02	Material transfer in the pebble crushing circuit	

Table 4-1. BACT Summary

Emission Source ID/Name	Emission Source Description	BACT Summary
Transfer from SAG No. 1 Belt Feeder FE-03 onto CNV CV-06 and CNV CV-11	Material transfer in the pebble crushing circuit	Water sprays and enclosures minimize emissions from pebble-crushing system.
Transfer from CNV CV-11 to SAG 1 Feed Chute	Material transfer in the pebble crushing circuit	
Transfer from SAG No. 2 Belt Feeder FE-04 onto CNV CV-10	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-10 to SAG 2 Feed Chute	Material transfer in the pebble crushing circuit	
Transfer from SAG No. 3 Belt Feeder FE-05 onto CNV CV-09	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-09 to SAG 3 Feed Chute	Material transfer in the pebble crushing circuit	
Transfer from SAG No. 4 Belt Feeder FE-06 onto CNV CV-07 and CNV CV-08	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-08 to SAG 4 Feed Chute	Material transfer in the pebble crushing circuit	
Transfer onto CNV CV-02	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-02 onto CNV CV-03	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-03 into the Surge Bin BN-01	Material transfer in the pebble crushing circuit	
Transfer from Belt Feeders FE-02 and FE-01 into crushers CR-01 and CR-02	Material transfer in the pebble crushing circuit	
Transfer from bottom of crushers CR-01 and CR-02 onto CNV CV-04	Material transfer in the pebble crushing circuit	
Transfer from CNV CV-03 into the Surge Bin BN-03	Material transfer in the pebble crushing circuit	
Transfer from Belt Feeders FE-07 onto CNV CV-04	Material transfer in the pebble crushing circuit	

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SECTION 5

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

5.1 Bingham Canyon Mine

KUC is proposing the following limitations and monitoring requirements for the Bingham Canyon Mine.

- Maximum total mileage per calendar day for ore and waste haul trucks shall not exceed 30,000 miles. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System (GPS) or equivalent.

This condition establishes a limitation on daily activity. The daily mileage limitation effectively limits fugitive road dust emissions, tailpipe emissions from the haul trucks, and overall activity of sources at the mine. Ore processing at the Copperton Concentrator, which results in minimal emissions, is also limited through the BCM activity limitations.

Emissions resulting from the movement of ore and waste around the mine represent a significant portion of overall emissions at the BCM. The emissions related to material movement include fugitive dust generated from truck travel on the haul roads and the tailpipe emissions from the haul trucks. Specifically, on an annual basis, greater than 99.9 percent of total mine emissions for NO_X and SO_2 come from the haul truck tailpipes. Also, on an annual basis, material movement represents 85 percent of the overall particulate emissions at the BCM. Based on these emissions, the material movement of ore and waste by haul trucks represents a vast majority of overall emissions at the BCM and can effectively be used to represent mine operations.

Daily emissions from the BCM can be regulated with the limitation on vehicle miles traveled by ore and waste haul trucks of 30,000 miles per day. Compliance to this limitation is demonstrated on a daily basis and is an appropriate metric for a 24-hour particulate standard.

It should be noted; the 30,000 miles per day limitation also limits overall BCM operations. Ancillary mining activities such as operation of the in-pit crusher, mining support equipment, blasting, and drilling only occur to produce adequate amount of ore and waste rock that can be hauled via the trucks and sent to the concentrator via the conveyor system.

On a 24-hour basis, these emissions can be represented with a 30,000 miles per day limitation. Since they effectively represent mine operations, a single daily limitation is appropriate in the SIP for the BCM. These emissions have been included in the appropriate SIP model.

KUC uses a real time tracking system for both tracking haul trucks as well as for recording miles travelled. These records are used to comply with the 30,000 miles per day limitation. The system may be a GPS or a system with similar tracking capabilities necessary to comply with this condition.

- KUC Shall Use Ultra-low Sulfur Diesel Fuel in Its Haul Trucks.

This condition establishes a requirement for the use of ultra-low sulfur diesel fuel in haul trucks.

- To minimize emissions at the mine:

- The owner/operator shall control emissions from the in-pit crusher with a baghouse.
- Apply water to all active haul roads as weather and operational conditions warrant, except during precipitation or freezing conditions, and shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.
- A chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.

These conditions require the control of emissions from the in-pit crushers with a baghouse.

The condition also establishes requirements for reducing and controlling fugitive particulate emissions from active unpaved haul roads at the mine. Water and chemical dust suppressants shall be used to minimize fugitive dust.

Specifically, active ore and waste haulage roads within the pit influence boundary are water sprayed and/or treated with a commercial dust suppressant. Crushed road-base material is applied to active ore and waste haulage roads within the pit influence boundary to enhance the effectiveness of fugitive dust control measures. Commercial dust suppressants are applied to active ore and waste haulage roads outside of the pit influence boundary no less than twice per year.

Each year KUC reports dust control measures implemented at the BCM during the previous year with details such as volume of water applied, commercial dust suppressant activity, etc.

- KUC is Subject to the Requirements in the Most Recent Federally approved Fugitive Emissions and Fugitive Dust Rule.

KUC is subject to the fugitive dust rules approved by UDAQ and EPA. These rules outline requirements that mines are to follow in minimizing the fugitive dust from the mining operations.

5.2 Copperton Concentrator

No limitations or monitoring requirements are proposed for the Copperton Concentrator emission sources as the emissions from the facility are minimal and are effectively controlled with the implementation of BACT.

FINAL

BACT Determinations for the Utah Power Plant, Tailings Site, and Laboratory

Prepared for

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April 2017

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Acronyms and Abbreviations

AO	approval order
BACT	best available control technology
CAA	Clean Air Act
CatOx	catalytic oxidation
CO	carbon monoxide
DLN	dry low nitrogen
EPA	Environmental Protection Agency
KUC	Kennecott Utah Copper
LNB	low NO_x burner
MMBTU/hr	million British Thermal Units per hour
MW	megawatts
NAAQS	National Ambient Air Quality Standard
NOx	nitrogen oxides
OFA	over-fire air
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppmvd	parts per million by volume dry
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SCR	selective catalytic reduction
SIP	State Implementation Plan
SNCR	selective non-catalytic reduction
SO_2	sulfur dioxide
tpy	tons per year
UDAQ	Utah Department of Air Quality
UPP	Utah Power Plant
VOC	volatile organic compound

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SECTION 1

Introduction

Kennecott Utah Copper, LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities located at the northwest corner of Salt Lake County, Utah: Utah Power Plant (UPP), tailings site, and the laboratory. The tailings site receives tailings in slurry form. The slurry is deposited in the tailings pond. The UPP is a coal and natural gas fired power plant that supplies power for KUC operations. Coal is used to fuel the plant in spring, summer, and fall; while natural gas is approved for use in the winter months. The laboratory is used to perform various tests and also functions to optimize operations through analysis of materials. In addition to a BACT analysis, KUC has also documented the most stringent measures for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and to meet any reasonable further progress requirements. As requested by the Utah Division of Air Quality (UDAQ), the BACT analysis should identify and evaluate BACT for each relevant pollutant. The technical and economic feasibility of each potential technology are components of the BACT analysis that help to show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOC). For each emission source, the BACT analysis followed a four step process:

Step 1—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC)

Step 2—Eliminate technically infeasible options

Step 3—Eliminate economically/chronologically infeasible options

Step 4—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent most stringent measures.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS was combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends that BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development.

SECTION 2

Recent Permitting Actions

An approval order (AO) was issued for the UPP on November 10, 2015, which authorized the construction and operation of a natural gas fired emergency generator. Issued in 2011, AO DAQE-AN105720026-11 authorized KUC to replace Boiler Units 1, 2, and 3 with a new natural gas fired combustion turbine operating in combined cycle mode with a heat recovery steam generator. The new combustion turbine will be equipped with state of the art add-on controls to minimize emissions from the unit and represents BACT. Dry low nitrogen oxide (DLN) combustors and the selective catalytic reduction (SCR) system will control NO_x emissions. The catalytic oxidation (CatOx) system will control carbon monoxide (CO) and VOC emissions. Good combustion practices and burning natural gas will minimize emissions of the remaining pollutants.

The tailings site was permitted under AO DAQE-AN10572018-06. The emissions sources at the laboratory are permitted under AO DAQE-261-95. All three facilities operate under a single Title V operating permit, #3500346002.

The current potential to emit (PTE) emissions in tons per year (tpy) for the tailing site, UPP, and the laboratory are shown in Table 1-1.

Table 2-1. Facility Potential to Emit

	PM_{10} PTE (tpy)	**$PM_{2.5}$ PTE (tpy)**	**NO_x PTE (tpy)**	**SO_2 PTE (tpy)**	**VOC PTE (tpy)**
UPP	248	248	1,641	2,577	41
Tailings Site	36.3	5.4**	0.26	—*	0.04
Laboratory	0.12	0.12	0.68	0.13	0.12

Notes:
$PM_{2.5}$ = particulate matter 2.5 microns or smaller in aerodynamic diameter
PM_{10} = particulate matter 10 microns or smaller in aerodynamic diameter
PTE = potential to emit
NO_x = oxides of Nitrogen
SO_2 = sulfur dioxide
tpy = tons per year
VOC = volatile organic compounds
CO = carbon monoxide
*Permitted combustion sources result in negligible SO_2 emissions at the tailings site.
**$PM_{2.5}$ emissions are estimated to be 15 percent of PM_{10} emissions.

Distinguishing by season of operation is allowed under EPA's *Implementation Guidance for the 2006 24-hour Fine Particle NAAQS* (March 2, 2012), which specifically acknowledges that several nonattainment areas located in the western United States only have experienced exceedances during the winter season. In such cases, the EPA authorizes states to (1) develop a seasonal emission inventory and (2) evaluate emission reduction strategies for a single season only [p. 11]. "When following a seasonal approach, the EPA believes that *the control strategy evaluation* (based on seasonal emission reduction measures) and the assessment of future year air quality concentrations (through air quality modeling or other analyses) *should be conducted for that season*." [p. 12]. In view of the nature of Utah's $PM_{2.5}$ nonattainment circumstance, the BACT analysis for UPP focuses primarily on a wintertime control strategy.

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SECTION 3

BACT Determinations

This section provides BACT determinations for emission sources deemed significant at the UPP and tailings site. Emissions at the laboratory are minimal, currently effectively controlled with implementation of BACT, and therefore not included in this analysis.

3.1 Utah Power Plant

Historically, KUC has operated three coal fired boilers rated at 100 megawatts (MW) combined, referred to as Units 1-3, at the UPP. The units operated on coal during the summer months, but were limited to burning natural gas during the winter months between November 1 and March 1. In October 2016, KUC has permanently ceased operation of Units 1-3. Therefore, a BACT analysis for Units 1-3 is not included in this document.

3.1.1 UPP Unit 4 Boiler

Source Description: Tangentially fired boiler capable of burning both coal and natural gas, rated at 838 million British Thermal Units per hour (MMBTU/hr) (coal), or 872 MMBTU/hr (natural gas), equipped with an electrostatic precipitator. Since the ambient 24-hour concentrations of $PM_{2.5}$ exceed the NAAQS only during the winter months, the BACT analysis is limited to controls for the combustion of natural gas, which are the only controls that may affect the attainment of the $PM_{2.5}$ NAAQS in the Salt Lake City nonattainment area.

3.1.1.1 NO_x BACT

Step 1—Identify All NO_x Control Technologies listed in RBLC. The RBLC identifies (1) low NO_x burners with over-fire air (low NO_x burner [LNB] with over-fire air [OFA]) and (2) LNB with OFA and SCR as potential technologies for NO_x control from a natural gas fired boiler.

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Previous SIP determination for UPP Unit 4 required the installation of LNB with OFA and SCR with 90% NO_x control when operating on natural gas during the winter months between November 1 and March 1. Because the top technology is already identified in previous SIPs, additional analysis is not necessary.

Step 4—Identify BACT. LNB with OFA and SCR with 90% control efficiency constitute BACT for controlling NO_x emissions from natural gas combustion in the boiler during the wintertime period (November 1 through March 1).

3.1.1.2 SO_2 BACT

Step 1—Identify all SO_2 Control Technologies listed in RBLC. The RBLC identifies the use of pipeline quality natural gas as a control when burning natural gas.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4— Identify BACT. The use of pipeline quality natural gas constitute BACT when burning natural gas.

3.1.1.3 $PM_{2.5}$ BACT

Step 1—Identify all $PM_{2.5}$ Control Technologies listed in RBLC. The RBLC identifies good combustion practices as a control for reducing $PM_{2.5}$ when burning natural gas.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. Good combustion practices constitute BACT while burning natural gas.

3.1.1.4 VOC BACT

Step 1—Identify all VOC Control Technologies listed in RBLC. The RBLC identifies good combustion practices as a control when burning natural gas.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4— Identify BACT. Good combustion practices constitute BACT for VOC while burning natural gas.

Controlling NO_x emissions by 90 percent with LNB, OFA, and SCR and the use of pipeline quality natural gas and good combustion practices represent most stringent measures for Unit 4 at the UPP when operating on natural gas between November 1 and March 1.

3.1.2 UPP Unit 5 Combustion Turbine and Duct Burner

Source Description: A combustion turbine and duct burner in combined-cycle operation with a nominal generating capacity of approximately 275 MW, equipped with SCR and CatOx.

3.1.2.1 NO_x BACT

Step 1—Identify All NO_x Control Technologies listed in RBLC. The RBLC identifies selective noncatalytic reduction (SNCR) and SCR as potential technologies for NO_x control. The SCR technology is the most stringent control alternative listed in the RBLC.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. SCR constitutes BACT for controlling NO_x emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.2 VOC BACT

Step 1—Identify All CO and VOC Control Technologies listed in RBLC. The RBLC identifies CatOx to control emissions of CO and VOC.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. CatOx constitutes BACT for controlling CO and VOC emissions from the combustion turbine and duct burner.

3.1.2.3 SO_2 BACT

Step 1—Identify All SO_2 Control Technologies listed in RBLC. The RBLC identifies the use of pipeline quality natural gas and good combustion practices as a control when burning natural gas.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The use of pipeline quality natural gas and good combustion practices constitute BACT for controlling SO_2 emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.4 $PM_{2.5}$ BACT

Step 1—Identify All $PM_{2.5}$ Control Technologies listed in RBLC. The RBLC identifies the use of pipeline quality natural gas and good combustion practices as a control when burning natural gas.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The use of pipeline quality natural gas and good combustion practices constitute BACT for controlling $PM_{2.5}$ emissions from the Unit 5 combustion turbine and duct burner.

Limiting NO_X emissions to 2 parts per million by volume dry (ppmvd) at 15% O_2 and the use of pipeline quality natural gas and good combustion practices represent the most stringent measures for Unit 5 at the UPP.

3.1.3 Cooling Towers

Source Description: Noncontact water cooling towers are used to control waste heat from the boilers. All towers are equipped with drift eliminators with drift loss rated at 0.002 percent.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.002 percent and good operating practices represent most stringent measures for the cooling towers.

3.1.4 Tioga Space Heaters

Source Description: Natural gas-fired space heaters are used for comfort heating and cooling, and water heating throughout the power plant. The space heaters use low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. All space heaters are rated at less than 5 MMBTU/hr.

3.1.4.1 NO_x BACT

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The technologies identified in the RBLC for controlling NO_x emissions from heaters (LNB and good combustion practices) are already in use and constitute BACT.

3.1.4.2 $PM_{2.5}$, SO_2, and VOC BACT

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.

Step 2—Eliminate Technically Infeasible Options. Not applicable as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measures for Tioga Space Heaters at the UPP.

3.2 Tailings Site

3.2.1 Wind Erosion from Tailings Embankment

Source Description: Tailings are sent to the tailings site via a slurry pipeline. At the facility, tailings are separated by size in a cyclone with the larger particles used to build the embankments and the smaller particles discharged in slurry form in the impoundment. Emissions from the tailings site are mainly from wind erosion of dry tailings on the embankment. The facility has a current dust control plan approved by the UDAQ Executive Director for control of fugitive particulate matter.

Step 1—Identify All Control Technologies Listed in RBLC. The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

- Watering
- Polymer application
- Revegetation
- Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

Step 2—Eliminate Technically Infeasible Options. Because of the size of the impoundment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The tailings site can be categorized into four operational areas: impoundment, flat embankment, sloped embankment, and reclaimed areas. The impoundment area is saturated with water and does not result in windblown dust emissions. Visual inspections are routinely performed to ensure the impoundment is saturated with water and in the unlikely event an area appears to be drying out, the area would be resaturated.

The tailings are actively deposited in the embankment areas. In an active embankment cell, the tailings are deposited every fourth day. The tailings are extremely wet when deposited. Areas can remain moist for several days. Application of water for dust control in active areas is not feasible as it tends to channelize directly to the drain point instead of spreading across the surface. The flat embankment areas will therefore have a potential for wind erosion on days 2, 3, and 4. Emissions are estimated based on days with potential for wind erosion.

In the inactive embankment areas, where tailings deposition has been completed for the year, KUC installs sprinklers for watering. In 2010 and 2011, KUC converted this to an automated sprinkler system that wets the surface at regular intervals. This upgrade allows the surface to maintain its moisture.

The embankment slopes are sprayed with polymers to minimize windblown dust. Polymer is reapplied as necessary to maintain its effectiveness to minimize emissions.

Once released for reclamation, KUC implements a revegetation plan to reclaim the areas. Polymers are applied to areas still waiting to be reclaimed.

The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.

Step 4—Identify BACT. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions. The dust control plan requires frequent monitoring of the impoundment for wind erosion potential, applying chemical dust suppressants in the late spring, applying water via water trucks and the dust suppression sprinkler system as needed to maintain adequate moisture content. Therefore, KUC recognizes water spray/wet suppression, polymer application, and revegetation are selected as BACT for the tailings site.

The current practices of dust management at the tailings site also represent most stringent measures.

3.3 Service Roads

Source Description: Service roads exist throughout the tailings site and are used by KUC personnel daily.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies potential technologies for control of fugitive emissions on unpaved roads as; paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance of roads.

Step 2—Eliminate Technically Infeasible Options. Paving the haul roads is not technically feasible at the tailings site because of the frequently changing road locations over time resulting from tailing placement.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The remaining technologies of water application, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are economically and chronologically feasible.

Step 4—Identify BACT. The application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are identified as BACT for the service roads.

The application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads also represent most stringent measures for the service roads at the tailings site.

SECTION 4

BACT Summary

This section provides a summary of BACT for emission sources deemed insignificant at the UPP, tailings site, and the laboratory.

Table 4-1. BACT Summary

Emission Source ID/Name	Emission Source Description	BACT Summary
Natural Gas Steam Boiler	Natural Gas Steam Boiler	Emissions are minimized with low NO_X burners and use of pipeline quality natural gas.
Nat Gas Purge Vents	Natural Gas Safety Purge Vents	Operating procedures minimize emissions from purging events.
Gasoline Fueling	Fueling Station at the UPP	Stage 1 and Stage 2 vapor recovery systems minimize emissions.
Coal Storage Pile	Coal Storage Pile	Water sprays are used to minimize emissions from the storage pile.
Drop to Coal Storage Pile	Coal Transfer	Enclosures and water sprays are used to minimize emissions.
Coal Transfer Point	Coal Transfer	Enclosures and water sprays are used to minimize emissions.
Ash Handling	Ash Transfer	Water sprays are used to minimize emissions from ash handling operations.
Salt Lake City Biosolids	Organic matter used to enhance reclamation	Emissions are minimized by inherent moisture content of approximately 40%.
South Valley Biosolids	Organic matter used to enhance reclamation	Emissions are minimized by inherent moisture content of approximately 40%.
Cold Solv. Degrease. Washers	Cold Solvent Degreasers	Keeping the lids closed on the degreasers minimize solvent loss and emissions.
Unpaved	Service Roads at the UPP	The unpaved roads are treated with magnesium chloride and watered at regular frequency to minimize emissions.
Paved	Service Roads at the UPP	Paving the surface is the highest form of dust control for roads.
Tailings Diesel Engine	Diesel Emergency Generator	Emissions comply with applicable New Source Performance Standards.
UPP Diesel Engine	Diesel Emergency Generator	Emissions comply with applicable New Source Performance Standards.
Natural Gas Generators	Natural Gas Generators	Emissions comply with applicable New Source Performance Standards.
LPG Engine 1	LPG Communications Generator	Emissions comply with applicable New Source Performance Standards.

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SECTION 5

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

5.1 Utah Power Plant

KUC is proposing the following limitations and monitoring requirements for the UPP.

Unit 5 shall not exceed the following emission rates to the atmosphere

Pollutant	lb/hr	Ppmvd (15% O_2 dry)
NO_x		2.0*
$PM_{2.5}$ with duct firing: Filterable and condensable	18.8	

*Under steady state operation

Stack testing to show compliance with the above Unit 5 emissions limitations shall be performed as follows:

Pollutant	Test Frequency
$PM_{2.5}$	every year
NO_x	every year

The heat input during all compliance testing shall be no less than 90% of the design rate.

The following requirements are applicable to Unit 4 during the period November 1 to February 28/29 inclusive:

During the period from November 1, to the last day in February inclusive, only natural gas shall be used as a fuel, unless the supplier or transporter of natural gas imposes a curtailment. The power plant may then burn coal, only for the duration of the curtailment plus sufficient time to empty the coal bins following the curtailment.

Except during a curtailment of natural gas supply, emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

Pollutant	Grains/dscf	ppmdv (3% O2) 68°F, 29.92 in. Hg
$PM_{2.5}$ Filterable	0.004	
Filterable and condensable	0.03	
NO_x		336
NO_x (after 1/1/2018)		60

If operated during the winter months, stack testing to show compliance with the above Unit #4 emissions limitations shall be performed as follows:

Pollutant	Test Frequency
$PM_{2.5}$	every year
NO_x	every year

The heat input during all compliance testing shall be no less than 90% of the maximum average hourly production rate achieved in any 24-hour period during the previous three (3) years. The limited use of natural gas during startup, for maintenance firings and break-in firings does not constitute operation and does not require stack testing.

5.2 Tailings Site

The primary source of emissions at the tailings site is wind-blown dust. The intent of the $PM_{2.5}$ serious nonattainment SIP is to review emissions during winter time inversions. Since these inversions represent stagnant wind conditions, emissions from the tailings site will be minimal and therefore tailings site SIP conditions are not necessary for the $PM_{2.5}$ SIP. Emissions at the tailings site are effectively controlled with the implementation of BACT and most stringent measures.

5.3 Laboratory

No limitations or monitoring requirements are proposed for the laboratory emission sources as the emissions from the facility are minimal and are effectively controlled with the implementation of BACT and most stringent measures.

FINAL

Best Available Control Technology Determinations for the Smelter, Refinery, and Molybdenum Autoclave Process

Prepared for

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April 2017

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Acronyms and Abbreviations

ACT	Alternative control techniques
AO	approval order
BACT	best available control technology
BCM	Bingham Canyon Mine
CAA	Clean Air Act
CEM	Continuous emissions monitor
CFR	*Code of Federal Regulations*
CHP	Combined heat and power
CO	carbon monoxide
CPI	Consumer Price Index
EPA	Environmental Protection Agency
ESP	Electrostatic precipitator
FGR	Flue gas recirculation
FS	Flash Smelting
GPS	Global Positioning System
gr/dscf	grains per standard cubic feet
KUC	Kennecott Utah Copper
LNB	Low NOx burner
MACT	maximum achievable control technology
MAP	molybdenum autoclave process
MMBtu/hr	million British Thermal Units per hour
NAAQS	National Ambient Air Quality Standard
NH_3	ammonia
NO_x	nitrogen oxides
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppm	parts per million
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SCR	Selective catalytic reduction
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOP	Standard operating procedure
TEG	Turbine Electric Generator
tpy	tons per year

UDAQ	Utah Department of Air Quality
ULNB	Ultra-low NOx burner
VOC	volatile organic compound
WRAP	Western Regional Air Partnership

SECTION 1

Introduction

Kennecott Utah Copper LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities: smelter, refinery, and the molybdenum autoclave process (MAP). In addition to a BACT analysis, KUC has also documented the most stringent measures for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and meet any reasonable further progress requirements. As requested by the Utah Department of Air Quality (UDAQ), the BACT analysis should identify and evaluate reasonable and available control technologies for each relevant pollutant. The technical and economic feasibility of each potential control technology are components of the BACT analysis that help show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). For each emission source, the BACT analysis followed a four step process:

Step 1—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC)

Step 2—Eliminate technically infeasible options

Step 3—Eliminate economically/chronologically infeasible options

Step 4—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent most stringent measures.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS were combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends the BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development.

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SECTION 2

Recent Permitting Actions

The smelter, refinery, and MAP together have over 70 individual significant and insignificant sources. The smelter recently had UDAQ permitting actions. A modified approval order (AO) was issued for the smelter on June 10, 2014. AO DAQE-AN0103460054-14 allows the smelter to operate a crushing and screening plant and modifies stack testing requirements for the smelter emissions sources. No other significant modifications were made to the smelter AO in the last 5 years.

The EPA performed extensive technology reviews of smelter emissions in support of the 2002 primary copper smelting major source maximum achievable control technology (MACT) standard (40 *Code of Federal Regulations* [*CFR*] 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC smelter are included in the Federal Register notices associated with the draft and final promulgation of both of these rules. Both of these standards establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. The primary copper smelting area source MACT standard specifically identifies the KUC smelter main stack emission performance as MACT for copper smelters (existing sources, not using batch copper converters). Smelter process and emission controlling technologies that contributed to EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred subsequent to promulgation of the MACT standards.

AO DAQE-AN01013460045-10 for the refinery was issued in 2010 to add the combined heat and power (CHP) unit. The CHP unit utilizes SoLoNO$_X$™ burners minimizing NO_X emissions from the unit. The smelter and refinery facilities operate under a single Title V Operating Permit # 3500030003.

The MAP facility, will process molybdenum disulfide into molybdenum trioxide and ammonia. The MAP facility was originally permitted in 2008 and was modified in March 2013 (AO DAQE-AN0103460052-13) to reflect the updated design of the plant. The permitting actions require thorough control technology analysis and the plant will implement BACT to minimize emissions from the facility.

Potential to emit (PTE) emissions in tons per year (tpy) for the Smelter, Refinery and MAP are shown in Table 2-1.

Table 2-1. Facility Potential to Emit Emissions

	PM_{10} PTEs (tpy)	$PM_{2.5}$ PTEs (tpy)	NO_x PTEs (tpy)	SO_2 PTEs (tpy)	VOC PTEs (tpy)
Smelter	510.82	426.35	185.29	1,085.72	13.50
Refinery	25.64	25.64	38.57	4.44	8.42
MAP	13.11	9.99	35.57	2.43	6.71

Notes:
PM_{10} = Particulate matter 10 microns or smaller in aerodynamic diameter
NO_x = oxides of nitrogen
SO_2 = sulfur dioxide
VOC = volatile organic compounds
$PM_{2.5}$ = Particulate matter 2.5 microns or smaller in aerodynamic diameter
PTE = potential to emit
tpy = tons per year

SECTION 3

Best Available Control Technology Determinations

This section provides BACT determinations for emission sources deemed significant at the smelter, refinery, and the MAP facility.

3.1 Smelter

The EPA performed extensive technology reviews of smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules (e.g., the design of the smelter is based on the furnace technology). Typical smelting operations require batch processing which intermittently produces high concentrations of SO_2 and particulate in a manner that can reduce the efficiency of the acid plant as a control device. By employing the flash smelting (FS) and flash converting (FC) technologies, KUC is able to eliminate many of the problems inherent with batch type smelter operations. These improvements include continuous flow of off-gases to the acid plant during the FC process as well as reduced total volume of off-gases. Additionally, the furnaces are stationary which improves the ability to capture the off-gases as well as the ability to capture any fugitive emissions with the secondary capture system, which cleans the gases with baghouses and scrubbers before venting to the main stack. As a result, both MACT standards go so far as to establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology.

The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources not using batch copper converters). The KUC Smelter employs several technologies to minimize the smelting emissions that report to the main stack.

- The concentrate dryer burns natural gas to heat/dry concentrate for use in the FS furnace. Operation with low-NO_x burners (LNB) along with lower dryer temperatures minimizes the formation of NO_x while also preventing the formation of SO_2. KUC operates both a baghouse and a scrubber as controls for the concentrate dryer.
- The secondary gas system collects fugitive emissions in the hot metals building (typically associated with the furnaces) and vents them through a baghouse and a sodium-based scrubber before they are vented to the main stack.
- The matte grinding circuit crushes and dries granulated matte for use in the FC furnace. The ground matte is collected in a baghouse and pneumatically conveyed to the FC furnace feed bin. NO_x emissions from natural gas combustion are controlled with LNB and low temperature firing and PM_{10} emissions are controlled with the production baghouse.
- In the anodes area, blister copper from the FC furnace is refined in two available refining furnaces to remove the final traces of sulfur. Copper production can be supplemented with copper scrap, which can be added to the refining furnaces for re-melt. The anodes refining furnaces are natural gas fired with oxy-fuel burners. Off-gas is vented (in series) to a quench tower, lime injection, baghouse, and scrubber and vented to the main stack. NO_x reduction activities also include maintaining furnaces to prevent ingress of air.
- The shaft furnace and holding furnace are used to re-melt anode scrap and other copper scrap to incorporate into copper production. LNBs are used to reduce NO_x from the natural gas combustion and a

baghouse is operated to control PM_{10} emissions. The shaft furnace is in the anodes area, but vents separately to the main stack.

3.1.1 Main Stack

Source Description. Multiple process equipment emissions are routed through the main stack. Such equipment includes the matte granulators, acid plant, anode building, powerhouse, furnaces, dryers, and grinding circuits. Many of these sources of emissions have their own primary control devices (baghouse, scrubbers, etc.). Some are then routed to the secondary gas system and then through the main stack.

Equipment emissions routed through the main stack at the smelter include:

Equipment	Pollutant Emissions	Primary Emissions Control
Concentrate dryer	$PM_{2.5}$, SO_2, NO_X	LNB, baghouse, and scrubber
Powerhouse superheater	$PM_{2.5}$, SO_2, NO_X, VOC	Ultra-low NOx burner (ULNB), Flue gas recirculation (FGR), fuel throughput limits, and good operational practices
Powerhouse Foster Wheeler aux boiler	$PM_{2.5}$, SO_2, NO_X, VOC	LNB, FGR, fuel throughput limits, and good operational practices
Matte grinding	$PM_{2.5}$, SO_2	LNB, baghouse and good operational practices
Anode refining furnaces	$PM_{2.5}$, SO_2, NO_X, VOC	Oxy-fuel burners, baghouse, and scrubbers
Anode shaft furnace	$PM_{2.5}$, SO_2, NO_X, VOC	Baghouse
Anode holding furnace	$PM_{2.5}$, SO_2, NO_X, VOC	Baghouse
Vacuum cleaning system	$PM_{2.5}$	Baghouse
North and south matte granulators	$PM_{2.5}$, SO_2	Scrubber, SGS baghouse, and SGS scrubbers

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies different control technologies for process equipment eventually routed through the main stack. These control technologies are currently in place as previously discussed.

The EPA performed extensive technology reviews of smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC smelter are included in the Federal Register notices associated with the draft and final promulgation of both of these rules. Both of these standards go so far as to establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. The primary copper smelting area source MACT standard specifically identifies the KUC smelter main stack emission performance as MACT for copper smelters (existing sources not using batch copper converters). Smelter process and emission controlling technologies that contributed to EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred subsequent to promulgation of the MACT standards.

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 selected as BACT.

Step 4—Identify BACT. Because no new major developments in technologies have occurred subsequent to the promulgation of the MACT standards, the control technologies currently in place constitute BACT.

Complying with applicable requirements of the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE) represent the most stringent measures for the main stack.

3.1.2 Powerhouse Holman Boiler

Source Description: The boiler is used to provide process steam at the smelter. Emissions of NO_x are limited with flue gas recirculation, LNB, opacity limits, an alternate monitoring plan; which requires continuous monitoring of operational parameters (fuel use, stack oxygen, steam output) and operational controls with good combustion practices. Emissions of $PM_{2.5}$, CO, SO_2, and VOC are limited with use of pipeline quality natural gas, good combustion practices, gas consumption limit, good design, opacity limits, and proper operation of the boiler.

3.1.2.1 NO_x BACT

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired boilers:

- Selective catalytic reduction (SCR)
- FGR
- LNBs with good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The Holman boiler is equipped with FGR and LNB to reduce NO_x emissions. The addition of the SCR would reduce the emissions from the boiler from 9.9 tpy (based on 2016 actual emissions) to 2.0 tpy.

From the Alternative Control Techniques (ACT) Document — NO_x Emissions from Industrial / Commercial / Institutional Boilers, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 100 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.03 lb/MMBtu. From Table 6-5 of the ACT document, the total annualized cost for the 100 MMBtu/hr gas boiler is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from Consumer Price Index (CPI) Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74; therefore, for the Holman boiler, the estimated cost is $487,287.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $62,000 and is therefore not cost effective for BACT.

Step 4—Identify BACT. FGR, LNBs with good combustion practices, limited gas consumption, good design, and proper operation constitute BACT for this source.

KUC continuously monitors operation parameters to predict NO_x emissions and ensure proper boiler operation. The parameters monitored are fuel use (to predict NO_x emissions lb/hr), stack oxygen (to monitor proper boiler operation and compliance with NO_x lb/MMBtu emission limit), and steam output (used to estimate heat input if fuel use is unavailable). The ranges for these parameters were developed during a 30-day monitoring campaign where data from a certified NO_x analyzer were used to develop predictive equations with the operation parameters.

3.1.2.2 SO_2, VOC, and $PM_{2.5}$ BACT

Step 1—Identify All Control Technologies listed in the RBLC. The RBLC identifies the following as possible control technologies for boilers:

- Use of pipeline quality natural gas and good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable because all potential technologies identified in Step 1 were selected as BACT.

Step 4—Identify BACT. Use of pipeline quality natural gas, good combustion practices, opacity limits, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNBs with good combustion practices, limited gas consumption, good design, and proper boiler operation represent the most stringent measures for the Holman Boiler.

3.1.3 Feed Process (Wet and Dry)

Source Description: Silica flux, concentrate, and converter slag are transferred directly to feed bins then conveyed to the dryer. Particulate emissions from the loading of the flux and concentrate, and from transfer points of the conveyor, are vented to a baghouse.

Step 1—Identify All Control Technologies listed in RBLC. Although RBLC did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, electrostatic precipitators (ESPs), and wet scrubbers.

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP, because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP and then by wet scrubbers.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable as most effective technology identified in Step 1 selected as BACT.

Step 4—Identify BACT. Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

The use of a baghouse to control particulate emissions also represents the most stringent measures for both the wet and dry feed process.

3.1.4 Matte and Slag Granulators

Source Description: Slag and matte granulators are each equipped with a three-stage impingement plate scrubber. The smelter operates two matte granulators and one slag granulator. The molten matte is granulated with water in two separate granulation tanks (two matte granulators), each equipped with a scrubber. The convertor slag is granulated in a separate granulator (one slag granulator), also equipped with a scrubber. The matte granulators are vented through the main stack. The slag granulator is vented to the atmosphere through a separate stack. $PM_{2.5}$ and SO_2 emissions are controlled by a neutral pH three-stage impingement plate scrubber.

3.1.4.1 $PM_{2.5}$ BACT

Step 1—Identify All Control Technologies Listed in RBLC. Although RBLC did not provide controls for the specific operation, other possible particulate control technologies include baghouses, cyclones, ESP, and scrubbers.

Step 2—Eliminate Technically Infeasible Options. While baghouses are most effective in controlling particulate emissions, this technology is not feasible for the granulators. The exhaust from the granulators has very high moisture content, which is not suitable for baghouses. Moisture condensation can cause accumulation of mud on the bags and baghouse walls. This results in blinded bags and clogged dust removal equipment. As discussed in the Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, cyclones are mainly used to control large particles.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, as most technically feasible technology for this process, identified in Step 2, was selected as BACT.

Step 4—Identify BACT. Scrubbers constitute BACT for the granulators.

3.1.4.2 SO_2 BACT

Step 1—Identify All Control Technologies listed in RBLC. The RBLC does not identify any specific control technologies for the granulators.

Step 2—Eliminate Technically Infeasible Options. Not applicable

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable

Step 4—Identify BACT. Scrubbers constitute BACT for the granulators.

The use of scrubbers also represent the most stringent measures for both the matte and slag granulators.

3.1.5 Feed Storage Building

Source Description: Wet copper concentrate feed is stored in the enclosed wet feed storage building. Particulate matter from loading materials into the feed storage building, from reclaiming materials, and from conveyor/transfer point SME 002-A, are vented to a baghouse.

Step 1—Identify All Control Technologies listed in RBLC. Although RBLC did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, as most effective technology, identified in Step 1, selected as BACT.

Step 4—Identify BACT. Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

The use of a baghouse to control particulate emissions also represents Most Stringent Measures for the feed storage building.

3.1.6 Anode Area Fugitives

Source Description: Emissions from the anode building process are controlled with a baghouse, quench tower, and scrubber. However, some emissions escape as fugitives.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC does not identify any specific control technologies for process fugitives. The MACT, however, does address such emissions.

40 *CFR* 63.11147(a)(3) states, "You must operate one or more capture systems that collect the gases and fumes released from each vessel used to refine blister copper, re-melt anode copper, or re-melt anode scrap and convey each collected gas stream to a control device. One control device may be used for multiple collected gas streams."

KUC certified compliance with 63.11147(a)(3), as required by 63.11150(b)(4), in a letter dated and received by UDAQ on January 30, 2007.

Step 2—Eliminate Technically Infeasible Options. Not applicable

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable

Step 4—Identify BACT. In addition to opacity limits and required maintenance, current design of anode process units and the collection hoods on anode building processes have been engineered/designed to reduce fugitives and these practices constitute BACT.

The current design of anode process units and the collection hoods on anode building processes were engineered/designed to reduce fugitives and these represent most stringent measures.

3.1.7 Smelter Fugitives

Source Description: Emissions from smelter processes are controlled with appropriate control technologies including closed processes, launder hoods and others outlined below. However, some emissions escape as fugitives.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC does not identify any specific control technologies for such fugitives.

The EPA performed extensive technology reviews of smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Regarding the design and fugitive emission controls of the KUC smelter, the EPA provided the following discussion when promulgating the final copper smelting MACT standard (FR Vol. 67, No. 113, Page 40488):

> Due to its unique design and operations, most of the process fugitive emission sources associated with smelters using batch converting are eliminated at the Kennecott smelter. There are no transfers of molten material in open ladles between the smelting, converting, and anode refining departments at the Kennecott smelter. In addition, there are no fugitive emissions associated with the repeated rolling-out of converters for charging, skimming, and pouring. Also, only one continuous flash converter is needed at the Kennecott smelter compared with the need for three of more batch copper converters at the other smelters.

Both standards go so far as to establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. Smelter process and emission controlling technologies that contributed to the EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred subsequent to the promulgation of the MACT standards.

Specific notes regarding control techniques listed in Table 5 of Attachment 5 of the EPA comments are listed below:

- KUC smelter hot metals operations are serviced by an extensive local ventilation (secondary gas) system. This system collects gasses and routes them through baghouses and scrubbers before venting them to the main stack where they are continuously monitored for multiple pollutants.
- KUC smelter hot metals operations are completely enclosed in a building.
- KUC processes only clean scrap in its melting furnaces.
- A leak detection/prevention/repair program is not applicable to KUC smelter furnaces and hot metals process units because they are enclosed and operate at negative pressure due to their inherent design.
- Because KUC furnaces are enclosed and do not require open air transfer of molten metal, they are not dependent on hooding systems for process gas collection.
- It is not necessary to add curtains to improve hood performance at the KUC smelter as the process does not rely on hoods to capture process gasses.
- The KUC process does not require the open air transfer of molten metal from smelting to converting vessels so it is not necessary to collect these emissions.
- The EPA noted in the primary copper smelting MACT standard, KUC was the first smelter in the United States to capture and control emissions from anode refining furnaces.

Step 2—Eliminate Technically Infeasible Options. Not applicable

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable

Step 4—Identify BACT. In addition to opacity limits and required maintenance, current designs of processes were engineered/designed to reduce fugitives and therefore these practices constitute BACT.

The current designs of processes were engineered/designed to reduce fugitives and therefore these practices also represent the most stringent measures.

3.1.8 Acid Plant Fugitives

Source Description: The double contact acid plant removes SO_2 from the off-gases of the flash furnaces. The sulfuric acid produced by the plant is sold. Among other technologies, the system is equipped with tubular candle fiber mist eliminators and the tail gas is discharged to the main stack. However, some emissions escape as fugitives, which are controlled using best operational practices to minimize emissions. Best operational practices to minimize the emissions include opacity limits, weekly visual opacity surveys and the requirement of prompt repair or correction and control to minimize emissions.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC does not identify any specific control technologies for such fugitives.

Step 2—Eliminate Technically Infeasible Options. Not applicable

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable

Step 4—Identify BACT. Best operational practices may include, but are not limited to (1) placement or adjustment of negative pressure ductwork and collection hoses, (2) welding of process gas leaks, or (3) containment of process gas leaks. These practices and current design of processes were engineered/designed to reduce fugitives and therefore constitute BACT.

The best operational practices currently implemented and the current design of the processes also represent the most stringent measures for the acid plant fugitives.

3.1.9 Powerhouse Foster Wheeler Boiler

Source Description: This boiler is used to produce superheated steam to start the smelter, drive acid plant compressors, and standby power. Emissions of NO_x are limited with FGR, LNB with good combustion practice, continuous monitoring of NO_x at the smelter main stack, and limitations on fuel throughput. Emissions of $PM_{2.5}$, CO, SO_2, and VOCs are limited with use of pipeline quality natural gas; good combustion practices; good design and proper operation of the boiler; and continuous monitoring of opacity, particulate, and SO_2 at the smelter main stack.

3.1.9.1 NO_x BACT

Step 1—Identify All Control Technologies listed in RBLC. The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired boilers.

- SCR
- FGR
- LNB with good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The powerhouse boiler is equipped with FGR and LNB to reduce NO_x emissions. Emissions from this boiler are vented through the main stack and it is difficult to differentiate the boiler NO_x emissions from the main stack emissions. Based on the understanding of operations at the Smelter, the addition of the SCR might reduce the annual emissions from the boiler from 5.3 tpy (based on 2016 actual emissions and engineering estimates) to 1.1 tpy.

From the Alternative Control Techniques Document – NO_x Emissions from Industrial/Commercial/Institutional Boiler, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 100 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.03 lb/MMBtu. From Table 6-5, the total annualized cost for the 100 MMBtu/hr gas boiler is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74; therefore, for the powerhouse boiler the estimated cost is $261,000.

Based on the annualized costs for the SCR, the cost of *additional* control per ton of NO_x removed is $62,000 and is therefore not cost effective for BACT.

Step 4—Identify BACT. FGR, LNB with good combustion practices, good design and proper operation constitute BACT.

3.1.9.2 SO_2, VOC, and $PM_{2.5}$ BACT

Step 1—Identify All Control Technologies listed in RBLC. The RBLC identifies the following as possible control technologies for boilers.

- Use of pipeline quality natural gas and good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, because all potential technologies identified in Step 1 are selected as BACT.

Step 4—Identify BACT. Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measures for the Powerhouse Foster Wheeler Boiler.

3.1.10 Miscellaneous Storage Piles/Loadout

Source Description: Concentrate, granulated matte, slag, and other materials are stored in storage piles on pads. Water sprays or chemicals are applied as necessary to minimize fugitive emissions.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies dry foggers, adding moisture, and enclosures as possible control technologies for fugitive emissions. Other possible technologies available to control fugitive dust emissions that are not identified in the RBLC include chemical dust suppression, baghouse, cyclone, and scrubber.

Step 2—Eliminate Technically Infeasible Options. The emission sources are fugitive in nature and therefore it is not technically feasible to duct emissions to a baghouse, scrubber, or cyclone. Additionally, the locations of the storage piles are also changing, making the construction of permanent enclosures difficult. Therefore, these control technologies are not technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The remaining technology of water or chemical applications is economically and chronologically feasible.

Step 4—Identify BACT. KUC uses water sprays, chemical dust suppressants, and temporary enclosures to minimize particulate emissions from the miscellaneous storage piles, which were demonstrated to be very effective. These business practices constitute BACT for this emission source.

The use of water sprays, chemical dust suppressants, and temporary enclosures to minimize particulate emissions from the miscellaneous storage piles also represent the most stringent measures.

3.1.11 Slag Concentrator

Source Description: Emissions associated with the crushing, grinding, and slag processing at the smelter are minimized with the water sprays and enclosures.

Step 1—Identify All Control Technologies Listed in RBLC. Although RBLC did not provide controls for the specific operation, other possible particulate control technologies include baghouses, cyclones, scrubbers, water sprays, and enclosures.

Step 2—Eliminate Technically Infeasible Options. Baghouses are not feasible for the slag processing equipment. The slag stock piles are sprayed with water frequently to minimize emissions. The material as a result has very high moisture content, which is not suitable for baghouses. Moisture droplets and condensation can cause accumulation of mud on the bags, baghouse walls, and ductwork. This results in blinded bags and clogged dust removal equipment. Further, when ambient temperatures are below freezing, the mud will freeze on the baghouse bags and plug them.

Wet scrubbers are not expected to be effective in minimizing emissions from crushing and grinding operations. Operation of the scrubbers is compromised due to below freezing ambient temperatures and very cold water streams in the scrubber. The duct work of the scrubbers will freeze during subfreezing ambient temperature conditions.

As discussed in the WRAP Fugitive Dust Handbook, cyclones are mainly used to control large particles.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The remaining technology of water sprays and enclosures is economically and chronologically feasible.

Step 4—Identify BACT. KUC uses water sprays and enclosures to minimize particulate emissions from the slag concentrator, which were demonstrated to be very effective. These business practices constitute the BACT for this emission source.

The use of water sprays and enclosures to minimize particulate emissions represent the most stringent measures from the slag concentrator.

3.1.12 Smelter Cooling Towers

Source Description: Three noncontact water cooling towers are used for various smelter processes. The towers are equipped with drift eliminators with drift loss rated at 0.001 percent.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.

Step 2—Eliminate Technically Infeasible Options. Not applicable, as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, because all potential technologies identified, in Step 1, are selected as BACT.

Step 4—Identify BACT. Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.001 percent and good operating practices represent most stringent measures for the cooling tower.

3.2 Refinery

3.2.1 Boilers

Source Description: The two boilers are rated at 82 MMBtu/hr (gas) and 79 MMBtu/hr (oil) each and are permitted to operate on natural gas to meet the steam demand at the refinery. During natural gas curtailment, the boilers are permitted to operate on oil. Emissions of NO_x are limited with FGR and LNB with good combustion practices. Emissions of $PM_{2.5}$, SO_2, and VOCs are limited with good combustion practices, good design, opacity limits, sulfur content limit, and proper operation of the boilers.

3.2.1.1 NO_x BACT

Step 1—Identify All Control Technologies listed in RBLC. The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired boilers

- SCR
- FGR
- LNB with good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The refinery boilers are equipped with FGR and LNB to reduce NO_x emissions. The addition of the SCR will reduce the emissions from the boilers from 12.9 tpy (based on based on 2016 actual emissions) to 2.6 tpy.

From the Alternative Control Techniques Document – NO_X Emissions from Industrial/Commercial/Institutional Boilers, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 50 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing

SCR technology is 0.02 lb/MMBtu (the 100 MMBtu/hr boiler controlled NO_x emission rate with SCR is listed at 0.03 lb/MMBtu). From Table 6-5 of the ACT document, the total annualized cost for the 50 MMBtu/hr gas boiler (closest entry to 82 MMBtu/hr Refinery boiler) is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74. The estimated costs for the refinery boilers is $428,040 for both boilers.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $42,000 for the refinery boilers and is, therefore, not cost effective for BACT.

Step 4—Identify BACT. FGR, LNB with good combustion practices, good design, and proper operation constitute BACT for this source.

3.2.1.2 SO_2, VOC, and $PM_{2.5}$ BACT

Step 1—Identify All Control Technologies listed in RBLC. The RBLC identifies the following as possible control technologies for natural gas fired boilers:

- Use of pipeline quality natural gas and good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, because all potential technologies identified, in Step 1, selected as BACT.

Step 4—Identify BACT. Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measures for the boilers.

3.2.2 CHP Unit

Source Description: The CHP unit will generate power and steam to support refinery operations. The CHP unit uses a low NO_x duct burner and the turbine has $SoLoNO_x$ burners. Emissions of $PM_{2.5}$, SO_2, and VOC are limited with good design and proper operation.

3.2.2.1 NO_x BACT

Step 1—Identify All Control Technologies listed in RBLC. The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired turbines and duct burners.

- SCR
- LNB with good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. The CHP unit is equipped with LNB ($SoLoNO_x$ technology burners on turbine) to reduce NO_x emissions. The addition of the SCR will reduce actual annual emissions from the CHP unit from 12.2 tpy (based on 2014 actual emissions) to 1.2 tpy. The CHP unit had major work performed in 2015 and 2016, therefore 2014 emissions are used for the analysis.

Solar developed an estimation spreadsheet for the Taurus 70 combustion turbine and duct burner arrangement, which utilized vendor quotations for the installation of an SCR system. From the Solar calculations, the annualized capital and operating costs were estimated to be $932,100/yr.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $85,000 for the CHP unit and is therefore not cost effective for BACT.

Step 4—Identify BACT. LNB with good combustion practices, good design, and proper operation of the CHP Unit constitute BACT for this source.

3.2.2.2 SO_2, VOC, and $PM_{2.5}$ Best Available Control Technologies

Step 1—Identify All Control Technologies listed in RBLC. The RBLC identifies the following as possible control technologies for small turbines and duct burners:

- Use of pipeline quality natural gas and good combustion practices
- Good design and proper operation

Step 2—Eliminate Technically Infeasible Options. All control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, because all potential technologies identified, in Step 1, selected as BACT.

Step 4—Identify BACT. Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the CHP unit constitute BACT for this emission source.

LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measures for the CHP unit.

3.2.3 Refinery Cooling Towers

Source Description: Two noncontact water cooling towers are used for various refinery processes. The towers are equipped with drift eliminators with drift loss rated at 0.001 percent.

Step 1—Identify All Control Technologies Listed in RBLC. The RBLC identifies drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.

Step 2—Eliminate Technically Infeasible Options. Not applicable, as all identified control technologies are technically feasible.

Step 3—Eliminate Economically/Chronologically Infeasible Options. Not applicable, because all potential technologies identified, in Step 1, are selected as BACT.

Step 4—Identify BACT. Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.001 percent and good operating practices represent most stringent measures for the cooling tower.

SECTION 4

Best Available Control Technology Summary

This section provides a summary of BACT for emission sources deemed insignificant at the Smelter and Refinery.

Table 4-1. Best Available Control Technology Summary for Smelter and Refinery

Emission Source ID/Name	Emission Source Description	BACT Summary
Building heating	Natural gas heaters	Emissions are minimized with LNB and use of pipeline quality natural gas.
At water heaters	Natural gas water heaters	Emissions are minimized with LNB and use of pipeline quality natural gas.
Ground Matte Silo BH	Storage silo	Emissions controlled with a baghouse.
Mold Coating Silo BH	Storage silo	Emissions controlled with a baghouse.
Hydromet Plt Limestone Silo BH	Storage silo	Emissions controlled with a baghouse.
Hydromet Plt Lime Silo BH	Storage silo	Emissions controlled with a baghouse.
Lab BH	Smelter laboratory	Emissions controlled with a baghouse.
Recycle and Crushing Building	Recycle and crushing building	Process is enclosed to minimize emissions.
Anode Area Lime Silo	Storage silo	Emissions controlled with a baghouse.
Secondary Gas System Lime Silo	Storage silo	Emissions controlled with a baghouse.
Loading to Storage Pile on Patio	Material handling	Emissions are minimized with water sprays and enclosures.
Fueling	Fueling stations at the smelter	Stage 1 and Stage 2 vapor recovery systems minimize emissions.
Degreasing	Cold solvent degreasers at the Smelter	Keeping the lids closed on the degreasers minimize solvent loss and emissions.
Emergency backup power generators	Emergency generators	Emissions comply with applicable New Source Performance Standards.
Smelter Comm. Generator	LPG communications generator	Emissions comply with applicable New Source Performance Standards.
Cathode Wash	Process area	Emissions are minimized through enclosures and complying with standard operating procedures (SOPs).
Anode Scrap	Process area	Emissions are minimized through enclosures and complying with SOPs.
Hydrometallurgical Precious Metals Recovery Scrubber	Process area	Emissions controlled with scrubber
Hydrometallurgical Silver Production Scrubber	Process area	Emissions controlled with scrubber
Se Crushing/Packing Baghouse	Process area	Emissions controlled with baghouse

Table 4-1. Best Available Control Technology Summary for Smelter and Refinery

Emission Source ID/Name	Emission Source Description	BACT Summary
Au/Ag Baghouse	Process area	Emissions controlled with baghouse
Soda Ash Filter	Process area	Emissions controlled with bin vent filter
Space Heaters	Natural gas heaters	Emissions are minimized with LNB and use of pipeline quality natural gas.
Gasoline Fueling	Fueling stations at the refinery	Stage 1 and Stage 2 vapor recovery systems minimize emissions.
Degreasing	Cold solvent degreasers at the Smelter	Keeping the lids closed on the degreasers minimize solvent loss and emissions.
Paint	Process area	Emissions minimized with enclosures
Primer	Process area	Emissions minimized with enclosures
Diesel Generators	Emergency generator	Emissions comply with applicable New Source Performance Standards.
LPG Generator	LPG communications generator	Emissions comply with applicable New Source Performance Standards.

The MAP facility was first permitted in 2008 and was modified in March 2013 (AO DAQE-AN0103460052-13) to reflect the updated design of the plant. The permitting actions have required thorough control technology analysis that the plant will implement BACT to minimize emissions from the facility. Due to this very recent permitting action, KUC has not developed a detailed BACT analysis for the emission sources at MAP facility. However, KUC has developed the following summary of BACT for emission sources at the MAP facility.

Table 4-2. Best Available Control Technology Summary for the Molybdenum Autoclave Process Facility

Emission Source ID/Name	Emission Source Description	BACT Summary
CHP Unit	Combined Heat and Power Unit	LNB and use of pipeline quality natural gas will minimize emissions
Cooling Tower	20,000 gallon per minute (gpm) Cooling Tower	Drift eliminator with efficiency of 0.0005 percent will minimize emissions
IT Building Backup Generator	LPG Communications Generator	Emissions will comply with applicable New Source Performance Standards.
Emergency Fire Pump	Emergency Fire Pump	Emissions will comply with applicable New Source Performance Standards.
Dryers and Re-oxidizer	Three Process dryers and re-oxidizer each rated less than 5 MMBtu/hr	Use of pipeline quality natural gas will minimize emissions
Calciner	Process calciner rated at 16 MMBtu/hr	LNB and use of pipeline quality natural gas will minimize emissions
Startup Boiler	Process startup boiler rated at 30 MMBtu/hr	LNB and use of pipeline quality natural gas will minimize emissions
Scrubbers	Process ammonia, sulfuric acid and hydrogen sulfide emissions	Emissions will be controlled with scrubbers

Table 4-2. Best Available Control Technology Summary for the Molybdenum Autoclave Process Facility

Emission Source ID/Name	Emission Source Description	BACT Summary
Packaging Area	Material Packaging Area	Emissions will be controlled with baghouse and bin vent filters
Reagent Storage	Reagent Storage Tanks and Bins	Emissions will be controlled with bin vent filters and scrubbers
Material Handling	Concentrate transfer and handling	Emission sources will be located inside building and enclosures
Solvent Extraction Lines	Solvent tanks and mixers	Emissions will be minimized through SOPs
Test Laboratory	Laboratory for the MAP operations	Emissions will be controlled with baghouse
Process Boiler	Process boiler rated at 12 MMBtu/hr	LNB and use of pipeline quality natural gas will minimize emissions

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SECTION 5

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

5.1 Smelter

Emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

Emission Point	Pollutant	Test Frequency
Main Stack (Stack No. 11)	$PM_{2.5}$	• 89.5 lbs (filterable, daily average) • 434 lbs/hr (filterable + condensable daily average)
	SO_2	• 552 lbs/hr (3 hr. rolling average) • 422 lbs/hr (daily average)
	NO_x	• 154 lbs/hr (daily average)
Holman Boiler	NO_x	• 14.0 lbs/hr (calendar-day average)

Stack testing to show compliance with the emissions limitations of Condition (A) above shall be performed as specified below:

Emission Point	Pollutant	Test Frequency
Main Stack	PM_{10}	Every year
	SO_2	Continuous Emissions Monitor (CEM)
	NO_x	CEM
Holman Boiler	NO_x	Every 3 years and alternate method determined according to applicable new source performance standards

During startup/shutdown operations, NO_x and SO_2 emissions are monitored by CEMs or alternate methods in accordance with applicable NSPS standards. This condition establishes emissions limitations and compliance requirements for the smelter main stack and the Holman Boiler.

KUC continuously monitors operational parameters to predict NO_x emissions and to ensure proper boiler operation. The parameters monitored are fuel use (to predict NO_x emissions lb/hr), stack oxygen (to monitor proper boiler operation and compliance with NO_x lb/MMBtu emission limit), and steam output (used to estimate heat input if fuel use unavailable). The ranges for these parameters were developed during a 30-day monitoring campaign where data from a certified NO_x analyzer were used to develop predictive equations with the operational parameters. The alternative monitoring method identified in this condition is consistent with the applicable NSPS.

5.2 Refinery

Emissions to the atmosphere from the indicated emission point shall not exceed the following rate:

Emission Point	Pollutant	Maximum Emission
The sum of two (tankhouse) boilers	NO_x	9.5 lb/hr
Combined heat plant	NO_x	5.96 lbs/hr

Stack testing to show compliance with the above emission limitations shall be performed as follows:

Emission Point	Pollutant	Testing Frequency
Tankhouse boilers	NO_x	Every 3 years*
Combined heat plant	NO_x	Every year

Notes:

*Stack testing shall be performed on boilers that have operated more than 300 hours during a 3-year period.

KUC must operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction. Records shall be kept on site which indicate the date, and time of startups and shutdowns. This condition establishes emissions limitations and compliance requirements for the Refinery Boilers and Combined Heat and Power unit.

5.3 Molybdenum Autoclave Process

Emissions to the atmosphere from the natural gas turbine, combined with the duct burner, and with the turbine electric generator (TEG); firing shall not exceed the following rate:

Emission Point	Pollutant	Maximum Emission Rate
Combined heat plant	NO_x	5.01 lbs/hr

Stack testing to show compliance with the above emission limitations shall be performed as follows:

Emission Point	Pollutant	Testing Frequency
Combined heat plant	NO_x	Every year

Records shall be kept on site which indicate the date and time of startups and shutdowns. This condition establishes emissions limitation and compliance requirements for the MAP facility combined heat and power unit.

FINAL REPORT

Kennecott Utah Copper

$PM_{2.5}$ State Implementation Plan: Best Available Control Technology Determinations

Submitted to

Utah Division of Air Quality

Prepared for:

Kennecott Utah Copper

Prepared by:

February 2018

FINAL

BACT Determinations for the Bingham Canyon Mine and Copperton Concentrator

Prepared for

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February 2018

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Acronyms and Abbreviations

AO	approval order
BACT	best available control technology
BCM	Bingham Canyon Mine
CAA	Clean Air Act
CO	carbon monoxide
EPA	Environmental Protection Agency
gr/dscf	grains per dry standard cubic feet
GPS	Global Positioning System
KUC	Kennecott Utah Copper
MMBTU/hr	million British Thermal Units per hour
NAAQS	National Ambient Air Quality Standard
NH_3	ammonia
NOx	nitrogen oxides
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppm	parts per million
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SIP	State Implementation Plan
SO_2	sulfur dioxide
TPY	tons per year
UDAQ	Utah Department of Air Quality
VOC	volatile organic compound

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SECTION 1

Introduction

Kennecott Utah Copper LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities: Bingham Canyon Mine (BCM) and the Copperton Concentrator. In addition to a BACT analysis, KUC has also documented Most Stringent Measures for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and meet any reasonable further progress requirements. As requested by the Utah Division of Air Quality (UDAQ), the BACT analysis should identify and evaluate reasonable and available control technologies for each relevant pollutant. The technical and economic feasibility of each potential technology are components of the BACT analysis that help to show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). For each emission source, the BACT analysis followed a four-step process:

- **Step 1**—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC) and/or California Environmental Protection Agency – Air Resource Board BACT Clearinghouse (CARB)
- **Step 2**—Eliminate technically infeasible options
- **Step 3**—Eliminate economically/chronologically infeasible options
- **Step 4**—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent the most stringent measure.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS were combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends that BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development standard.

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SECTION 2

Recent Permitting Actions

Current operations at the BCM are permitted under Approval Order (AO) DAQE-AN105710042-18, issued on January 10, 2018.

Emissions from the BCM are mainly limited by the following conditions:

- "Total material moved (ore and waste) shall not exceed 260 million tons per rolling 12-month period." This condition limits the total material moved at the BCM, thus limiting all point, fugitive and tailpipe emissions.
- "Maximum total mileage per calendar day for ore and waste haul trucks shall not exceed 30,000 miles." This condition limits daily vehicle miles travelled at the BCM, thus limiting both fugitive and tailpipe emissions.
- "Emissions of particulate matter less than or equal to 10 microns in aerodynamic diameter (PM_{10}), NO_x, and SO_2 combined shall not exceed 7,350 tons and emissions of $PM_{2.5}$, NO_x, and SO_2 shall not exceed 6,205 tons per rolling 12-month period."
- "KUC shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year."

KUC is required to submit an annual fugitive dust control report that provides a description of the fugitive dust control practices implemented at the BCM.

Current operations at the Copperton Concentrator are permitted under AO DAQE-AN105710035-13 issued on June 25, 2013. Potential to Emit (PTE) emissions for the Copperton Concentrator are a very small percentage of combined emissions from the mine and concentrator facilities. Emissions for the Copperton Concentrator are limited by implementation of BACT controls.

PTE emissions in tpy for the BCM and the Copperton Concentrator are shown in Table 2-1.

Table 2-1. Facility Potential to Emit Emissions (Including Fugitive and Nonroad Engine Emissions)

	PM_{10} PTEs (tpy)	**$PM_{2.5}$ PTEs (tpy)**	**NO_x PTEs (tpy)**	**SO_2 PTEs (tpy)**	**VOC PTEs (tpy)**
Bingham Canyon Mine	1,519	369	5,838	7	314
Copperton Concentrator	25.3	13.86	10.66	0.1	4.04

Notes:
NO_x = oxides of nitrogen
PM_{10} = Particulate matter 10 microns or smaller in aerodynamic diameter
$PM_{2.5}$ = Particulate matter 2.5 microns or smaller in aerodynamic diameter
PTE = potential to emit
tpy = tons per year
SO_2 = sulfur dioxide
VOC = volatile organic compounds

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BACT Determinations

This section provides BACT determinations for emission sources deemed significant at the BCM and the Copperton Concentrator.

KUC has reviewed publicly available permitting documents for open pit mines around the country. Permits for two facilities were reviewed in detail – the Morenci Mine and Rosemont Copper Project in Arizona. Although on a smaller scale, the Rosemont project was reviewed as the permit was based on recent BACT determinations for mining operations. Operations at the Morenci mine closely resemble those at KUC. Similar to the BCM and Copperton Concentrator, at these facilities emissions from large crushing operations are controlled with fabric filters, emissions from open areas, roads, storage piles and material handling are minimized with practices such as dust suppressant application and watering. Visible emissions limitations are included in the permit for mobile sources such as graders, dozers and haul trucks.

3.1 Bingham Canyon Mine

3.1.1 In-pit Crusher

Source Description: The crusher is used to crush copper ore mined at the BCM. Particulate emissions from the in-pit crusher are controlled with a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emissions controls information for copper ore crushers. However, the databases identify baghouse (fabric filter) and enclosures with water sprays as possible control technologies for limiting emissions from crushers. The databases did not provide needed information on copper ore crushing. Therefore, due to differences in the material type listed in the databases and copper ore crushed at the BCM, a direct comparison of baghouse grain loading cannot be established.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are economically feasible.
- **Step 4—Identify BACT.** Fabric filters are the most effective in controlling emissions. Therefore, use of a baghouse (fabric filter) constitutes BACT for the in-pit crusher.

The existing baghouse for the crusher is permitted at a grain loading of 0.016 grains per dry standard cubic feet (gr/dscf). KUC investigated the options of either upgrading the filter system in the baghouse or replacing the baghouse.

Based on the review the RBLC and CARB databases, KUC found small baghouses with the grain loading of 0.002 gr/dscf to 0.003 gr/dscf. Using the most stringent emissions rates, KUC requested vendor information on baghouse upgrades to meet the 0.002 gr/dscf grain loading. Based on the data provided by the vendors, the total installed costs for the upgraded baghouse would be about $608,000. Based on the grain loading of the upgraded baghouse, $PM_{2.5}$ emissions from the crusher will be reduced from 2.28 tpy after the primary control to 0.28 tpy. The vendor provided information is included in the Appendix.

Based on the costs for the baghouse replacement, the cost per ton of $PM_{2.5}$ removed is $304,000. Therefore, replacing the crusher baghouse is not cost effective for BACT. Additionally, the vendors are unable to guarantee continuous compliance with the low emission rate from the baghouse for the in-pit crusher.

The current emission rate therefore represents the most stringent measure for the in-pit crusher.

3.1.2 Disturbed Areas

Source Description: Disturbed areas from mining activities. KUC current practices include application of dust palliatives and revegetation of the areas as soon as practical, as well as water application from passing water trucks in the operational areas to minimize dust. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emissions controls information for disturbed areas from mining activities. However, the databases identify revegetation, adding moisture, and enclosures (wind screens) as possible control technologies for fugitive emissions.
- **Step 2—Eliminate Technically Infeasible Options.**

  Applying additional moisture (water) on the disturbed areas, as mining occurs, is not technically feasible for KUC's mine operations. The ore is transferred through a series of conveyors. Excessive moisture in the ore material causes the conveyors to foul and breakdown resulting in costly equipment repairs. Therefore, adding moisture to the ore material is not technically feasible.

  Because the disturbed areas are so expansive and cover varying terrain, adding enclosures or wind screens are not technically feasible for this mine source.

  However, at the request of UDAQ, KUC had discussions with mine management about the feasibility of application of water for dust control on the disturbed areas that have been released for reclamation. Because the areas are so expansive, set up of irrigation systems for watering is not technically feasible. Using water trucks would disturb the reclaimed areas and would not provide benefit over reclamation and would therefore not be technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 were technically infeasible or selected as BACT.
- **Step 4—Identify BACT.** The practice of applying dust palliatives and revegetation is the most effective in reducing emissions from disturbed areas that have been released for reclamation. Therefore, the application of palliatives and revegetation constitute BACT for areas released for reclamation.

The application of palliatives and revegetation also represent BACM for the disturbed areas. Because best available measures are in use, they also represent the most stringent measure.

3.1.3 Waste Rock Offloading from Trucks

Source Description: Haul trucks dump waste rock or overburden at the waste rock disposal areas while minimizing the height of the drop. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify water application and enclosures as possible control technologies for fugitive emissions from similar sources of emissions. Another possible control technology not identified, but effective in reducing emissions from batch drop transfer points, is minimizing the drop distance while the waste rock is being dumped.
- **Step 2—Eliminate Technically Infeasible Options.**

Because the drop location is not static, an enclosure is not technically feasible. Water application is not technically feasible because excessive water application may result in geotechnical issues on the waste rock dumps. Additionally, an installation or setup of a water irrigation system for water application is not technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable as the remaining technology of minimizing the drop distance, while the waste rock is being dumped, is selected as BACT.
- **Step 4—Identify BACT.** Minimizing drop distances while the waste rock is being dumped is effective in controlling emissions and constitutes BACT.

Minimizing drop distances while the waste rock is being dumped also represents BACM. Because best available measures are in use, they also represent the most stringent measure.

3.1.4 Graders

Source Description: The graders primarily operate on the haul roads, maintaining surfaces of the roads. Particulate matter is controlled by the application of water and chemical dust suppressants to the roads. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify the application of water and chemical dust suppressants as a possible control technology for similar fugitive emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the graders. Because best available measures are in use, they also represent the most stringent measure.

3.1.5 Bulldozers and Front-end Loaders

Source Description: The dozers and front-end loaders operate in the pit, on the haul roads performing cleanup operations, and in dumping operations at the waste rock disposal areas. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify the application of water and chemical dust suppressants as required as a possible control technology for similar fugitive emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the bulldozers and front-end loaders. Because best available measures are in use, they also represent the most stringent measure.

3.1.6 Unpaved Haul Roads

Source Description: Haul roads are used to transfer ore and waste rock. The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary minimize emissions from the unpaved haul roads. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify potential technologies for control of fugitive emissions on unpaved haul roads as: paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance (including the use of road base material) of haul roads.
- **Step 2—Eliminate Technically Infeasible Options.** Paving the haul roads is not technically feasible at the mine because of the weight of the haul trucks, the rapid deterioration that would occur, and the frequently changing road locations. The location of these roads changes regularly making the paving of the surface infeasible. Paving the roads to minimize emissions is not technically feasible and will not be evaluated further. Additionally, with changing mine plans and haul routes, it is impossible to accurately estimate the costs for paving the road surface.

  Application of chemical dust suppressants is not technically feasible for some haul road locations because of the adverse effect the chemical can have on the coefficient of friction of the road surface. Given that the grade of the haul roads exceeds 10 percent in some locations, creating a slippery skin on the road inhibits the ability of mobile equipment to brake and steer safely while traveling on the grade.
- **Step 3**—**Eliminate Economically/Chronologically Infeasible Options.** The remaining technologies of water application, chemical dust suppressants outside of the pit influence boundary, limiting unnecessary traffic on roads, and routine maintenance of haul roads are economically and chronologically feasible.
- **Step 4**—**Identify BACT.** The application of water and road-base material within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary is effective in minimizing emissions. Watering the unpaved haul road reduces fugitive $PM_{2.5}$ and PM_{10} emissions by binding the soil particles together, reducing free particles available to be picked up by wind or vehicles. Additional watering and application of chemical dust suppressants on certain locations of unpaved haul roads also occurs when heavy traffic is expected along the road. Water is applied on a scheduled basis and supplemented as needed based on road conditions. Dust is also reduced through performing regular and routine maintenance of the haul roads (through use of road-base material) and limiting unnecessary traffic on roads.

In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in the round-trips and vehicle miles traveled, thereby reducing fugitive dust emissions.

The annual fugitive dust control report for the mine is provided in the Appendix for reference.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the unpaved haul roads. Because best available measures are in use, they also represent the most stringent measure.

3.1.7 Tailpipe Emissions from Mobile Sources

Source Description: Tailpipe emissions from haul trucks and support equipment such as graders and dozers. Tailpipe emissions from the haul trucks and support equipment meet the required EPA standards for

NONROAD equipment. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify no add on control technologies for tailpipe emissions from haul trucks and support equipment of the size used at the BCM.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable.
- **Step 4—Identify BACT.** Haul trucks and support equipment used at the facility meet the required EPA standards for nonroad equipment. The facility uses on-road specification diesel fuel in its off-road equipment. In 2007, an EPA ruling required sulfur content in all on-road specification diesel fuels be reduced (from 50 parts per million [ppm] formerly to 15 ppm currently). Because only on-road specification diesel fuel is used in its equipment, the facility has also made a transition to ultra-low sulfur diesel fuel. All the facility's diesel-powered equipment now runs on ultra-low sulfur diesel fuel.

  Additionally, the facility periodically upgrades its haul truck fleet to also take advantage of available higher-tier-level, lower-emitting engines. In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in round-trips and truck operating hours, thereby reducing emissions.

  Purchasing new haul trucks with higher capacity and Tier level which meet its mining needs also represents the most stringent measure.

  During the previous SIP work in 2014, KUC developed a detailed analysis for the haul truck engine repowering and upgrade to higher tier level trucks. The analysis is provided in the Appendix.

3.1.8 Fueling Stations

Source Description: Adding gasoline and diesel to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify two control techniques for controlling VOC emissions from gasoline and diesel fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

  The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the fueling stations.

3.1.9 Cold Solvent Degreasers

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed always to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for degreasers.

A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the mine were 1.7 tpy. The previously identified practices also represent the most stringent measure for the degreasers.

3.1.10 Mine Conveyor Transfer Points

Source Description: The mine has two ore conveyor transfer drop points — Point C6/C7 and Point C7/C8. All exhaust air and particulate emissions from each transfer drop point are routed through the respective baghouse before being vented to the atmosphere. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify baghouse (fabric filter) and enclosures with water sprays as possible control technologies for limiting emissions from transfer points.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Fabric filters are the most effective in controlling emissions. Therefore, the baghouse (fabric filter) constitutes BACT for the conveyor transfer points.

The baghouse for each of the transfer points is permitted at a grain loading of 0.007 gr/dscf. The 2014 actual $PM_{2.5}$ emissions for conveyor transfer points controlled with a baghouse were 0.69 and 0.42 tpy each. Due to the low level of emissions from these sources, the BACT analysis did not evaluate the upgrade of the baghouses for these units. Additionally, based on the economics data presented in Section 3.1.1 of this document for baghouse replacement/upgrades, any upgrades or replacement would not be economically feasible.

This emission rate also represents the most stringent measure for the conveyor transfer points.

3.1.11 Lime Bins

Source Description: The Copperton Concentrator has two lime silos used for lime storage. Particulate emissions generated during loading and unloading operations are vented through a filter. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify vent filters and enclosures as possible control technologies for limiting emissions from storage silos.

- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Vent filters are the most effective in controlling emissions. Therefore, bin vent filters constitute BACT for the lime silos/bins.

The vent filter for each of the lime silos is permitted at a grain loading of 0.016 gr/dscf. These units are operated intermittently. The 2014 actual $PM_{2.5}$ emissions for the two lime silos controlled with a baghouse were 0.02 tpy. Due to the low level of emissions from these sources, the upgrade of the vent filters for these units would not be economically feasible.

This emission rate also represents the most stringent measure for the lime silos.

3.1.12 Sample Preparation Building

Source Description: The sample preparation building at the mine is used for preparation of waste rock and ore samples for testing. Particulate emissions from the sample preparation building are vented through a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify baghouses and enclosures as possible control technologies for limiting emissions from buildings or enclosed areas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Baghouses are the most effective in controlling emissions. Therefore, the fabric filters (baghouse) constitute BACT for the sample preparation building.

The baghouse for the sample preparation building is permitted at a grain loading of 0.016 gr/dscf. The building and the control system are operated intermittently. The 2014 actual $PM_{2.5}$ emissions for the sample preparation building controlled with a baghouse were 0.05 tpy. Due to the low level of emissions from these sources, the upgrade of the baghouse for the unit would not be economically feasible.

This emission rate also represents the most stringent measure for the sample preparation building.

3.1.13 Propane Communications Generators

Source Description: The mine operates six (6) propane fired communications generators. These generators are used to support mine communication systems during emergencies or loss of power in the mine. Emissions are controlled with good combustion practices while operating the generators. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify good combustion practices as the primary control technology for emergency generators between 70 HP and 150 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generators. The emergency generators also comply with applicable New Source Performance Standards.

It should be noted that the 2014 actual $PM_{2.5}$ and precursor emissions for all the propane emergency generators combined were 0.18 tpy.

Good combustion practices also represent the most stringent measure for the propane communication generators.

3.1.14 Ore Handling

Source Description: The mined ore is moved around the mine through conveyors and trucked to the stock piles as needed. The sources include Truck Offloading Ore Main In-pit Crusher, Truck Offloading Ore Stockpile, Main In-Pit Enclosed Transfer Points, Conveyor-stacker Transfer Point, Coarse Ore Stacker and Reclaim Tunnels. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emission controls for such material handling sources from a copper mine. The location of many of these sources change regularly making the construction of emission controls such as enclosures and application of dust suppressants infeasible for such sources. Therefore, potential control technologies include material characteristics such as large size with minimal quantities of fine material, enclosures and inherent moisture content as applicable to the emission source.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Material characteristics such as large ore size and presence of very small quantities of fine material are identified as BACT for the ore handling sources.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for these ore handling sources were 0.94 tpy.

The material characteristics such as large ore size and presence of very small quantities of fine material, inherent moisture content and enclosures also represent the most stringent measure for the ore handling emission sources.

3.1.15 Ore Storage Pile

Source Description: Low grade ore is stockpiled at the mine and blended into the process as necessary. Potential wind-blown dust emissions are minimized through application of water sprays and chemical dust suppressants and compaction. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify water sprays, chemical dust suppressants and compaction as potential control technologies to minimize emissions from large storage piles.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Water sprays, chemical dust suppressants and compaction are identified as BACT for the ore storage pile.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for the ore storage pile were 0.33 tpy.

These controls also represent the most stringent measure for the ore storage pile.

3.1.16 Road Base Crushing and Screening Plant

Source Description: The mine has semiportable plants that crush and screen rock for use for base material on the unpaved haul roads. Particulate emissions from the crushing, screening, and transfer operations are effectively controlled with water sprays and belt enclosures. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emission controls for a road base crushing and screening plant for a copper mine. However, possible control technologies include baghouses, enclosures and water sprays for minimizing emissions from the road base crushing and screening plant.
- **Step 2—Eliminate Technically Infeasible Options.** The road base crushing system is moved through the mine to facilitate the production of road base material to meet demands. As a result, permanent installation of a baghouse to control emissions from the plant is not technically feasible. Water Sprays and temporary enclosures are feasible for the plant.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technically feasible technologies are economically feasible.
- **Step 4—Identify BACT.** Water sprays and enclosures are identified as BACT for the road base crushing and screening plant.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for the road base crushing and screening plant were 0.05 tpy.

These controls also represent the most stringent measure for the road base crushing and screening plants.

3.1.17 Drilling and Blasting

Source Description: Drilling and blasting are performed at the mine to access new ore bodies. Water injection is used to minimize emissions from drilling. The blast areas are controlled as practical to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific controls for drilling and blasting in open pit mines. Based on the mining experience, KUC identifies water injection and maintaining control of blast areas as potential control technologies to minimize emissions from drilling and blasting.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.

- **Step 4—Identify BACT.** Water injection and maintaining control of blast areas are identified as BACT from drilling and blasting operations.

It should be noted that the 2014 actual $PM_{2.5}$ and precursor emissions for drilling and blasting sources were 0.75 tpy. These controls also represent the most stringent measure for the drilling and blasting operations.

3.1.18 Solvent Extraction and Electrowinning Process

Source Description: Tanks, mixers and settlers are used in the solvent extraction and electrowinning process. Covers are used to minimize emissions from these sources. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific controls for solvent extraction and electrowinning process. Based on the mining experience, KUC identifies covers on process equipment to minimize emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Use of covers is identified as BACT for the solvent extraction and electrowinning process.

It should be noted that potential emissions of $PM_{2.5}$ and precursors for solvent extraction and electrowinning are minimal.

These controls also represent the most stringent measure for the solvent extraction and electrowinning process.

3.2 Copperton Concentrator

3.2.1 Tioga Heaters

Source Description: Natural gas-fired heaters are used throughout the Copperton Concentrator. The heaters are rated at less than 5 MMBTU/hr each. Specifically, the facility includes seven (7) 4.2 MMBtu/hr natural gas fired heaters and one (1) 2.4 MMBtu/hr natural gas fired heater. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.1.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC for controlling NO_x emissions from heaters of good combustion practices is already in use and constitutes BACT.

3.2.1.2 $PM_{2.5}$, SO_2, CO, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify the use of pipeline quality natural gas and good combustion practices as control technology for minimizing $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters and these control technologies constitute BACT.

At the request of UDAQ, KUC contacted vendors regarding the feasibility of replacement of the 8 Tioga heaters at the Copperton Concentrator.

Based on the data provided by the vendors, the total installed cost of the eight new heaters is estimated to be $940,000. The costs assume the installation costs to be 35 percent of the equipment costs. Theses heaters will be equipped with the latest burner technology. Assuming the new heaters will minimize NOx emissions by 90% from current levels, the new heaters might reduce the annual emissions from the Tioga heaters from 6.2 tpy (based on PTE emissions for the heaters) to 0.68 tpy. The vendor provided information is included in the Appendix.

Based on the costs for the new heaters, the cost of new heaters per ton of NO_x removed is $153,000. Therefore, replacing the Tioga heaters is not cost effective for BACT.

Low NO_X burners, use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the Tioga heaters.

3.2.2 Pebble Crushing System

Source Description: The pebble crushing system includes crusher and ore handling conveyors and transfer points. The system is placed inside a building to minimize particulate emissions to the atmosphere. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify baghouses, wet scrubbers, water sprays and enclosures as possible control technologies to minimize emissions from a crushing plant.
- **Step 2—Eliminate Technically Infeasible Options.** Because the emissions will be vented inside the building, wet scrubbers and fabric filters are not technically feasible. Water sprays are not feasible as the water makes the material too wet to crush.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technically feasible technologies are feasible.
- **Step 4—Identify BACT.** Enclosures, or placing the source inside the building, is effective in minimizing emissions from the crusher operations and identified as BACT for the pebble crushing system.

It should be noted, the 2014 actual $PM_{2.5}$ emissions for the pebble crushing system were 0.07 tpy. This control also represents the most stringent measure for the pebble crushing system.

3.2.3 Cold Solvent Degreasers

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed always to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for degreasers.

A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the concentrator were 0.08 tpy.

The previously identified practices also represent the most stringent measure for the degreasers.

3.2.4 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted that the 2014 actual VOC emissions for the gasoline fueling stations at the Copperton Concentrator were 0.29 tpy.

The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.2.5 Molybdenum Storage Bins and Loading Bags

Source Description: The Copperton Concentrator has molybdenum storage bins from which bags are loaded for offsite shipping. Particulate emissions generated during loading and unloading operations are vented through a filter. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify vent filters and enclosures as possible control technologies for limiting emissions from storage silos.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Vent filters are the most effective in controlling emissions. Therefore, bin vent filters constitute BACT for the molybdenum storage bins and loading bags.

The 2014 actual $PM_{2.5}$ emissions for these operations controlled with a bin vent filter were 0.5 tpy. Due to the low level of emissions from these sources, the upgrade of the vent filters for these units would not be economically feasible.

This control technology also represents the most stringent measure for the process.

3.2.6 Feed and Product Dryer Oil Heaters

Source Description: Natural gas-fired heaters provide heat to the feed and product dryers that are used in molybdenum process at the Copperton Concentrator. The heaters are rated at 5.7 MMBTU/hr and 2.2 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.6.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify Low NO_X burners and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC and CARB for controlling NO_x emissions from heaters of Low NO_X Burners and good combustion practices is already in use and constitutes BACT.

3.2.6.2 $PM_{2.5}$, SO_2, CO, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify use of pipeline quality natural gas and good combustion practices as control technologies for minimizing $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB databases identify use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters and these control technologies constitute BACT.

Low NO_X burners, use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the heaters. Due to low level of emissions from these units, upgrading these would not be economically feasible.

SECTION 4

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

4.1 Bingham Canyon Mine

KUC is proposing the following limitations and monitoring requirements for the Bingham Canyon Mine.

- Maximum total mileage per calendar day for ore and waste haul trucks shall not exceed 30,000 miles. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System (GPS) or equivalent.
- KUC Shall Use Ultra-low Sulfur Diesel Fuel in Its Haul Trucks.
- To minimize emissions at the mine:
- The owner/operator shall control emissions from the in-pit crusher with a baghouse.
- Apply water to all active haul roads as weather and operational conditions warrant, except during precipitation or freezing conditions, and apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.
- A chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.
- KUC is Subject to the Requirements in the Most Recent Federally approved Fugitive Emissions and Fugitive Dust Rule.

Supporting Information

The condition above establishes a limitation on daily activity. The daily mileage limitation effectively limits fugitive road dust emissions, tailpipe emissions from the haul trucks, and overall activity of sources at the mine. Ore processing at the Copperton Concentrator, which results in minimal emissions, is also limited through the BCM activity limitations.

Emissions resulting from the movement of ore and waste around the mine represent a significant portion of overall emissions at the BCM. The emissions related to material movement include fugitive dust generated from truck travel on the haul roads and the tailpipe emissions from the haul trucks. Specifically, on an annual basis, greater than 99.9 percent of total mine emissions for NO_X and SO_2 come from the haul truck tailpipes. Also, on an annual basis, material movement represents 85 percent of the overall particulate emissions at the BCM. Based on these emissions, the material movement of ore and waste by haul trucks represents a vast majority of overall emissions at the BCM and can effectively be used to represent mine operations.

Daily emissions from the BCM can be regulated with the limitation on vehicle miles traveled by ore and waste haul trucks of 30,000 miles per day. Compliance with this limitation is demonstrated daily and is an appropriate metric for a 24-hour particulate standard.

It should be noted that the 30,000 miles per day limitation also limits overall BCM operations. Ancillary mining activities such as operation of the in-pit crusher, mining support equipment, blasting, and drilling only occur to produce an adequate amount of ore and waste rock that can be hauled via the trucks and sent to the concentrator via the conveyor system.

On a 24-hour basis, these emissions can be represented with the 30,000 miles per day limitation. Since they effectively represent mine operations, a single daily limitation is appropriate in the SIP for the BCM. These emissions have been included in the appropriate SIP model.

KUC uses a real-time tracking system for both tracking haul trucks as well as for recording miles travelled. These records are used to comply with the 30,000 miles per day limitation. The system may be a GPS or a system with similar tracking capabilities necessary to comply with this condition.

The condition also establishes a requirement for the use of ultra-low sulfur diesel fuel in haul trucks.

The conditions require the control of emissions from the in-pit crushers with a baghouse.

The condition also establishes requirements for reducing and controlling fugitive particulate emissions from active unpaved haul roads at the mine. Water and chemical dust suppressants shall be used to minimize fugitive dust.

Specifically, active ore and waste haulage roads within the pit influence boundary are water sprayed and/or treated with a commercial dust suppressant. Crushed road-base material is applied to active ore and waste haulage roads within the pit influence boundary to enhance the effectiveness of fugitive dust control measures. Commercial dust suppressants are applied to active ore and waste haulage roads outside of the pit influence boundary no less than twice per year.

Each year KUC reports dust control measures implemented at the BCM during the previous year with details such as volume of water applied, commercial dust suppressant activity, etc.

KUC is subject to the fugitive dust rules approved by UDAQ and EPA. These rules outline requirements that mines are to follow in minimizing the fugitive dust from the mining operations.

4.2 Copperton Concentrator

No limitations or monitoring requirements are proposed for the Copperton Concentrator emission sources as the emissions from the facility are minimal and are effectively controlled with the implementation of BACT.

Attachments

- In-pit Crusher Baghouse Vendor Data
- Mine FDCP Report
- Haul Trucks Analysis
- Degreaser Solvent SDS
- Tioga Heaters Vendor Information

FINAL

BACT Determinations for the Utah Power Plant, Tailings Site, and Laboratory

Prepared for

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February 2018

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Contents

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Acronyms and Abbreviations

AO	approval order
BACT	best available control technology
CAA	Clean Air Act
CatOx	catalytic oxidation
CO	carbon monoxide
DLN	dry low nitrogen
EPA	Environmental Protection Agency
KUC	Kennecott Utah Copper
LNB	low NO_x burner
MMBTU/hr	million British Thermal Units per hour
MW	megawatts
NAAQS	National Ambient Air Quality Standard
NOx	nitrogen oxides
OFA	over-fire air
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppmvd	parts per million by volume dry
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearinghouse
SCR	selective catalytic reduction
SIP	State Implementation Plan
SNCR	selective non-catalytic reduction
SO_2	sulfur dioxide
tpy	tons per year
UDAQ	Utah Department of Air Quality
UPP	Utah Power Plant
VOC	volatile organic compound

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SECTION 1

Introduction

Kennecott Utah Copper, LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities located at the northwest corner of Salt Lake County, Utah: Utah Power Plant (UPP), tailings site, and the laboratory. The tailings site receives tailings in slurry form. The slurry is deposited in the tailings pond. The UPP is a coal and natural gas fired power plant that supplies power for KUC operations. Coal is used to fuel the plant in spring, summer, and fall; while natural gas is approved for use in the winter months. The laboratory is used to perform various tests and functions to optimize operations through analysis of materials. In addition to a BACT analysis, KUC has also documented the most stringent measure for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and to meet any reasonable further progress requirements. As requested by the Utah Division of Air Quality (UDAQ), the BACT analysis should identify and evaluate BACT for each relevant pollutant. The technical and economic feasibility of each potential technology are components of the BACT analysis that help to show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOC). For each emission source, the BACT analysis followed a four-step process:

- **Step 1**—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC) and/or California Environmental Protection Agency – Air Resource Board BACT Clearinghouse (CARB)
- **Step 2**—Eliminate technically infeasible options
- **Step 3**—Eliminate economically/chronologically infeasible options
- **Step 4**—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent most stringent measure.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS was combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends that BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development.

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SECTION 2

Recent Permitting Actions

An approval order (AO) was issued for the UPP on November 10, 2015, which authorized the construction and operation of a natural gas fired emergency generator. Issued in 2011, AO DAQE-AN105720026-11 authorized KUC to replace Boiler Units 1, 2, and 3 with a new natural gas fired combustion turbine operating in combined cycle mode with a heat recovery steam generator. The new combustion turbine will be equipped with state of the art add-on controls to minimize emissions from the unit and represents BACT. Dry low nitrogen oxide (DLN) combustors and the selective catalytic reduction (SCR) system will control NO_x emissions. The catalytic oxidation (CatOx) system will control carbon monoxide (CO) and VOC emissions. Good combustion practices and burning natural gas will minimize emissions of the remaining pollutants.

The tailings site is permitted under AO DAQE-AN10572018-06. The emissions sources at the laboratory are permitted under AO DAQE-261-95. All three facilities operate under a single Title V Operating Permit #3500346002.

The current potential to emit (PTE) emissions in tons per year (tpy) for the tailings site, UPP, and the laboratory are shown in Table 1-1.

Table 2-1. Facility Potential to Emit

	PM_{10} PTE (tpy)	**$PM_{2.5}$ PTE (tpy)**	**NO_x PTE (tpy)**	**SO_2 PTE (tpy)**	**VOC PTE (tpy)**
UPP	248	248	1,641	2,577	41
Tailings Site	36.3	5.4**	0.26	—*	0.04
Laboratory	0.12	0.12	0.68	0.13	0.12

Notes:
$PM_{2.5}$ = particulate matter 2.5 microns or smaller in aerodynamic diameter
PM_{10} = particulate matter 10 microns or smaller in aerodynamic diameter
PTE = potential to emit
NO_x = oxides of Nitrogen
SO_2 = sulfur dioxide
tpy = tons per year
VOC = volatile organic compounds
*Permitted combustion sources result in negligible SO_2 emissions at the tailings site.
**$PM_{2.5}$ emissions are estimated to be 15 percent of PM_{10} emissions.

Distinguishing by season of operation is allowed under EPA's *Implementation Guidance for the 2006 24-hour Fine Particle NAAQS* (March 2, 2012), which specifically acknowledges that several nonattainment areas located in the western United States only have experienced exceedances during the winter season. In such cases, the EPA authorizes states to (1) develop a seasonal emission inventory and (2) evaluate emission reduction strategies for a single season only [p. 11]. "When following a seasonal approach, the EPA believes that *the control strategy evaluation* (based on seasonal emission reduction measures) and the assessment of future year air quality concentrations (through air quality modeling or other analyses) *should be conducted for that season*." [p. 12]. In view of the nature of Utah's $PM_{2.5}$ nonattainment circumstance, the BACT analysis for UPP focuses primarily on a wintertime control strategy.

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SECTION 3

BACT Determinations

This section provides BACT determinations for emission sources deemed significant at the UPP, Tailings site, and Laboratory.

3.1 Utah Power Plant

Historically, KUC has operated three coal fired boilers rated at 100 megawatts (MW) combined, referred to as Units 1-3, at the UPP. The units operated on coal during the spring, summer and fall months, but were limited to burning natural gas during the winter months between November 1 and March 1. In October 2016, KUC permanently ceased operation of Units 1-3. Therefore, a BACT analysis for Units 1-3 is not included in this document.

3.1.1 UPP Unit 4 Boiler

Source Description: Tangentially fired boiler capable of burning both coal and natural gas, rated at 838 million British Thermal Units per hour (MMBTU/hr) (coal), or 872 MMBTU/hr (natural gas), equipped with an electrostatic precipitator. Since the ambient 24-hour concentrations of $PM_{2.5}$ exceed the NAAQS during the winter months, the BACT analysis is limited to controls for the combustion of natural gas, which are the only controls that may affect the attainment of the $PM_{2.5}$ NAAQS in the Salt Lake City nonattainment area. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.1.1 NO_x BACT

- **Step 1—Identify All NO_x Control Technologies listed in RBLC and CARB.** The RBLC and CARB identifies (1) low NO_x burners with over-fire air (low NO_x burner [LNB] with over-fire air [OFA]) and (2) LNB with OFA and SCR as potential technologies for NO_x control from a natural gas fired boiler.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Previous SIP determination for UPP Unit 4 required the installation of LNB with OFA and SCR with 90% NO_X control when operating on natural gas during the winter months between November 1 and March 1. Because the top technology is already identified in previous SIPs, additional analysis is not necessary.
- **Step 4—Identify BACT.** LNB with OFA and SCR with 90% control efficiency constitute BACT for controlling NO_x emissions from natural gas combustion in the boiler during the wintertime period (November 1 through March 1).

Control efficiency of 90% for LNB with OFA and SCR is a default value used by the industry. A detailed design of the control systems would be necessary to develop anticipated control efficiency for Unit 4. Due to SIP time constraints, a detailed design is not feasible and therefore it is recommended that UDAQ use the default value.

3.1.1.2 SO_2 BACT

- **Step 1—Identify all SO_2 Control Technologies listed in RBLC and CARB.** The RBLC identifies the use of pipeline quality natural gas as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4— Identify BACT.** The use of pipeline quality natural gas constitutes BACT when burning natural gas.

3.1.1.3 $PM_{2.5}$ BACT

- **Step 1—Identify all $PM_{2.5}$ Control Technologies listed in RBLC.** The RBLC identifies good combustion practices as a control for reducing $PM_{2.5}$ when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Good combustion practices constitute BACT while burning natural gas.

3.1.1.4 VOC BACT

- **Step 1—Identify all VOC Control Technologies listed in RBLC.** The RBLC identifies good combustion practices as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4— Identify BACT.** Good combustion practices constitute BACT for VOC while burning natural gas.

Controlling NO_X emissions by 90 percent with LNB, OFA, and SCR and the use of pipeline quality natural gas and good combustion practices represent the most stringent measure for Unit 4 at the UPP when operating on natural gas between November 1 and March 1.

3.1.2 UPP Unit 5 Combustion Turbine and Duct Burner

Source Description: A combustion turbine and duct burner in combined-cycle operation with a nominal generating capacity of approximately 275 MW, equipped with SCR and CatOx. Construction of Unit 5 is not complete at this time.

3.1.2.1 NO_x BACT

- **Step 1—Identify All NO_x Control Technologies listed in RBLC and CARB.** The RBLC and CARB databases identifies selective noncatalytic reduction (SNCR) and SCR as potential technologies for NO_x control. The SCR technology is the most stringent control alternative listed in the RBLC.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** SCR constitutes BACT for controlling NO_x emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.2 VOC BACT

- **Step 1—Identify All CO and VOC Control Technologies listed in RBLC and CARB.** The RBLC identifies CatOx to control emissions of CO and VOC.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** CatOx constitutes BACT for controlling CO and VOC emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.3 SO_2 BACT

- **Step 1—Identify All SO_2 Control Technologies listed in RBLC and CARB.** The RBLC identifies the use of pipeline quality natural gas and good combustion practices as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The use of pipeline quality natural gas and good combustion practices constitute BACT for controlling SO_2 emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.4 $PM_{2.5}$ BACT

- **Step 1—Identify All $PM_{2.5}$ Control Technologies listed in RBLC and CARB**. The RBLC identifies the use of pipeline quality natural gas and good combustion practices as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The use of pipeline quality natural gas and good combustion practices constitute BACT for controlling $PM_{2.5}$ emissions from the Unit 5 combustion turbine and duct burner.

Limiting NO_X emissions to 2 parts per million by volume dry (ppmvd) at 15% O_2; CatOx for control of CO and VOC emissions; and the use of pipeline quality natural gas and good combustion practices represent the most stringent measure for Unit 5 at the UPP.

3.1.3 Cooling Towers

Source Description: Noncontact water cooling towers are used to control waste heat from the boilers. All towers are equipped with drift eliminators with drift loss rated at 0.002 percent. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Drift eliminators and good operating practices constitute BACT.

The existing Unit 4 Cooling Tower could be upgraded with 0.001 percent drift factor from the existing 0.002%. Based on KUC's discussions with the vendors, the total installed costs for the upgrade of the drift eliminator would be $177,000. The upgrade of the drift eliminators would reduce the annual emissions from the Unit 4 Cooling Tower from 3.49 tpy (PTE emissions for the cooling tower) to about 1.75 tpy. The vendor provided information is included in the Appendix.

Based on the costs for the drift eliminator upgrade, the cost per ton of $PM_{2.5}$ removed is $102,000. Therefore, replacing the replacing the existing drift eliminator with a high efficiency drift eliminator is not cost effective for BACT. Based on this cost effectiveness analysis, eliminators with 0.0005% drift loss are not further evaluated as they would not be cost effective as well.

The use of drift eliminators with drift loss rated at 0.002 percent and good operating practices represent the most stringent measure for the cooling towers.

The overall cost is $102,000 per ton of $PM_{2.5}$ removed but when amortized over a 20 year period the cost is reduced to $5,100/ton of $PM_{2.5}$ removed. This is cost effective as BACT.

If the cooling towers with a 0.0005% drift loss were implemented, then the cost may even be lower.

3.1.4 Tioga Space Heaters

Source Description: Natural gas-fired space heaters are used for comfort heating and cooling, and water heating throughout the power plant. The space heaters use low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. All space heaters are rated at less than 5 MMBTU/hr. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.4.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC and CARB for controlling NO_x emissions from heaters (LNB and good combustion practices) are already in use and constitute BACT.

3.1.4.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for Tioga Space Heaters at the UPP. As discussed in the BACT analysis for other KUC facilities, replacing the existing space heaters with new heaters is not cost effective for the BACT analysis.

3.1.5 Cold Solvent Degreaser

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identifies operating practices such as closing the degreaser lids as a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed at all times to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for the degreaser.

A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the UPP were 0.3 tpy.

The previously identified practices also represent the most stringent measure for the degreasers.

3.1.6 Natural Gas Emergency Generators

Source Description: The UPP operates two 1.2 MMBTU/hr natural gas generators. Emissions are controlled with good combustion practices while operating the generator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for natural gas generators less than 5 MMBTU/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the natural gas generators.

It should be noted, the 2014 actual emissions for $PM_{2.5}$ and precursors for the natural gas generators were 0.18 tpy.

Good combustion practices also represent the most stringent measure for the natural gas generators.

3.1.7 Roads at UPP

Source Description: Unpaved and paved access roads exist throughout the UPP and are used by KUC personnel daily. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies potential technologies for control of fugitive emissions on unpaved roads as: paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance of roads.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3**—**Eliminate Economically/Chronologically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 4**—**Identify BACT.** Paving sections of the road, the application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are identified as BACT for the roads at the UPP.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from roads at the UPP were 0.27 tpy. Paving sections of the road, the application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads also represent the most stringent measure for the roads at the UPP.

3.1.8 Hot Water Heater

Source Description: Natural gas-fired water heater is used for water heating throughout the power plant. The water heater uses low NO_x burners (LNB) and regular inspections are done to the unit to ensure optimum combustion performance. The water heater is rated at 7.13 MMBTU/hr. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.8.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC for controlling NO_x emissions from the heater (LNB and good combustion practices) are already in use and constitute BACT.

3.1.8.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from the heater.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.

- **Step 4—Identify BACT.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from the heater and these control technologies constitute BACT.

The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for the hot water heater at the UPP.

3.1.9 Coal and Ash Handling at UPP

Source Description: Coal and ash handling system that includes small coal storage pile, conveyors, and coal and ash storage silos. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies potential technologies for control of fugitive emissions from coal and ash handling as enclosures and water sprays.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 4—Identify BACT.** Enclosures and water sprays are identified as BACT for coal and ash handling at the UPP.

It should be noted, the 2014 actual $PM_{2.5}$ emissions from coal and ash handling at the UPP were 0.92 tpy. Enclosures and water sprays also represent the most stringent measure for coal and ash handling at the UPP.

3.1.10 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted, the 2014 actual VOC emissions for the gasoline fueling stations at the UPP were 0.33 tpy.

The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.1.11 Diesel Fire Pump

Source Description: The UPP operates 175 HP diesel-fired fire pump during emergencies. The fire pump complies with applicable New Source Performance Standards to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. Potential emission control technologies identified in the RBLC and CARB for similar sized diesel fire pumps include good combustion practices and limiting the sulfur content of fuel to 0.0015 percent. Certification and compliance with applicable New Source Performance Standards is an acceptable means of demonstrating BACT for emergency fire pumps.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements are identified as BACT for all pollutants emitted from the emergency fire pump.

It should be noted that the 2014 actual emissions from the fire pump of $PM_{2.5}$ and precursors were 0.12 tpy.

Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements also represent the most stringent measure for the emergency fire pump.

3.1.12 Diesel Engine for Coal Unloading System

Source Description: The UPP had a170 HP diesel-fired engine to operate the coal unloading system. This emission source no longer exists at the UPP. Therefore, a BACT analysis has not been developed for this emission source.

3.2 Tailings Site

3.2.1 Wind Erosion from Tailings Site

Source Description: Tailings are sent to the tailings site via a slurry pipeline. At the facility, tailings are separated by size in a cyclone with the larger particles used to build the embankments and the smaller particles discharged in slurry form in the impoundment. Emissions from the tailings site are mainly from wind erosion of dry tailings on the embankment. The facility has a current dust control plan approved by the UDAQ Executive Director for control of fugitive particulate matter. A copy of the quarterly report that documents dust control measures implemented at the facility is included in the Appendix for reference. The dust control plan requires frequent monitoring of the impoundment for wind erosion potential, applying chemical dust suppressants in the late spring, applying water via water trucks and the dust suppression sprinkler system as needed to maintain adequate moisture content.

In 2013, KUC conducted a study to identify and evaluate the range of dust control practices that have been attempted and successfully applied for mine tailings impoundments. A study also reviewed published literature and available air quality compliance documentation to extend the breadth of the evaluation. The study is included in the Appendix.

The tailings site can be categorized into four operational areas: impoundment, active embankment, inactive embankment, and reclaimed areas. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.2 BACT Analysis for Tailings Impoundment

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

Watering

Polymer application

Revegetation

Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists in minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the impoundment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.**

The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.

- **Step 4—Identify BACT.** The impoundment area is saturated with water and does not result in windblown dust emissions. Visual inspections are routinely performed to ensure the impoundment is saturated with water and in the unlikely event an area appears to be drying out, the area would be re-saturated. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions. Additionally, the impoundment area is saturated with water and does not result in windblown dust emissions.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.3 BACT Analysis for Tailings Active (Flat) Embankments

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

Watering

Polymer application

Revegetation

Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the embankment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.
- **Step 4—Identify BACT.** The tailings are actively deposited in the embankment areas. In an active embankment cell, the tailings are deposited every fourth day. The tailings are extremely wet when deposited. Areas can remain moist for several days. Application of water for dust control in active areas is not feasible as it tends to channelize directly to the drain point instead of spreading across the surface. The flat embankment areas will therefore have a potential for wind erosion on days 2, 3, and 4. Emissions are estimated based on days with potential for wind erosion. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions and identified as BACT.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.4 BACT Analysis for Tailings Inactive and Sloped Embankments

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

  Watering

  Polymer application

  Revegetation

  Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the embankment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.

- **Step 4—Identify BACT.** In the inactive embankment areas, where tailings deposition has been completed for the year, KUC installs sprinklers for watering. Over the past few years, KUC converted this to an automated sprinkler system that wets the surface at regular intervals. This upgrade allows the surface to maintain its moisture.

  The embankment slopes are sprayed with polymers to minimize windblown dust. Polymer is reapplied as necessary to maintain its effectiveness to minimize emissions. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions and identified as BACT.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.5 BACT Analysis for Tailings Reclaimed Areas

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

  Watering

  Polymer application

  Revegetation

  Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the reclaimed areas, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.
- **Step 4—Identify BACT.** Once released for reclamation, KUC implements a revegetation plan to reclaim the areas. Polymers are applied to areas still waiting to be reclaimed. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions and are identified as BACT.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.6 Service Roads

- **Source Description:** Service roads exist throughout the tailings site and are used by KUC personnel daily.
- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies potential technologies for control of fugitive emissions on unpaved roads as; paving the unpaved roads, the

application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance of roads.

- **Step 2—Eliminate Technically Infeasible Options.** Paving the haul roads is not technically feasible at the tailings site because of the frequently changing road locations over time resulting from tailing placement.
- **Step 3**—**Eliminate Economically/Chronologically Infeasible Options.** The remaining technologies of water application, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are economically and chronologically feasible.
- **Step 4**—**Identify BACT.** The application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are identified as BACT for the service roads.

The application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads also represent the most stringent measure for the service roads at the tailings site.

3.2.7 Propane Communication Generator

Source Description: The tailings facility operates a propane fired communication generator. This generator is used to support communication systems during emergencies or loss of power at the tailings facility. Emissions are controlled with good combustion practices while operating the generator.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for emergency generators around 75 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- St**ep 3—Eliminate Economically/Chronologically Infeasible Options**. Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generator. The emergency generator also complies with applicable New Source Performance Standards.

Good combustion practices also represent the most stringent measure for the propane communication generator.

3.2.8 Biosolids Application

Source Description: Salt Lake County and Salt Lake City operate small landfill type operations that produce organic material which are used by the Tailings Facility to enhance the reclamation of closed tailings areas. The application of biosolids does not result in any emissions of $PM_{2.5}$, SO_2, NO_X or VOC. Very small quantities of ammonia emissions are estimated from these operations resulting from the natural process of decomposition. Therefore, a BACT analysis is not developed for this emission source. The 2014 actual emissions from the source were 0.021 tpy of ammonia.

3.3 Laboratory

3.3.1 Hot Water Boiler

Source Description: Natural gas-fired water boiler is used for water heating for the laboratory. The water boiler uses low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. The water heater is rated at 7.1 MMBTU/hr.

3.1.8.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from boilers less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC and CARB for controlling NO_x emissions from the boiler (LNB and good combustion practices) are already in use and constitute BACT.

3.1.8.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from the boiler.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from the boiler and these control technologies constitute BACT.

  The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for the hot water boiler at the laboratory.

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Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

4.1 Utah Power Plant

Unit 5

KUC is proposing the following limitations and monitoring requirements for the UPP. Unit 5 shall not exceed the following emission rates to the atmosphere.

Pollutant	lb/hr	ppmvd (@ 15% O_2)
NO_x		2.0*
$PM_{2.5}$ with duct firing: Filterable and condensable	18.8	

Note:
*Under steady state operation

Stack testing to show compliance with the above Unit 5 emissions limitations shall be performed as follows:

Pollutant	Test Frequency
$PM_{2.5}$	every year
NO_x	every year

The heat input during all compliance testing shall be no less than 90% of the design rate.

Unit 4

The following requirements are applicable to Unit 4 during the period November 1 to February 28/29 inclusive:

During the period from November 1, to the last day in February inclusive, only natural gas shall be used as a fuel, unless the supplier or transporter of natural gas imposes a curtailment. The power plant may then burn coal, only for the duration of the curtailment plus sufficient time to empty the coal bins following the curtailment.

Except during a curtailment of natural gas supply, emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

Pollutant	Grains/dscf	ppmdv (3% O_2) 68˚F, 29.92 in. Hg
$PM_{2.5}$ Filterable	0.004	
Filterable and condensable	0.03	
NO_x		336
NO_x (after 1/1/2018)		60

If operated during the winter months, stack testing to show compliance with the above Unit #4 emissions limitations shall be performed as follows:

Pollutant	Test Frequency
$PM_{2.5}$	every year
NO_x	every year

The heat input during all compliance testing shall be no less than 90% of the maximum average hourly production rate achieved in any 24-hour period during the previous three (3) years. The limited use of natural gas during startup, for maintenance firings and break-in firings does not constitute operation and does not require stack testing.

4.2 Tailings Site

The primary source of emissions at the tailings site is wind-blown dust. The intent of the $PM_{2.5}$ serious nonattainment SIP is to review emissions during winter time inversions. Since these inversions represent stagnant wind conditions, emissions from the tailings site will be minimal and therefore tailings site SIP conditions are not necessary for the $PM_{2.5}$ SIP. Emissions at the tailings site are effectively controlled with the implementation of BACT and the most stringent measure.

4.3 Laboratory

No limitations or monitoring requirements are proposed for the laboratory emission sources as the emissions from the facility are minimal and are effectively controlled with the implementation of BACT and the most stringent measure.

Attachments

- UPP Cooling Tower Vendor Data
- Tailings Quarterly Report
- Tailings Dust Control Practices Study
- Tailings FDCP
- Degreaser Solvent SDS

FINAL

Best Available Control Technology Determinations for the Smelter and Refinery

Prepared for

Kennecott Utah Copper

February 2018

Prepared by

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Contents

Attachments

- Smelter Dryer/Granulator baghouse information
- Anodes Furnaces NO_X study
- Degreaser Solvent SDS
- EPA Compliance Letter

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Acronyms and Abbreviations

ACT	Alternative control techniques
AO	approval order
BACT	best available control technology
BCM	Bingham Canyon Mine
CAA	Clean Air Act
CEM	Continuous emissions monitor
CFR	*Code of Federal Regulations*
CHP	Combined heat and power
CO	carbon monoxide
CPI	Consumer Price Index
EPA	Environmental Protection Agency
ESP	Electrostatic precipitator
FGR	Flue gas recirculation
FS	Flash Smelting
GPS	Global Positioning System
gr/dscf	grains per standard cubic feet
KUC	Kennecott Utah Copper
LNB	Low NOx burner
MACT	maximum achievable control technology
MMBtu/hr	million British Thermal Units per hour
NAAQS	National Ambient Air Quality Standard
NH_3	ammonia
NO_x	nitrogen oxides
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppm	parts per million
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SCR	Selective catalytic reduction
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOP	Standard operating procedure
TEG	Turbine Electric Generator
tpy	tons per year
UDAQ	Utah Department of Air Quality

ULNB	Ultra-low NOx burner
VOC	volatile organic compound
WRAP	Western Regional Air Partnership

SECTION 1

Introduction

Kennecott Utah Copper LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities: Smelter andRefinery. In addition to a BACT analysis, KUC has also documented the most stringent measure for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and meet any reasonable further progress requirements. As requested by the Utah Department of Air Quality (UDAQ), the BACT analysis should identify and evaluate reasonable and available control technologies for each relevant pollutant. The technical and economic feasibility of each potential control technology are components of the BACT analysis that help show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environmental Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). For each emission source, the BACT analysis followed a four-step process:

- **Step 1**—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC) and/or California Environmental Protection Agency – Air Resource Board BACT Clearinghouse (CARB)
- **Step 2**—Eliminate technically infeasible options
- **Step 3**—Eliminate economically/chronologically infeasible options
- **Step 4**—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent the most stringent measure.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS were combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends the BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development.

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SECTION 2

Recent Permitting Actions

The Smelter and Refinery together have over 70 individual significant and insignificant sources. The Smelter recently had UDAQ permitting actions. A modified approval order (AO) was issued for the smelter on June 10, 2014. AO DAQE-AN0103460054-14 allows the Smelter to operate a crushing and screening plant and modifies stack testing requirements for the Smelter emissions sources. No other significant modifications were made to the Smelter AO in the last 5 years.

The EPA performed extensive technology reviews of Smelter emissions in support of the 2002 primary copper smelting major source maximum achievable control technology (MACT) standard (40 *Code of Federal Regulations* [*CFR*] 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC Smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Both standards establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources, not using batch copper converters). Smelter process and emission controlling technologies that contributed to EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred after promulgation of the MACT standards.

AO DAQE-AN01013460045-10 for the Refinery was issued in 2010 to add the combined heat and power (CHP) unit. The CHP unit utilizes SoLoNO$_X^{TM}$ burners minimizing NO_X emissions from the unit. The Smelter and Refinery facilities operate under a single Title V Operating Permit # 3500030003.

Potential to emit (PTE) emissions in tons per year (tpy) for the Smelter, Refinery and MAP are shown in Table 2-1.

Table 2-1. Facility Potential to Emit Emissions

	PM_{10} PTEs (tpy)	**$PM_{2.5}$ PTEs (tpy)**	**NO_x PTEs (tpy)**	**SO_2 PTEs (tpy)**	**VOC PTEs (tpy)**
Smelter	510.82	426.35	185.29	1,085.72	13.50
Refinery	25.64	25.64	38.57	4.44	8.42

Notes:
PM_{10} = Particulate matter 10 microns or smaller in aerodynamic diameter
NO_x = oxides of nitrogen
SO_2 = sulfur dioxide
VOC = volatile organic compounds
$PM_{2.5}$ = Particulate matter 2.5 microns or smaller in aerodynamic diameter
PTE = potential to emit
tpy = tons per year

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Best Available Control Technology Determinations

This section provides BACT determinations for emission sources deemed significant at the Smelter and Refinery.

KUC has reviewed publicly available permitting documents for smelters around the country. Based on the review of the Hayden Smelter in Arizona, it was determined the technology implemented at the KUC Smelter is different from that at the Hayden Smelter. The permitting documents show that emissions from sources such as acid plant, anode plant and furnaces are limited with baghouses, optimum operation of processes and visible emissions limitations.

3.1 Smelter

The EPA performed extensive technology reviews of Smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC Smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules (e.g., the design of the Smelter is based on the furnace technology). Typical smelting operations require batch processing which intermittently produces high concentrations of SO_2 and particulate in a manner that can reduce the efficiency of the acid plant as a control device. By employing the flash smelting (FS) and flash converting (FC) technologies, KUC can eliminate many of the problems inherent with batch type smelter operations. These improvements include continuous flow of off-gases to the acid plant during the FC process as well as reduced total volume of off-gases. Additionally, the furnaces are stationary which improves the ability to capture the off-gases as well as the ability to capture any fugitive emissions with the secondary capture system, which cleans the gases with baghouses and scrubbers before venting to the main stack. As a result, both MACT standards go so far as to establish a separate category for only the KUC Smelter due to its unique design and emission performance not achievable by conventional technology.

The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources not using batch copper converters). The KUC Smelter employs several technologies to minimize the smelting emissions that report to the main stack.

- The concentrate dryer burns natural gas to heat/dry concentrate for use in the FS furnace. Operation with low-NO_x burners (LNB) along with lower dryer temperatures minimizes the formation of NO_x while also preventing the formation of SO_2. KUC operates both a baghouse and a scrubber as controls for the concentrate dryer.
- The secondary gas system collects fugitive emissions in the hot metals building (typically associated with the furnaces) and vents them through a baghouse and a sodium-based scrubber before they are vented to the main stack.
- The matte grinding circuit crushes and dries granulated matte for use in the FC furnace. The particulate from the ground matte is collected in a baghouse and pneumatically conveyed to the FC furnace feed bin. NO_x emissions from natural gas combustion are minimized with LNB and low temperature firing and PM_{10} emissions are controlled with the production baghouse.

- In the anodes area, blister copper from the FC furnace is refined in two available refining furnaces to remove the final traces of sulfur. Copper production can be supplemented with copper scrap, which can be added to the refining furnaces for re-melt. The anodes refining furnaces are natural gas fired with oxy-fuel burners. Off-gas is vented (in series) to a quench tower, lime injection, baghouse, and scrubber and vented to the main stack. NO_x reduction activities also include maintaining furnaces to prevent ingress of air.
- The shaft furnace and holding furnace are used to re-melt anode scrap and other copper scrap to incorporate into copper production. LNBs are used to reduce NO_x from the natural gas combustion and a baghouse is operated to control PM_{10} emissions. The shaft furnace is in the anodes area, but vents separately to the main stack.

3.1.1 Main Stack

Source Description. Multiple process equipment emissions are routed through the main stack. Such equipment includes the matte granulators, acid plant, anode building, powerhouse, furnaces, dryers, and grinding circuits. Many of these sources of emissions have their own primary control devices (baghouse, scrubbers, etc.). Some are then routed to the secondary gas system and then through the main stack. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

Equipment emissions routed through the main stack at the Ssmelter include:

Equipment	Pollutant Emissions	Primary Emissions Control
Concentrate dryer	$PM_{2.5}$, SO_2, NO_X	LNB, baghouse, and scrubber
Powerhouse superheater	$PM_{2.5}$, SO_2, NO_X, VOC	Ultra-low NOx burner (ULNB), Flue gas recirculation (FGR), fuel throughput limits, and good operational practices
Powerhouse Foster Wheeler aux boiler	$PM_{2.5}$, SO_2, NO_X, VOC	LNB, FGR, fuel throughput limits, and good operational practices
Matte grinding	$PM_{2.5}$, SO_2	LNB, baghouse and good operational practices
Anode refining furnaces	$PM_{2.5}$, SO_2, NO_X, VOC	Oxy-fuel burners, baghouse, and scrubbers
Anode shaft furnace	$PM_{2.5}$, SO_2, NO_X, VOC	Baghouse, LNB and good operational practices
Anode holding furnace	$PM_{2.5}$, SO_2, NO_X, VOC	Baghouse, LNB and good operational practices
Vacuum cleaning system	$PM_{2.5}$	Baghouse
North and south matte granulators	$PM_{2.5}$, SO_2	Scrubber, SGS baghouse, and SGS scrubbers

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies different control technologies for process equipment eventually routed through the main stack. These control technologies are currently in place as previously discussed.

The EPA performed extensive technology reviews of smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC Smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Both standards go so far as to establish a separate category for only the KUC Smelter due to its unique design and emission performance not achievable by conventional technology. The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources not using batch copper converters). Smelter process and emission controlling technologies that contributed to EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred after promulgation of the MACT standards.

Baghouses used to control particulate emissions from the concentrate dryer, matte grinding, anode furnaces and granulators are maintained regulatory and the bags are replaced as recommended by the vendors. The bags currently used by KUC in these baghouses are provided in the Appendix. The exhaust from these processes is at high temperature and low pH due to the acidic nature of the materials. Over the years, KUC has experimented with different types of bags, such as pleated bags, that are more effective in removing particulate. However, these bags could not provide optimum performance due to high temperature and low pH. Therefore, upgrading to different types of bags is not technically feasible for these processes.

Again, KUC maintains and replaces bags in these baghouses as recommended by vendors to maintain performance, pressure differential and particulate removal efficiency.

The KUC Smelter continues to be the cleanest Smelter operations in the world. KUC reviewed emission reductions alternatives for anode furnaces venting through the main stack. The operations at the Smelter are continuously optimized to ensure high efficiency operation of the facility, including periodic upgrades of the burners to maintain optimum operations. KUC performed a pre-feasibility level study to evaluate NO_X emissions reductions options for the anodes furnaces at the Smelter. The study evaluated emission reduction strategies such as SCR, SNCR, oxidation systems and wet scrubbers. Portions of the study are provided as an Attachment. The entire study is not included to ensure project confidentiality.

While all the identified technologies were determined to be feasible, each had significant energy and economic impacts. Based on the pre-feasibility study, the costs per ton of NO_X removed from these technologies ranges from $55,000 to $590,000. These costs are based on the prefeasibility study and actual implantation costs are expected to be higher as major process and structural modifications would need to be made to implement these alternatives.

Therefore, NOx emissions reduction technologies such as SCR, SNCR and wet scrubber are not cost effective for BACT for the anode furnaces venting to the main stack.

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 selected as BACT.
- **Step 4—Identify BACT.** Because no new major developments in technologies have occurred after the promulgation of the MACT standards, the control technologies currently in place constitute BACT.

Complying with applicable requirements of the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE) represent the most stringent measure for the main stack.

3.1.2 Powerhouse Holman Boiler

Source Description: The boiler is used to provide process steam at the smelter. Emissions of NO_x are limited with flue gas recirculation (FGR), LNB, opacity limits, an alternative monitoring plan which requires continuous monitoring of operational parameters (fuel use, stack oxygen, steam output), and operational controls with good combustion practices. Emissions of $PM_{2.5}$, CO, SO_2, and VOC are limited with use of pipeline quality natural gas, good combustion practices, gas consumption limit, good design, opacity limits, and proper operation of the boiler. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.2.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies the following as possible control technologies for NO_x for natural gas-fired boilers:

  Selective catalytic reduction (SCR)

  FGR

  LNBs with good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The Holman boiler is equipped with FGR and LNB to reduce NO_x emissions. The addition of the SCR would reduce the emissions from the boiler from 9.9 tpy (based on 2016 actual emissions) to 2.0 tpy.

From the Alternative Control Techniques (ACT) Document — NO_X Emissions from Industrial/Commercial/ Institutional Boilers, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 100 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.03 lb/MMBtu. From Table 6-5 of the ACT document, the total annualized cost for the 100 MMBtu/hr gas boiler is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from Consumer Price Index (CPI) Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74; therefore, for the Holman boiler, the estimated cost is $487,287.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $26,000 and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** FGR, LNBs with good combustion practices, limited gas consumption, good design, and proper operation constitute BACT for this source.

KUC continuously monitors operational parameters to predict NO_x emissions and ensure proper boiler operation. The parameters monitored are fuel use (to predict NO_x emissions lb/hr), stack oxygen (to monitor proper boiler operation and compliance with NO_x lb/MMBtu emission limit), and steam output (used to estimate heat input if fuel use is unavailable). The ranges for these parameters were developed during a 30-day monitoring campaign where data from a certified NO_x analyzer were used to develop predictive equations with the operation parameters.

3.1.2.2 SO_2, VOC, and $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies listed in the RBLC and CARB**. The RBLC and CARB identifies the following as possible control technologies for boilers:

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 were selected as BACT.
- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, opacity limits, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNBs with good combustion practices, limited gas consumption, good design, and proper boiler operation represent the most stringent measure for the Holman Boiler.

3.1.3 Feed Process (Wet and Dry)

Source Description: Silica flux, concentrate, and converter slag are transferred directly to feed bins then conveyed to the dryer. Particulate emissions from the loading of the flux and concentrate, and from transfer points of the conveyor, are vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, electrostatic precipitators (ESPs), and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP, because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable as most effective technology identified in Step 1 selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

The use of a baghouse to control particulate emissions also represents the most stringent measure for both the wet and dry feed process.

3.1.4 Matte and Slag Granulators

Source Description: Slag and matte granulators are each equipped with a three-stage impingement plate scrubber. The smelter operates two matte granulators and one slag granulator. The molten matte is granulated with water in two separate granulation tanks (two matte granulators), each equipped with a scrubber. The convertor slag is granulated in a separate granulator (one slag granulator), also equipped with a scrubber. The matte granulators are vented through the main stack. The slag granulator is vented to the atmosphere through a separate stack. $PM_{2.5}$ and SO_2 emissions are controlled by a neutral pH three-stage impingement plate scrubber. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.4.1 $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, other possible particulate control technologies include baghouses, cyclones, ESP, and scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** While baghouses are most effective in controlling particulate emissions, this technology is not feasible for the granulators. The exhaust from the granulators has very high moisture content, which is not suitable for baghouses. Moisture condensation can cause accumulation of mud on the bags and baghouse walls. This results in blinded bags and clogged dust removal equipment. As discussed in the Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, cyclones are mainly used to control large particles. Therefore, scrubbers are the technically feasible option.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most technically feasible technology for this process, identified in Step 2, was selected as BACT.
- **Step 4—Identify BACT.** Scrubbers constitute BACT for the granulators.

3.1.4.2 SO_2 BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB**. The RBLC and CARB do not identify any specific control technologies for the granulators.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** Scrubbers constitute BACT for the granulators.

The use of scrubbers also represents the most stringent measure for both the matte and slag granulators.

3.1.5 Feed Storage Building

Source Description: Wet copper concentrate feed is stored in the enclosed wet feed storage building. Particulate matter from loading materials into the feed storage building, from reclaiming materials, and from conveyor/transfer point SME 002-A, are vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

The use of enclosures and baghouse to control particulate emissions also represents the most stringent measure for the feed storage building.

3.1.6 Anode Area Fugitives

Source Description: Emissions from the anode building process are controlled with a baghouse, quench tower, and scrubber. However, some emissions can escape as fugitives. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB do not identify any specific control technologies for process fugitives. The MACT, however, does address such emissions.

40 *CFR* 63.11147(a)(3) states, “You must operate one or more capture systems that collect the gases and fumes released from each vessel used to refine blister copper, re-melt anode copper, or re-melt anode scrap and convey each collected gas stream to a control device. One control device may be used for multiple collected gas streams.”

KUC certified compliance with 63.11147(a)(3), as required by 63.11150(b)(4), in a letter dated and received by UDAQ on January 30, 2007. This document is included as an attachment to this report.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** In addition to opacity limits and required maintenance, current design of anode process units and the collection hoods on anode building processes have been engineered/designed to reduce fugitives and these practices constitute BACT.

The current design of anode process units and the collection hoods on anode building processes were engineered/designed to reduce fugitives and these represent the most stringent measure.

3.1.7 Smelter Fugitives

Source Description: Emissions from Smelter processes are controlled with appropriate control technologies including closed processes, launder hoods and others outlined below. However, some emissions can escape as fugitives. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB do not identify any specific control technologies for such fugitives.

  The EPA performed extensive technology reviews of Smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Regarding the design and fugitive emission controls of the KUC smelter, the EPA provided the following discussion when promulgating the final copper smelting MACT standard (FR Vol. 67, No. 113, Page 40488):

  > Due to its unique design and operations, most of the process fugitive emission sources associated with smelters using batch converting are eliminated at the Kennecott smelter. There are no transfers of molten material in open ladles between the smelting, converting, and anode refining departments at the Kennecott smelter. In addition, there are no fugitive emissions associated with the repeated rolling-out of converters for charging, skimming, and pouring. Also, only one continuous flash converter is needed at the Kennecott smelter compared with the need for three or more batch copper converters at the other smelters.

Both standards go so far as to establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. Smelter process and emission controlling technologies that contributed to the EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred after the promulgation of the MACT standards.

Specific notes regarding control techniques listed in Table 5 of Attachment 5 of the EPA comments are listed below:

- KUC Smelter hot metals operations are serviced by an extensive local ventilation (secondary gas) system. This system collects gasses and routes them through baghouses and scrubbers before venting them to the main stack where they are continuously monitored for multiple pollutants.

- KUC Smelter hot metals operations are completely enclosed in a building.
- KUC processes only grade 1 scrap in its melting furnaces.
- A leak detection/prevention/repair program is not applicable to KUC Smelter furnaces and hot metals process units because they are enclosed and operate at negative pressure due to their inherent design.
- Because KUC furnaces are enclosed and do not require open air transfer of molten metal, they are not dependent on hooding systems for process gas collection.
- It is not necessary to add curtains to improve hood performance at the KUC Smelter as the process does not rely on hoods to capture process gasses.
- The KUC process does not require the open-air transfer of molten metal from smelting to converting vessels so it is not necessary to collect these emissions.
- The EPA noted in the primary copper smelting MACT standard, KUC was the first Smelter in the United States to capture and control emissions from anode refining furnaces.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** In addition to opacity limits and required maintenance, current designs of processes were engineered/designed to reduce fugitives and therefore these practices constitute BACT. KUC has implemented best management practices to minimize fugitive emissions. These practices are reviewed frequently and improvements are implemented to minimize emissions.

The current designs of processes were engineered/designed to reduce fugitives and therefore these practices also represent the most stringent measure.

3.1.8 Acid Plant Fugitives

Source Description: The double contact acid plant removes SO_2 from the off-gases of the flash furnaces. The sulfuric acid produced by the plant is sold. Among other technologies, the system is equipped with tubular candle fiber mist eliminators and the tail gas is discharged to the main stack. However, some emissions can escape as fugitives, which are controlled using best operational practices to minimize emissions. Best operational practices to minimize the emissions include opacity limits, weekly visual opacity surveys and the requirement of prompt repair or correction and control to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB do not identify any specific control technologies for such fugitives.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** Best operational practices may include, (1) placement or adjustment of negative pressure ductwork and collection hoses, (2) welding of process gas leaks, or (3) containment of process gas leaks. These practices and current design of processes were engineered/designed to reduce fugitives and therefore constitute BACT.

The best operational practices currently implemented and the current designs of the processes also represent the most stringent measure for the acid plant fugitives.

3.1.9 Powerhouse Foster Wheeler Boiler

Source Description: This boiler is used to produce superheated steam to start the smelter, drive acid plant compressors, and standby power. Emissions of NO_x are limited with FGR, LNB with good combustion practice, continuous monitoring of NO_x at the smelter main stack, and limitations on fuel throughput. Emissions of $PM_{2.5}$, CO, SO_2, and VOCs are limited with use of pipeline quality natural gas; good combustion practices; good design and proper operation of the boiler; and continuous monitoring of opacity, particulate, and SO_2 at the Smelter main stack. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.9.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** The RBLC and CARB identify the following as possible control technologies for NO_x for natural gas-fired boilers.

  SCR

  FGR

  LNB with good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The powerhouse boiler is equipped with FGR and LNB to reduce NO_x emissions. Emissions from this boiler are vented through the main stack and it is difficult to differentiate the boiler NO_X emissions from the main stack emissions. Based on the understanding of operations at the smelter, the addition of the SCR might reduce the annual emissions from the boiler from 5.3 tpy (based on 2016 actual emissions and engineering estimates) to 1.1 tpy.

From the Alternative Control Techniques Document – NO_X Emissions from Industrial/Commercial/Institutional Boiler, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 100 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.03 lb/MMBtu. From Table 6-5, the total annualized cost for the 100 MMBtu/hr gas boiler is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74; therefore, for the powerhouse boiler the estimated cost is $261,000.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $15,000 and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** FGR, LNB with good combustion practices, good design and proper operation constitute BACT.

3.1.9.2 SO_2, VOC, and $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB**. The RBLC and CARB identify the following as possible control technologies for boilers.

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the Powerhouse Foster Wheeler Boiler.

3.1.10 Miscellaneous Storage Piles/Loadout

Source Description: Concentrate, granulated matte, slag, and other materials are stored in storage piles on pads. Water sprays or chemicals are applied as necessary to minimize fugitive emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify dry foggers, adding moisture, and enclosures as possible control technologies for fugitive emissions. Other possible technologies available to control fugitive dust emissions that are not identified in the RBLC include chemical dust suppression, baghouse, cyclone, and scrubber.
- **Step 2—Eliminate Technically Infeasible Options.** The emission sources are fugitive in nature and therefore it is not technically feasible to duct emissions to a baghouse, scrubber, or cyclone. Additionally, the locations of the storage piles are always changing, making the construction of permanent enclosures difficult. Therefore, these control technologies are not technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The remaining technology of water or chemical applications is economically and chronologically feasible.
- **Step 4—Identify BACT.** KUC uses water sprays, chemical dust suppressants, and temporary enclosures to minimize particulate emissions from the miscellaneous storage piles, which were demonstrated to be very effective. These business practices constitute BACT for this emission source.

The use of water sprays, chemical dust suppressants, and temporary enclosures to minimize particulate emissions from the miscellaneous storage piles also represent the most stringent measure.

3.1.11 Slag Concentrator

Source Description: Emissions associated with the crushing, grinding, and slag processing at the smelter are minimized with the water sprays and enclosures. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, other possible particulate control technologies include baghouses, cyclones, scrubbers, water sprays, and enclosures.

- **Step 2—Eliminate Technically Infeasible Options.** Baghouses are not feasible for the slag processing equipment. The slag stock piles are sprayed with water frequently to minimize emissions. The material as a result has very high moisture content, which is not suitable for baghouses. Moisture droplets and condensation can cause accumulation of mud on the bags, baghouse walls, and ductwork. This results in blinded bags and clogged dust removal equipment. Further, when ambient temperatures are below freezing, the mud will freeze on the baghouse bags and plug them.

Wet scrubbers are not expected to be effective in minimizing emissions from crushing and grinding operations. Operation of the scrubbers is compromised due to below freezing ambient temperatures and very cold water streams in the scrubber. The duct work of the scrubbers will freeze during subfreezing ambient temperature conditions.

As discussed in the WRAP Fugitive Dust Handbook, cyclones are mainly used to control large particles.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The remaining technology of water sprays and enclosures is economically and chronologically feasible.
- **Step 4—Identify BACT.** KUC uses water sprays and enclosures to minimize particulate emissions from the slag concentrator, which were demonstrated to be very effective. These business practices constitute the BACT for this emission source.

The use of water sprays and enclosures to minimize particulate emissions represent the most stringent measure from the slag concentrator.

3.1.12 Smelter Cooling Towers

Source Description: Three noncontact water cooling towers are used for various Smelter processes. The towers are equipped with drift eliminators with drift loss rated at 0.001 percent. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable, as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.001 percent and good operating practices represent the most stringent measure for the cooling tower. As determined in the BACT analysis for other KUC facilities, upgrading the drift eliminators with lower drift loss is not cost effective for the BACT analysis.

3.1.13 Ground Matte Silo

Source Description: Ground matte material is stored in silos. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.

- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.04 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the ground matte silo.

3.1.14 Molding Coatings Storage Silo

Source Description: Coatings material is stored in silos. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.003 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the coatings storage silo.

3.1.15 Lime Storage Silos

Source Description: The Smelter has three lime storage silos. These silos are used to store lime for the hydrometallurgical plant, anode area and the secondary gas system. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the three silo baghouses were 0.01 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the silos used to store lime for the hydrometallurgical plant, anode area and the secondary gas system.

3.1.16 Limestone Storage Silos

Source Description: The silo is used to store limestone for the hydrometallurgical plant. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.04 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for silo used to store limestone for the hydrometallurgical plant.

3.1.17 Recycle and Crushing Building

Source Description: The matte and slag material is recycled and crushed in a building. Particulate matter from these small-scale operations are minimized as they occur inside the building and are controlled with a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, enclosures, and water sprays.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is most effective at capturing fine particulate and minimizing emissions.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Conducting operations inside the building and use of a baghouse are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the recycle and crushing building were 0.03 tpy. Conducting crushing and recycling operations inside the building and use of a baghouse to control particulate emissions also represents the most stringent measure.

3.1.18 Smelter Laboratory

Source Description: The laboratory at the Smelter is used for preparation of samples for testing which sometimes results in dust. Particulate emissions from the laboratory building are vented through a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify baghouses and enclosures as possible control technologies for limiting emissions from buildings or enclosed areas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Baghouses are the most effective in controlling emissions. Therefore, fabric filters (baghouse) constitute BACT for the Smelter Laboratory.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for the laboratory controlled with a baghouse were 0.78 tpy. This emission rate also represents the most stringent measure for the Smelter Laboratory.

3.1.19 Propane Communication Generator

Source Description: The Smelter operates a propane fired communication generator. This generator is used to support communication systems during emergencies or loss of power at the Smelter. Emissions are controlled with good combustion practices while operating the generator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for emergency generators around 75 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generator. The emergency generator also complies with applicable New Source Performance Standards.

Good combustion practices also represent the most stringent measure for the propane communication generator.

3.1.20 Cold Solvent Degreaser

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identifies operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed at all times to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for the degreaser.

  A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found of ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the Smelter were 0.002 tpy.

The previously identified practices also represent the most stringent measure for the degreasers.

3.1.21 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted that the 2014 actual VOC emissions for the gasoline fueling stations at the Smelter were 0.07 tpy. The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.1.22 Diesel Emergency Generator for Pyrometallurgical Process

Source Description: The Smelter operates one 998 HP diesel-fired emergency generator to support the pyrometallurgical process during emergencies. The emergency generator is equipped with turbo charger and after cooling and complies with applicable New Source Performance Standards to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. Potential emission control technologies identified in the RBLC and CARB for similar sized diesel generators include turbo charger and after cooling, good combustion practices and limiting the sulfur content of fuel to 0.0015 percent. Certification and compliance with applicable New Source Performance Standards is an acceptable means of demonstrating BACT for emergency generators.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.

- **Step 4—Identify BACT.** Turbo charger and after cooling, good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements are identified as BACT for all pollutants emitted from the emergency generator.

It should be noted that the 2014 actual emissions from the generator of $PM_{2.5}$ and precursors were 0.78 tpy.

Turbo charger and after cooling, good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements also represent the most stringent measure for the emergency generator.

3.1.23 Space Heaters

Source Description: Natural gas-fired heaters are used throughout the Smelter. The individual heaters are rated at less than 5 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.23.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC for controlling NO_x emissions from heaters of good combustion practices is already in use and constitute BACT.

3.1.23.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The 2014 actual emissions from the heaters for $PM_{2.5}$ and precursors were 0.48 tpy. The use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the space heaters. As discussed in the BACT analysis for other KUC facilities, replacing the existing space heaters with new heaters is not cost effective for the BACT analysis.

3.1.24 Hot Water Boiler

Source Description: Natural gas-fired water boilers are used for water heating throughout the Smelter. The water boilers use low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. The water heaters are rated at less than 10 MMBTU/hr. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.24.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from boilers less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC and CARB for controlling NO_x emissions from the boilers (LNB and good combustion practices) are already in use and constitute BACT.

3.1.24.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from the boilers.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from the boilers and these control technologies constitute BACT.

The 2014 actual emissions from the boilers for $PM_{2.5}$ and precursors were 0.61 tpy. The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for the hot water boilers at the Smelter.

3.2 Refinery

3.2.1 Boilers

Source Description: The two boilers are rated at 82 MMBtu/hr (gas) and 79 MMBtu/hr (oil) each and are permitted to operate on natural gas to meet the steam demand at the Refinery. During natural gas curtailment, the boilers are permitted to operate on oil. Emissions of NO_x are limited with FGR and LNB with good combustion practices. Emissions of $PM_{2.5}$, SO_2, and VOCs are limited with good combustion practices, good design, opacity limits, sulfur content limit, and proper operation of the boilers. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.1.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** The RBLC and CARB identifies the following as possible control technologies for NO_x for natural gas-fired boilers

SCR

FGR

LNB with good combustion practices

Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The Refinery boilers are equipped with FGR and LNB to reduce NO_x emissions. The addition of the SCR will reduce the emissions from the boilers from 12.9 tpy (based on based on 2016 actual emissions) to 2.6 tpy.

From the Alternative Control Techniques Document – NO_X Emissions from Industrial/Commercial/Institutional Boilers, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 50 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.02 lb/MMBtu (the 100 MMBtu/hr boiler controlled NO_x emission rate with SCR is listed at 0.03 lb/MMBtu). From Table 6-5 of the ACT document, the total annualized cost for the 50 MMBtu/hr gas boiler (closest entry to 82 MMBtu/hr Refinery boiler) is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74. The estimated cost for the refinery boilers is $428,040 for both boilers.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $65,000 for the Refinery boilers and is, therefore, not cost effective for BACT.

- **Step 4—Identify BACT.** FGR, LNB with good combustion practices, good design, and proper operation constitute BACT for this source.

3.2.1.2 SO_2, VOC, and $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB**. The RBLC and CARB identifies the following as possible control technologies for natural gas fired boilers:

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the boilers.

3.2.2 CHP Unit

Source Description: The CHP unit will generate power and steam to support Refinery operations. The CHP unit uses a low NO_x duct burner and the turbine has $SoLoNO_x$ burners. Emissions of $PM_{2.5}$, SO_2, and VOC are limited with good design and proper operation. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.2.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC.** The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired turbines and duct burners.

  SCR

  LNB with good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The CHP unit is equipped with LNB (SoLoNO$_x$ technology burners on turbine) to reduce NO_x emissions. The addition of the SCR will reduce emissions by 90 percent.

Solar Turbines, Inc. developed an estimation spreadsheet for the Taurus 70 combustion turbine and duct burner arrangement, which utilized vendor quotations for the installation of an SCR system. From the Solar calculations, the annualized capital and operating costs were estimated to be $932,100/yr.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $35,000 for the CHP unit and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** LNB with good combustion practices, good design, and proper operation of the CHP Unit constitute BACT for this source.

3.2.2.2 SO_2, VOC, and $PM_{2.5}$ Best Available Control Technologies

- **Step 1—Identify All Control Technologies listed in RBLC**. The RBLC identifies the following as possible control technologies for small turbines and duct burners:

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, selected as BACT.

- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the CHP unit constitute BACT for this emission source.

LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the CHP unit.

3.2.3 Refinery Cooling Towers

Source Description: Two noncontact water cooling towers are used for various refinery processes. The towers are equipped with drift eliminators with drift loss rated at 0.001 percent. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable, as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, are selected as BACT.
- **Step 4—Identify BACT.** Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.001 percent and good operating practices represent the most stringent measure for the cooling tower. As determined in the BACT analysis for other KUC facilities, upgrading the drift eliminators with lower drift loss is not cost effective for the BACT analysis.

3.2.4 Propane Communication Generator

Source Description: The Refinery operates a propane fired communication generator. This generator is used to support communication systems during emergencies or loss of power at the Refinery. Emissions are controlled with good combustion practices while operating the generator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for emergency generators around 75 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generator. The emergency generator also complies with applicable New Source Performance Standards.

Good combustion practices also represent the most stringent measure for the propane communication generator.

3.2.5 Cold Solvent Degreaser

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identifies operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed always to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for the degreaser.

A Safety Data Sheet for the degreasing solvent is provided as an Attachment. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found of ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the Refinery were 0.02 tpy.

The above identified practices also represent the most stringent measure for the degreasers.

3.2.6 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted that the 2014 actual VOC emissions for the gasoline fueling stations at the Refinery were 0.04 tpy.

The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.2.7 Space Heaters

Source Description: Natural gas-fired heaters are used throughout the Refinery. The individual heaters are rated at less than 5 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.7.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC and CARB for controlling NO_x emissions from heaters of good combustion practices is already in use and constitute BACT.

3.3.7.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the space heaters. As discussed in the BACT analysis for other KUC facilities, replacing the existing space heaters with new heaters is not cost effective for the BACT analysis.

3.2.8 Diesel Emergency Generator

Source Description: The Refinery operates one 487 HP diesel-fired emergency generator to support the precious metals plant at the Refinery during emergencies. The emergency generator complies with applicable New Source Performance Standards to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. Potential emission control technologies identified in the RBLC and CARB for similar sized diesel generators include good combustion practices and limiting the sulfur content of fuel to 0.0015 percent. Certification and compliance with applicable New Source Performance Standards is an acceptable means of demonstrating BACT for emergency generators.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements are identified as BACT for all pollutants emitted from the emergency generator.

It should be noted, the 2014 actual emissions from the generator of $PM_{2.5}$ and precursors were 0.12 tpy.

Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements also represent the most stringent measure for the emergency generator.

3.2.9 Soda Ash Storage Silo

Source Description: The Refinery has on soda ash storage silo. The silo is used to store soda ash for the Refinery. Particulate matter from loading materials into the silo is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses in form of a bin vent filters are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.004 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the silo.

3.2.10 Precious Metals Packaging Area

Source Description: The Refinery has a small precious metals packaging area. Particulate matter from the process is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the packaging area baghouses were 0.008 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the precious metals packaging area.

3.2.11 Hydrometallurgical Precious Metals Processing

Source Description: The Refinery has a precious metals processing and recovery area. Particulate matter, ammonia and SO_2 from the process are vented to a scrubber. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** The fabric filter (baghouse) is more effective at capturing fine particulate. However, due to high temperature of the exhaust steam and its pH, baghouses are not technically feasible. Wet scrubbers are therefore the only technically feasible control of particulate emissions and SO_2.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Scrubbers are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ and precursor emissions from the processes were 0.58 tpy. The use of scrubbers to control particulate emissions, ammonia and SO_2 also represents the most stringent measure for the precious metals processing area.

3.2.13 Tankhouse Sources

Source Description: The Refinery Tankhouse and MPC buildings include liberator, cathode wash and anode scrub wash processes that result in sulfuric acid mist emissions. Potential sulfuric acid mist from the processes are vented to a mist eliminator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible sulfuric acid control technologies include scrubbers and mist eliminators.
- **Step 2—Eliminate Technically Infeasible Options.** The presence of electrolytes in the exhaust stream cannot be effectively captured with a wet scrubber. Therefore, wet scrubbers are not technically feasible for these sources. Mist eliminators are technically feasible and effective in minimizing sulfuric acid mist emissions.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Mist eliminators are the most effective control technology for controlling sulfuric acid mist emissions and constitute BACT.

It should be noted that the 2014 actual sulfuric acid mist as $PM_{2.5}$ emissions from the Tankhouse sources were 0.005 tpy. The use of mist eliminators to control sulfuric acid mist emissions also represents the most stringent measure for the Tankhouse sources.

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SECTION 4

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

4.1 Smelter

Emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

Emission Point	Pollutant	Test Frequency
Main Stack (Stack No. 11)	$PM_{2.5}$	• 85 lbs/hr (filterable) • 434 lbs/hr (filterable + condensable)
	SO_2	• 552 lbs/hr (3 hr. rolling average) • 422 lbs/hr (daily average)
	NO_x	• 154 lbs/hr (daily average)
Holman Boiler	NO_x	• 14.0 lbs/hr (calendar-day average)

Stack testing to show compliance with the emissions limitations of Condition (A) above shall be performed as specified below:

Emission Point	Pollutant	Test Frequency
Main Stack	$PM_{2.5}$	Every year
	SO_2	Continuous Emissions Monitor (CEM)
	NO_x	CEM
Holman Boiler	NO_x	Every 3 years and alternate method determined per applicable new source performance standards

Supporting Information

During startup/shutdown operations, NO_x and SO_2 emissions are monitored by CEMs or alternate methods in accordance with applicable NSPS rules. This condition establishes emissions limitations and compliance requirements for the Smelter main stack and the Holman Boiler.

KUC continuously monitors operational parameters to predict NO_x emissions and to ensure proper boiler operation. The parameters monitored are fuel use (to predict NO_x emissions lb/hr), stack oxygen (to monitor proper boiler operation and compliance with NO_x lb/MMBtu emission limit), and steam output (used to estimate heat input if fuel use unavailable). The ranges for these parameters were developed during a 30-day monitoring campaign where data from a certified NO_x analyzer were used to develop predictive equations with the operational parameters. The alternative monitoring method identified in this condition is consistent with the applicable NSPS.

4.2 Refinery

Emissions to the atmosphere from the indicated emission point shall not exceed the following rate:

Emission Point	Pollutant	Maximum Emission
The sum of two (tank house) boilers	NO_x	9.5 lb/hr
Combined heat plant	NO_x	5.96 lbs/hr

Stack testing to show compliance with the above emission limitations shall be performed as follows:

Emission Point	Pollutant	Testing Frequency
Tank house boilers	NO_x	Every 3 years*
Combined heat plant	NO_x	Every year

Note:
*Stack testing shall be performed on boilers that have operated more than 300 hours during a 3-year period.

Supporting Information

KUC must operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions always including during startup, shutdown, and malfunction. Records shall be kept on site which indicate the date, and time of startups and shutdowns. This condition establishes emissions limitations and compliance requirements for the Refinery Boilers and Combined Heat and Power unit.

Attachments

- Smelter Dryer/Granulator Baghouse Information
- Anodes Furnaces NO_X Study
- Degreaser Solvent SDS
- EPA Compliance Letter

FINAL REPORT

Kennecott Utah Copper

$PM_{2.5}$ State Implementation Plan: Best Available Control Technology Determinations

Submitted to

Utah Division of Air Quality

Prepared for:

Kennecott Utah Copper

Prepared by:

ch2m

July 2017

FINAL

BACT Determinations for the Bingham Canyon Mine and Copperton Concentrator

Prepared for

Kennecott Utah Copper

July 2017

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Acronyms and Abbreviations

AO	approval order
BACT	best available control technology
BCM	Bingham Canyon Mine
CAA	Clean Air Act
CO	carbon monoxide
EPA	Environmental Protection Agency
gr/dscf	grains per dry standard cubic feet
GPS	Global Positioning System
KUC	Kennecott Utah Copper
MMBTU/hr	million British Thermal Units per hour
NAAQS	National Ambient Air Quality Standard
NH_3	ammonia
NOx	nitrogen oxides
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppm	parts per million
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SIP	State Implementation Plan
SO_2	sulfur dioxide
TPY	tons per year
UDAQ	Utah Department of Air Quality
VOC	volatile organic compound

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SECTION 1

Introduction

Kennecott Utah Copper LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities: Bingham Canyon Mine (BCM) and the Copperton Concentrator. In addition to a BACT analysis, KUC has also documented Most Stringent Measures for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and meet any reasonable further progress requirements. As requested by the Utah Division of Air Quality (UDAQ), the BACT analysis should identify and evaluate reasonable and available control technologies for each relevant pollutant. The technical and economic feasibility of each potential technology are components of the BACT analysis that help to show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). For each emission source, the BACT analysis followed a four-step process:

- **Step 1**—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC) and/or California Environmental Protection Agency – Air Resource Board BACT Clearinghouse (CARB)
- **Step 2**—Eliminate technically infeasible options
- **Step 3**—Eliminate economically/chronologically infeasible options
- **Step 4**—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent the most stringent measure.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS were combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends that BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development standard.

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SECTION 2

Recent Permitting Actions

Current operations at the BCM are permitted under Approval Order (AO) DAQE-AN105710037-15, issued on November 10, 2015.

Emissions from the BCM are mainly limited by the following conditions:

- "Total material moved (ore and waste) shall not exceed 260 million tons per rolling 12-month period." This condition limits the total material moved at the BCM, thus limiting all point, fugitive and tailpipe emissions.
- "Maximum total mileage per calendar day for ore and waste haul trucks shall not exceed 30,000 miles." This condition limits daily vehicle miles travelled at the BCM, thus limiting both fugitive and tailpipe emissions.
- "Emissions of particulate matter less than or equal to 10 microns in aerodynamic diameter (PM_{10}), NO_x, and SO_2 combined shall not exceed 7,350 tons and emissions of $PM_{2.5}$, NO_x, and SO_2 shall not exceed 6,205 tons per rolling 12-month period."
- "KUC shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year."

KUC is required to submit an annual fugitive dust control report that provides a description of the fugitive dust control practices implemented at the BCM.

Current operations at the Copperton Concentrator are permitted under AO DAQE-AN105710035-13 issued on June 25, 2013. Potential to Emit (PTE) emissions for the Copperton Concentrator are a very small percentage of combined emissions from the mine and concentrator facilities. Emissions for the Copperton Concentrator are limited by implementation of BACT controls.

PTE emissions in tpy for the BCM and the Copperton Concentrator are shown in Table 2-1.

Table 2-1. Facility Potential to Emit Emissions (Including Fugitive and Nonroad Engine Emissions)

	PM_{10} PTEs (tpy)	**$PM_{2.5}$ PTEs (tpy)**	**NO_x PTEs (tpy)**	**SO_2 PTEs (tpy)**	**VOC PTEs (tpy)**
Bingham Canyon Mine	1,519	369	5,838	7	314
Copperton Concentrator	25.3	13.86	10.66	0.1	4.04

Notes:
NO_x = oxides of nitrogen
PM_{10} = Particulate matter 10 microns or smaller in aerodynamic diameter
$PM_{2.5}$ = Particulate matter 2.5 microns or smaller in aerodynamic diameter
PTE = potential to emit
tpy = tons per year
SO_2 = sulfur dioxide
VOC = volatile organic compounds

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SECTION 3

BACT Determinations

This section provides BACT determinations for emission sources deemed significant at the BCM and the Copperton Concentrator.

3.1 Bingham Canyon Mine

3.1.1 In-pit Crusher

Source Description: The crusher is used to crush copper ore mined at the BCM. Particulate emissions from the in-pit crusher are controlled with a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emissions controls information for copper ore crushers. However, the databases identify baghouse (fabric filter) and enclosures with water sprays as possible control technologies for limiting emissions from crushers. The databases did not provide needed information on copper ore crushing. Therefore, due to differences in the material type listed in the databases and copper ore crushed at the BCM, a direct comparison of baghouse grain loading cannot be established.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are economically feasible.
- **Step 4—Identify BACT.** Fabric filters are the most effective in controlling emissions. Therefore, use of a baghouse (fabric filter) constitutes BACT for the in-pit crusher.

The existing baghouse for the crusher is permitted at a grain loading of 0.016 grains per dry standard cubic feet (gr/dscf). KUC investigated the options of either upgrading the filter system in the baghouse or replacing the baghouse.

Based on the review the RBLC and CARB databases, KUC found small baghouses with the grain loading of 0.002 gr/dscf to 0.003 gr/dscf. Using the most stringent emissions rates, KUC requested vendor information on baghouse upgrades to meet the 0.002 gr/dscf grain loading. Based on the data provided by the vendors, the total installed costs for the upgraded baghouse would be about $608,000. Based on the grain loading of the upgraded baghouse, $PM_{2.5}$ emissions from the crusher will be reduced from 2.28 tpy after the primary control to 0.28 tpy. The vendor provided information is included in the Appendix.

Based on the costs for the baghouse replacement, the cost per ton of $PM_{2.5}$ removed is $304,000. Therefore, replacing the crusher baghouse is not cost effective for BACT. Additionally, the vendors are unable to guarantee continuous compliance with the low emission rate from the baghouse for the in-pit crusher.

The current emission rate therefore represents the most stringent measure for the in-pit crusher.

3.1.2 Disturbed Areas

Source Description: Disturbed areas from mining activities. KUC current practices include application of dust palliatives and revegetation of the areas as soon as practical, as well as water application from passing water trucks in the operational areas to minimize dust. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emissions controls information for disturbed areas from mining activities. However, the databases identify revegetation, adding moisture, and enclosures (wind screens) as possible control technologies for fugitive emissions.
- **Step 2—Eliminate Technically Infeasible Options.**

  Applying additional moisture (water) on the disturbed areas, as mining occurs, is not technically feasible for KUC's mine operations. The ore is transferred through a series of conveyors. Excessive moisture in the ore material causes the conveyors to foul and breakdown resulting in costly equipment repairs. Therefore, adding moisture to the ore material is not technically feasible.

  Because the disturbed areas are so expansive and cover varying terrain, adding enclosures or wind screens are not technically feasible for this mine source.

  However, at the request of UDAQ, KUC had discussions with mine management about the feasibility of application of water for dust control on the disturbed areas that have been released for reclamation. Because the areas are so expansive, set up of irrigation systems for watering is not technically feasible. Using water trucks would disturb the reclaimed areas and would not provide benefit over reclamation and would therefore not be technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 were technically infeasible or selected as BACT.
- **Step 4—Identify BACT.** The practice of applying dust palliatives and revegetation is the most effective in reducing emissions from disturbed areas that have been released for reclamation. Therefore, the application of palliatives and revegetation constitute BACT for areas released for reclamation.

The application of palliatives and revegetation also represent BACM for the disturbed areas. Because best available measures are in use, they also represent the most stringent measure.

3.1.3 Waste Rock Offloading from Trucks

Source Description: Haul trucks dump waste rock or overburden at the waste rock disposal areas while minimizing the height of the drop. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify water application and enclosures as possible control technologies for fugitive emissions from similar sources of emissions. Another possible control technology not identified, but effective in reducing emissions from batch drop transfer points, is minimizing the drop distance while the waste rock is being dumped.
- **Step 2—Eliminate Technically Infeasible Options.**

Because the drop location is not static, an enclosure is not technically feasible. Water application is not technically feasible because excessive water application may result in geotechnical issues on the waste rock dumps. Additionally, an installation or setup of a water irrigation system for water application is not technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable as the remaining technology of minimizing the drop distance, while the waste rock is being dumped, is selected as BACT.
- **Step 4—Identify BACT.** Minimizing drop distances while the waste rock is being dumped is effective in controlling emissions and constitutes BACT.

Minimizing drop distances while the waste rock is being dumped also represents BACM. Because best available measures are in use, they also represent the most stringent measure.

3.1.4 Graders

Source Description: The graders primarily operate on the haul roads, maintaining surfaces of the roads. Particulate matter is controlled by the application of water and chemical dust suppressants to the roads. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify the application of water and chemical dust suppressants as a possible control technology for similar fugitive emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the graders. Because best available measures are in use, they also represent the most stringent measure.

3.1.5 Bulldozers and Front-end Loaders

Source Description: The dozers and front-end loaders operate in the pit, on the haul roads performing cleanup operations, and in dumping operations at the waste rock disposal areas. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify the application of water and chemical dust suppressants as required as a possible control technology for similar fugitive emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary constitute BACT.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the bulldozers and front-end loaders. Because best available measures are in use, they also represent the most stringent measure.

3.1.6 Unpaved Haul Roads

Source Description: Haul roads are used to transfer ore and waste rock. The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary minimize emissions from the unpaved haul roads. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify potential technologies for control of fugitive emissions on unpaved haul roads as: paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance (including the use of road base material) of haul roads.
- **Step 2—Eliminate Technically Infeasible Options.** Paving the haul roads is not technically feasible at the mine because of the weight of the haul trucks, the rapid deterioration that would occur, and the frequently changing road locations. The location of these roads changes regularly making the paving of the surface infeasible. Paving the roads to minimize emissions is not technically feasible and will not be evaluated further. Additionally, with changing mine plans and haul routes, it is impossible to accurately estimate the costs for paving the road surface.

  Application of chemical dust suppressants is not technically feasible for some haul road locations because of the adverse effect the chemical can have on the coefficient of friction of the road surface. Given that the grade of the haul roads exceeds 10 percent in some locations, creating a slippery skin on the road inhibits the ability of mobile equipment to brake and steer safely while traveling on the grade.
- **Step 3**—**Eliminate Economically/Chronologically Infeasible Options.** The remaining technologies of water application, chemical dust suppressants outside of the pit influence boundary, limiting unnecessary traffic on roads, and routine maintenance of haul roads are economically and chronologically feasible.
- **Step 4**—**Identify BACT.** The application of water and road-base material within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary is effective in minimizing emissions. Watering the unpaved haul road reduces fugitive $PM_{2.5}$ and PM_{10} emissions by binding the soil particles together, reducing free particles available to be picked up by wind or vehicles. Additional watering and application of chemical dust suppressants on certain locations of unpaved haul roads also occurs when heavy traffic is expected along the road. Water is applied on a scheduled basis and supplemented as needed based on road conditions. Dust is also reduced through performing regular and routine maintenance of the haul roads (through use of road-base material) and limiting unnecessary traffic on roads.

In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in the round-trips and vehicle miles traveled, thereby reducing fugitive dust emissions.

The annual fugitive dust control report for the mine is provided in the Appendix for reference.

The application of water within the pit influence boundary and water and chemical dust suppressants outside the pit influence boundary also represents BACM for the unpaved haul roads. Because best available measures are in use, they also represent the most stringent measure.

3.1.7 Tailpipe Emissions from Mobile Sources

Source Description: Tailpipe emissions from haul trucks and support equipment such as graders and dozers. Tailpipe emissions from the haul trucks and support equipment meet the required EPA standards for NONROAD equipment. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify no add on control technologies for tailpipe emissions from haul trucks and support equipment of the size used at the BCM.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable.

- **Step 4—Identify BACT.** Haul trucks and support equipment used at the facility meet the required EPA standards for nonroad equipment. The facility uses on-road specification diesel fuel in its off-road equipment. In 2007, an EPA ruling required sulfur content in all on-road specification diesel fuels be reduced (from 50 parts per million [ppm] formerly to 15 ppm currently). Because only on-road specification diesel fuel is used in its equipment, the facility has also made a transition to ultra-low sulfur diesel fuel. All the facility's diesel-powered equipment now runs on ultra-low sulfur diesel fuel.

  Additionally, the facility periodically upgrades its haul truck fleet to also take advantage of available higher-tier-level, lower-emitting engines. In recent years, KUC has purchased newer haul trucks with higher capacity where possible, which has led to a decrease in round-trips and truck operating hours, thereby reducing emissions.

  Purchasing new haul trucks with higher capacity and Tier level which meet its mining needs also represents the most stringent measure.

  During the previous SIP work in 2014, KUC developed a detailed analysis for the haul truck engine repowering and upgrade to higher tier level trucks. The analysis is provided in the Appendix.

3.1.8 Fueling Stations

Source Description: Adding gasoline and diesel to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify two control techniques for controlling VOC emissions from gasoline and diesel fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

  The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the fueling stations.

3.1.9 Cold Solvent Degreasers

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.

- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed always to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for degreasers.

A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the mine were 1.7 tpy. The previously identified practices also represent the most stringent measure for the degreasers.

3.1.10 Mine Conveyor Transfer Points

Source Description: The mine has two ore conveyor transfer drop points — Point C6/C7 and Point C7/C8. All exhaust air and particulate emissions from each transfer drop point are routed through the respective baghouse before being vented to the atmosphere. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify baghouse (fabric filter) and enclosures with water sprays as possible control technologies for limiting emissions from transfer points.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Fabric filters are the most effective in controlling emissions. Therefore, the baghouse (fabric filter) constitutes BACT for the conveyor transfer points.

The baghouse for each of the transfer points is permitted at a grain loading of 0.007 gr/dscf. The 2014 actual $PM_{2.5}$ emissions for conveyor transfer points controlled with a baghouse were 0.69 and 0.42 tpy each. Due to the low level of emissions from these sources, the BACT analysis did not evaluate the upgrade of the baghouses for these units. Additionally, based on the economics data presented in Section 3.1.1 of this document for baghouse replacement/upgrades, any upgrades or replacement would not be economically feasible.

This emission rate also represents the most stringent measure for the conveyor transfer points.

3.1.11 Lime Bins

Source Description: The Copperton Concentrator has two lime silos used for lime storage. Particulate emissions generated during loading and unloading operations are vented through a filter. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify vent filters and enclosures as possible control technologies for limiting emissions from storage silos.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Vent filters are the most effective in controlling emissions. Therefore, bin vent filters constitute BACT for the lime silos/bins.

The vent filter for each of the lime silos is permitted at a grain loading of 0.016 gr/dscf. These units are operated intermittently. The 2014 actual $PM_{2.5}$ emissions for the two lime silos controlled with a baghouse were 0.02 tpy. Due to the low level of emissions from these sources, the upgrade of the vent filters for these units would not be economically feasible.

This emission rate also represents the most stringent measure for the lime silos.

3.1.12 Sample Preparation Building

Source Description: The sample preparation building at the mine is used for preparation of waste rock and ore samples for testing. Particulate emissions from the sample preparation building are vented through a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify baghouses and enclosures as possible control technologies for limiting emissions from buildings or enclosed areas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Baghouses are the most effective in controlling emissions. Therefore, the fabric filters (baghouse) constitute BACT for the sample preparation building.

The baghouse for the sample preparation building is permitted at a grain loading of 0.016 gr/dscf. The building and the control system are operated intermittently. The 2014 actual $PM_{2.5}$ emissions for the sample preparation building controlled with a baghouse were 0.05 tpy. Due to the low level of emissions from these sources, the upgrade of the baghouse for the unit would not be economically feasible.

This emission rate also represents the most stringent measure for the sample preparation building.

3.1.13 Propane Communications Generators

Source Description: The mine operates six (6) propane fired communications generators. These generators are used to support mine communication systems during emergencies or loss of power in the mine. Emissions are controlled with good combustion practices while operating the generators. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify good combustion practices as the primary control technology for emergency generators between 70 HP and 150 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generators. The emergency generators also comply with applicable New Source Performance Standards.

It should be noted that the 2014 actual $PM_{2.5}$ and precursor emissions for all the propane emergency generators combined were 0.18 tpy.

Good combustion practices also represent the most stringent measure for the propane communication generators.

3.1.14 Ore Handling

Source Description: The mined ore is moved around the mine through conveyors and trucked to the stock piles as needed. The sources include Truck Offloading Ore Main In-pit Crusher, Truck Offloading Ore Stockpile, Main In-Pit Enclosed Transfer Points, Conveyor-stacker Transfer Point, Coarse Ore Stacker and Reclaim Tunnels. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emission controls for such material handling sources from a copper mine. The location of many of these sources change regularly making the construction of emission controls such as enclosures and application of dust suppressants infeasible for such sources. Therefore, potential control technologies include material characteristics such as large size with minimal quantities of fine material, enclosures and inherent moisture content as applicable to the emission source.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Material characteristics such as large ore size and presence of very small quantities of fine material are identified as BACT for the ore handling sources.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for these ore handling sources were 0.94 tpy.

The material characteristics such as large ore size and presence of very small quantities of fine material, inherent moisture content and enclosures also represent the most stringent measure for the ore handling emission sources.

3.1.15 Ore Storage Pile

Source Description: Low grade ore is stockpiled at the mine and blended into the process as necessary. Potential wind-blown dust emissions are minimized through application of water sprays and chemical dust suppressants and compaction. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify water sprays, chemical dust suppressants and compaction as potential control technologies to minimize emissions from large storage piles.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Water sprays, chemical dust suppressants and compaction are identified as BACT for the ore storage pile.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for the ore storage pile were 0.33 tpy.

These controls also represent the most stringent measure for the ore storage pile.

3.1.16 Road Base Crushing and Screening Plant

Source Description: The mine has semiportable plants that crush and screen rock for use for base material on the unpaved haul roads. Particulate emissions from the crushing, screening, and transfer operations are effectively controlled with water sprays and belt enclosures. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific emission controls for a road base crushing and screening plant for a copper mine. However, possible control technologies include baghouses, enclosures and water sprays for minimizing emissions from the road base crushing and screening plant.
- **Step 2—Eliminate Technically Infeasible Options.** The road base crushing system is moved through the mine to facilitate the production of road base material to meet demands. As a result, permanent installation of a baghouse to control emissions from the plant is not technically feasible. Water Sprays and temporary enclosures are feasible for the plant.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technically feasible technologies are economically feasible.
- **Step 4—Identify BACT.** Water sprays and enclosures are identified as BACT for the road base crushing and screening plant.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for the road base crushing and screening plant were 0.05 tpy.

These controls also represent the most stringent measure for the road base crushing and screening plants.

3.1.17 Drilling and Blasting

Source Description: Drilling and blasting are performed at the mine to access new ore bodies. Water injection is used to minimize emissions from drilling. The blast areas are controlled as practical to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific controls for drilling and blasting in open pit mines. Based on the mining experience, KUC identifies water injection and maintaining control of blast areas as potential control technologies to minimize emissions from drilling and blasting.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Water injection and maintaining control of blast areas are identified as BACT from drilling and blasting operations.

It should be noted that the 2014 actual $PM_{2.5}$ and precursor emissions for drilling and blasting sources were 0.75 tpy. These controls also represent the most stringent measure for the drilling and blasting operations.

3.1.18 Solvent Extraction and Electrowinning Process

Source Description: Tanks, mixers and settlers are used in the solvent extraction and electrowinning process. Covers are used to minimize emissions from these sources. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases do not identify specific controls for solvent extraction and electrowinning process. Based on the mining experience, KUC identifies covers on process equipment to minimize emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Use of covers is identified as BACT for the solvent extraction and electrowinning process.

It should be noted that potential emissions of $PM_{2.5}$ and precursors for solvent extraction and electrowinning are minimal.

These controls also represent the most stringent measure for the solvent extraction and electrowinning process.

3.2 Copperton Concentrator

3.2.1 Tioga Heaters

Source Description: Natural gas-fired heaters are used throughout the Copperton Concentrator. The heaters are rated at less than 5 MMBTU/hr each. Specifically, the facility includes seven (7) 4.2 MMBtu/hr natural gas fired heaters and one (1) 2.4 MMBtu/hr natural gas fired heater. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.1.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC for controlling NO_x emissions from heaters of good combustion practices is already in use and constitutes BACT.

3.2.1.2 $PM_{2.5}$, SO_2, CO, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify the use of pipeline quality natural gas and good combustion practices as control technology for minimizing $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters and these control technologies constitute BACT.

At the request of UDAQ, KUC contacted vendors regarding the feasibility of replacement of the 8 Tioga heaters at the Copperton Concentrator.

Based on the data provided by the vendors, the total installed cost of the eight new heaters is estimated to be $940,000. The costs assume the installation costs to be 35 percent of the equipment costs. Theses heaters will be equipped with the latest burner technology. Assuming the new heaters will minimize NOx emissions by 90% from current levels, the new heaters might reduce the annual emissions from the Tioga heaters from 3.3 tpy (based on 2014 actual emissions) to 0.33 tpy. The vendor provided information is included in the Appendix.

Based on the costs for the new heaters, the cost of new heaters per ton of NO_x removed is $317,000. Therefore, replacing the Tioga heaters is not cost effective for BACT.

Low NO_X burners, use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the Tioga heaters.

3.2.2 Pebble Crushing System

Source Description: The pebble crushing system includes crusher and ore handling conveyors and transfer points. The system is placed inside a building to minimize particulate emissions to the atmosphere. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify baghouses, wet scrubbers, water sprays and enclosures as possible control technologies to minimize emissions from a crushing plant.
- **Step 2—Eliminate Technically Infeasible Options.** Because the emissions will be vented inside the building, wet scrubbers and fabric filters are not technically feasible. Water sprays are not feasible as the water makes the material too wet to crush.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technically feasible technologies are feasible.
- **Step 4—Identify BACT.** Enclosures, or placing the source inside the building, is effective in minimizing emissions from the crusher operations and identified as BACT for the pebble crushing system.

It should be noted, the 2014 actual $PM_{2.5}$ emissions for the pebble crushing system were 0.07 tpy. This control also represents the most stringent measure for the pebble crushing system.

3.2.3 Cold Solvent Degreasers

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed always to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for degreasers.

A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the concentrator were 0.08 tpy.

The previously identified practices also represent the most stringent measure for the degreasers.

3.2.4 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB databases identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted that the 2014 actual VOC emissions for the gasoline fueling stations at the Copperton Concentrator were 0.29 tpy.

The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.2.5 Molybdenum Storage Bins and Loading Bags

Source Description: The Copperton Concentrator has molybdenum storage bins from which bags are loaded for offsite shipping. Particulate emissions generated during loading and unloading operations are vented through a filter. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify vent filters and enclosures as possible control technologies for limiting emissions from storage silos.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Vent filters are the most effective in controlling emissions. Therefore, bin vent filters constitute BACT for the molybdenum storage bins and loading bags.

The 2014 actual $PM_{2.5}$ emissions for these operations controlled with a bin vent filter were 0.5 tpy. Due to the low level of emissions from these sources, the upgrade of the vent filters for these units would not be economically feasible.

This control technology also represents the most stringent measure for the process.

3.2.6 Feed and Product Dryer Oil Heaters

Source Description: Natural gas-fired heaters provide heat to the feed and product dryers that are used in molybdenum process at the Copperton Concentrator. The heaters are rated at 5.7 MMBTU/hr and 2.2 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.6.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify Low NO_X burners and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC and CARB for controlling NO_x emissions from heaters of Low NO_X Burners and good combustion practices is already in use and constitutes BACT.

3.2.6.2 $PM_{2.5}$, SO_2, CO, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB databases identify use of pipeline quality natural gas and good combustion practices as control technologies for minimizing $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB databases identify use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, CO, and VOC emissions from heaters and these control technologies constitute BACT.

Low NO_X burners, use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the heaters. Due to low level of emissions from these units, upgrading these would not be economically feasible.

SECTION 4

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

4.1 Bingham Canyon Mine

KUC is proposing the following limitations and monitoring requirements for the Bingham Canyon Mine.

- Maximum total mileage per calendar day for ore and waste haul trucks shall not exceed 30,000 miles. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System (GPS) or equivalent.
- KUC Shall Use Ultra-low Sulfur Diesel Fuel in Its Haul Trucks.
- To minimize emissions at the mine:
- The owner/operator shall control emissions from the in-pit crusher with a baghouse.
- Apply water to all active haul roads as weather and operational conditions warrant, except during precipitation or freezing conditions, and apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.
- A chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.
- KUC is Subject to the Requirements in the Most Recent Federally approved Fugitive Emissions and Fugitive Dust Rule.

Supporting Information

The condition above establishes a limitation on daily activity. The daily mileage limitation effectively limits fugitive road dust emissions, tailpipe emissions from the haul trucks, and overall activity of sources at the mine. Ore processing at the Copperton Concentrator, which results in minimal emissions, is also limited through the BCM activity limitations.

Emissions resulting from the movement of ore and waste around the mine represent a significant portion of overall emissions at the BCM. The emissions related to material movement include fugitive dust generated from truck travel on the haul roads and the tailpipe emissions from the haul trucks. Specifically, on an annual basis, greater than 99.9 percent of total mine emissions for NO_X and SO_2 come from the haul truck tailpipes. Also, on an annual basis, material movement represents 85 percent of the overall particulate emissions at the BCM. Based on these emissions, the material movement of ore and waste by haul trucks represents a vast majority of overall emissions at the BCM and can effectively be used to represent mine operations.

Daily emissions from the BCM can be regulated with the limitation on vehicle miles traveled by ore and waste haul trucks of 30,000 miles per day. Compliance with this limitation is demonstrated daily and is an appropriate metric for a 24-hour particulate standard.

It should be noted that the 30,000 miles per day limitation also limits overall BCM operations. Ancillary mining activities such as operation of the in-pit crusher, mining support equipment, blasting, and drilling only occur to produce an adequate amount of ore and waste rock that can be hauled via the trucks and sent to the concentrator via the conveyor system.

On a 24-hour basis, these emissions can be represented with the 30,000 miles per day limitation. Since they effectively represent mine operations, a single daily limitation is appropriate in the SIP for the BCM. These emissions have been included in the appropriate SIP model.

KUC uses a real-time tracking system for both tracking haul trucks as well as for recording miles travelled. These records are used to comply with the 30,000 miles per day limitation. The system may be a GPS or a system with similar tracking capabilities necessary to comply with this condition.

The condition also establishes a requirement for the use of ultra-low sulfur diesel fuel in haul trucks.

The conditions require the control of emissions from the in-pit crushers with a baghouse.

The condition also establishes requirements for reducing and controlling fugitive particulate emissions from active unpaved haul roads at the mine. Water and chemical dust suppressants shall be used to minimize fugitive dust.

Specifically, active ore and waste haulage roads within the pit influence boundary are water sprayed and/or treated with a commercial dust suppressant. Crushed road-base material is applied to active ore and waste haulage roads within the pit influence boundary to enhance the effectiveness of fugitive dust control measures. Commercial dust suppressants are applied to active ore and waste haulage roads outside of the pit influence boundary no less than twice per year.

Each year KUC reports dust control measures implemented at the BCM during the previous year with details such as volume of water applied, commercial dust suppressant activity, etc.

KUC is subject to the fugitive dust rules approved by UDAQ and EPA. These rules outline requirements that mines are to follow in minimizing the fugitive dust from the mining operations.

4.2 Copperton Concentrator

No limitations or monitoring requirements are proposed for the Copperton Concentrator emission sources as the emissions from the facility are minimal and are effectively controlled with the implementation of BACT.

Attachments

- In-pit Crusher Baghouse Vendor Data
- Mine FDCP Report
- Haul Trucks Analysis
- Degreaser Solvent SDS
- Tioga Heaters Vendor Information

F I N A L

BACT Determinations for the Utah Power Plant, Tailings Site, and Laboratory

Prepared for

Kennecott Utah Copper

July 2017

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Contents

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Acronyms and Abbreviations

AO	approval order
BACT	best available control technology
CAA	Clean Air Act
CatOx	catalytic oxidation
CO	carbon monoxide
DLN	dry low nitrogen
EPA	Environmental Protection Agency
KUC	Kennecott Utah Copper
LNB	low NO_x burner
MMBTU/hr	million British Thermal Units per hour
MW	megawatts
NAAQS	National Ambient Air Quality Standard
NOx	nitrogen oxides
OFA	over-fire air
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppmvd	parts per million by volume dry
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearinghouse
SCR	selective catalytic reduction
SIP	State Implementation Plan
SNCR	selective non-catalytic reduction
SO_2	sulfur dioxide
tpy	tons per year
UDAQ	Utah Department of Air Quality
UPP	Utah Power Plant
VOC	volatile organic compound

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SECTION 1

Introduction

Kennecott Utah Copper, LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities located at the northwest corner of Salt Lake County, Utah: Utah Power Plant (UPP), tailings site, and the laboratory. The tailings site receives tailings in slurry form. The slurry is deposited in the tailings pond. The UPP is a coal and natural gas fired power plant that supplies power for KUC operations. Coal is used to fuel the plant in spring, summer, and fall; while natural gas is approved for use in the winter months. The laboratory is used to perform various tests and functions to optimize operations through analysis of materials. In addition to a BACT analysis, KUC has also documented the most stringent measure for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and to meet any reasonable further progress requirements. As requested by the Utah Division of Air Quality (UDAQ), the BACT analysis should identify and evaluate BACT for each relevant pollutant. The technical and economic feasibility of each potential technology are components of the BACT analysis that help to show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environment Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOC). For each emission source, the BACT analysis followed a four-step process:

- **Step 1**—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC) and/or California Environmental Protection Agency – Air Resource Board BACT Clearinghouse (CARB)
- **Step 2**—Eliminate technically infeasible options
- **Step 3**—Eliminate economically/chronologically infeasible options
- **Step 4**—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent most stringent measure.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS was combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends that BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development.

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Recent Permitting Actions

An approval order (AO) was issued for the UPP on November 10, 2015, which authorized the construction and operation of a natural gas fired emergency generator. Issued in 2011, AO DAQE-AN105720026-11 authorized KUC to replace Boiler Units 1, 2, and 3 with a new natural gas fired combustion turbine operating in combined cycle mode with a heat recovery steam generator. The new combustion turbine will be equipped with state of the art add-on controls to minimize emissions from the unit and represents BACT. Dry low nitrogen oxide (DLN) combustors and the selective catalytic reduction (SCR) system will control NO_x emissions. The catalytic oxidation (CatOx) system will control carbon monoxide (CO) and VOC emissions. Good combustion practices and burning natural gas will minimize emissions of the remaining pollutants.

The tailings site is permitted under AO DAQE-AN10572018-06. The emissions sources at the laboratory are permitted under AO DAQE-261-95. All three facilities operate under a single Title V Operating Permit #3500346002.

The current potential to emit (PTE) emissions in tons per year (tpy) for the tailings site, UPP, and the laboratory are shown in Table 1-1.

Table 2-1. Facility Potential to Emit

	PM_{10} PTE (tpy)	**$PM_{2.5}$ PTE (tpy)**	**NO_x PTE (tpy)**	**SO_2 PTE (tpy)**	**VOC PTE (tpy)**
UPP	248	248	1,641	2,577	41
Tailings Site	36.3	5.4**	0.26	—*	0.04
Laboratory	0.12	0.12	0.68	0.13	0.12

Notes:
$PM_{2.5}$ = particulate matter 2.5 microns or smaller in aerodynamic diameter
PM_{10} = particulate matter 10 microns or smaller in aerodynamic diameter
PTE = potential to emit
NO_x = oxides of Nitrogen
SO_2 = sulfur dioxide
tpy = tons per year
VOC = volatile organic compounds
*Permitted combustion sources result in negligible SO_2 emissions at the tailings site.
**$PM_{2.5}$ emissions are estimated to be 15 percent of PM_{10} emissions.

Distinguishing by season of operation is allowed under EPA's *Implementation Guidance for the 2006 24-hour Fine Particle NAAQS* (March 2, 2012), which specifically acknowledges that several nonattainment areas located in the western United States only have experienced exceedances during the winter season. In such cases, the EPA authorizes states to (1) develop a seasonal emission inventory and (2) evaluate emission reduction strategies for a single season only [p. 11]. "When following a seasonal approach, the EPA believes that *the control strategy evaluation* (based on seasonal emission reduction measures) and the assessment of future year air quality concentrations (through air quality modeling or other analyses) *should be conducted for that season*." [p. 12]. In view of the nature of Utah's $PM_{2.5}$ nonattainment circumstance, the BACT analysis for UPP focuses primarily on a wintertime control strategy.

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SECTION 3

BACT Determinations

This section provides BACT determinations for emission sources deemed significant at the UPP, Tailings site, and Laboratory.

3.1 Utah Power Plant

Historically, KUC has operated three coal fired boilers rated at 100 megawatts (MW) combined, referred to as Units 1-3, at the UPP. The units operated on coal during the spring, summer and fall months, but were limited to burning natural gas during the winter months between November 1 and March 1. In October 2016, KUC permanently ceased operation of Units 1-3. Therefore, a BACT analysis for Units 1-3 is not included in this document.

3.1.1 UPP Unit 4 Boiler

Source Description: Tangentially fired boiler capable of burning both coal and natural gas, rated at 838 million British Thermal Units per hour (MMBTU/hr) (coal), or 872 MMBTU/hr (natural gas), equipped with an electrostatic precipitator. Since the ambient 24-hour concentrations of $PM_{2.5}$ exceed the NAAQS during the winter months, the BACT analysis is limited to controls for the combustion of natural gas, which are the only controls that may affect the attainment of the $PM_{2.5}$ NAAQS in the Salt Lake City nonattainment area. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.1.1 NO_x BACT

- **Step 1—Identify All NO_x Control Technologies listed in RBLC and CARB.** The RBLC and CARB identifies (1) low NO_x burners with over-fire air (low NO_x burner [LNB] with over-fire air [OFA]) and (2) LNB with OFA and SCR as potential technologies for NO_x control from a natural gas fired boiler.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Previous SIP determination for UPP Unit 4 required the installation of LNB with OFA and SCR with 90% NO_X control when operating on natural gas during the winter months between November 1 and March 1. Because the top technology is already identified in previous SIPs, additional analysis is not necessary.
- **Step 4—Identify BACT.** LNB with OFA and SCR with 90% control efficiency constitute BACT for controlling NO_x emissions from natural gas combustion in the boiler during the wintertime period (November 1 through March 1).

Control efficiency of 90% for LNB with OFA and SCR is a default value used by the industry. A detailed design of the control systems would be necessary to develop anticipated control efficiency for Unit 4. Due to SIP time constraints, a detailed design is not feasible and therefore it is recommended that UDAQ use the default value.

3.1.1.2 SO_2 BACT

- **Step 1—Identify all SO_2 Control Technologies listed in RBLC and CARB.** The RBLC identifies the use of pipeline quality natural gas as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4— Identify BACT.** The use of pipeline quality natural gas constitutes BACT when burning natural gas.

3.1.1.3 $PM_{2.5}$ BACT

- **Step 1—Identify all $PM_{2.5}$ Control Technologies listed in RBLC.** The RBLC identifies good combustion practices as a control for reducing $PM_{2.5}$ when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Good combustion practices constitute BACT while burning natural gas.

3.1.1.4 VOC BACT

- **Step 1—Identify all VOC Control Technologies listed in RBLC.** The RBLC identifies good combustion practices as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4— Identify BACT.** Good combustion practices constitute BACT for VOC while burning natural gas.

Controlling NO_X emissions by 90 percent with LNB, OFA, and SCR and the use of pipeline quality natural gas and good combustion practices represent the most stringent measure for Unit 4 at the UPP when operating on natural gas between November 1 and March 1.

3.1.2 UPP Unit 5 Combustion Turbine and Duct Burner

Source Description: A combustion turbine and duct burner in combined-cycle operation with a nominal generating capacity of approximately 275 MW, equipped with SCR and CatOx. Construction of Unit 5 is not complete at this time.

3.1.2.1 NO_x BACT

- **Step 1—Identify All NO_x Control Technologies listed in RBLC and CARB.** The RBLC identifies selective noncatalytic reduction (SNCR) and SCR as potential technologies for NO_x control. The SCR technology is the most stringent control alternative listed in the RBLC.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** SCR constitutes BACT for controlling NO_x emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.2 VOC BACT

- **Step 1—Identify All CO and VOC Control Technologies listed in RBLC and CARB.** The RBLC identifies CatOx to control emissions of CO and VOC.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** CatOx constitutes BACT for controlling CO and VOC emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.3 SO_2 BACT

- **Step 1—Identify All SO_2 Control Technologies listed in RBLC and CARB.** The RBLC identifies the use of pipeline quality natural gas and good combustion practices as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The use of pipeline quality natural gas and good combustion practices constitute BACT for controlling SO_2 emissions from the Unit 5 combustion turbine and duct burner.

3.1.2.4 $PM_{2.5}$ BACT

- **Step 1—Identify All $PM_{2.5}$ Control Technologies listed in RBLC and CARB**. The RBLC identifies the use of pipeline quality natural gas and good combustion practices as a control when burning natural gas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The use of pipeline quality natural gas and good combustion practices constitute BACT for controlling $PM_{2.5}$ emissions from the Unit 5 combustion turbine and duct burner.

Limiting NO_X emissions to 2 parts per million by volume dry (ppmvd) at 15% O_2; CatOx for control of CO and VOC emissions; and the use of pipeline quality natural gas and good combustion practices represent the most stringent measure for Unit 5 at the UPP.

3.1.3 Cooling Towers

Source Description: Noncontact water cooling towers are used to control waste heat from the boilers. All towers are equipped with drift eliminators with drift loss rated at 0.002 percent. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Drift eliminators and good operating practices constitute BACT.

The existing Unit 4 Cooling Tower could be upgraded with 0.001 percent drift factor from the existing 0.002%. Based on KUC's discussions with the vendors, the total installed costs for the upgrade of the drift eliminator would be $177,000. The upgrade of the drift eliminators would reduce the annual emissions from the Unit 4 Cooling Tower from 2.426 tpy (based on 2014 actual emissions) to about 1.21 tpy. The vendor provided information is included in the Appendix.

Based on the costs for the drift eliminator upgrade, the cost per ton of $PM_{2.5}$ removed is $146,000. Therefore, replacing the replacing the existing drift eliminator with a high efficiency drift eliminator is not cost effective for BACT. Based on this cost effectiveness analysis, eliminators with 0.0005% drift loss are not further evaluated as they would not be cost effective as well.

The use of drift eliminators with drift loss rated at 0.002 percent and good operating practices represent the most stringent measure for the cooling towers.

3.1.4 Tioga Space Heaters

Source Description: Natural gas-fired space heaters are used for comfort heating and cooling, and water heating throughout the power plant. The space heaters use low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. All space heaters are rated at less than 5 MMBTU/hr. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.4.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC and CARB for controlling NO_x emissions from heaters (LNB and good combustion practices) are already in use and constitute BACT.

3.1.4.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for Tioga Space Heaters at the UPP. As discussed in the BACT analysis for other KUC facilities, replacing the existing space heaters with new heaters is not cost effective for the BACT analysis.

3.1.5 Cold Solvent Degreaser

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identifies operating practices such as closing the degreaser lids as a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed at all times to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for the degreaser.

A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the UPP were 0.3 tpy.

The previously identified practices also represent the most stringent measure for the degreasers.

3.1.6 Natural Gas Emergency Generators

Source Description: The UPP operates two 1.2 MMBTU/hr natural gas generators. Emissions are controlled with good combustion practices while operating the generator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for natural gas generators less than 5 MMBTU/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the natural gas generators.

It should be noted, the 2014 actual emissions for $PM_{2.5}$ and precursors for the natural gas generators were 0.18 tpy.

Good combustion practices also represent the most stringent measure for the natural gas generators.

3.1.7 Roads at UPP

Source Description: Unpaved and paved access roads exist throughout the UPP and are used by KUC personnel daily. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies potential technologies for control of fugitive emissions on unpaved roads as: paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance of roads.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3**—**Eliminate Economically/Chronologically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 4**—**Identify BACT.** Paving sections of the road, the application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are identified as BACT for the roads at the UPP.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from roads at the UPP were 0.27 tpy. Paving sections of the road, the application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads also represent the most stringent measure for the roads at the UPP.

3.1.8 Hot Water Heater

Source Description: Natural gas-fired water heater is used for water heating throughout the power plant. The water heater uses low NO_x burners (LNB) and regular inspections are done to the unit to ensure optimum combustion performance. The water heater is rated at 7.13 MMBTU/hr. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.8.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC for controlling NO_x emissions from the heater (LNB and good combustion practices) are already in use and constitute BACT.

3.1.8.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from the heater.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from the heater and these control technologies constitute BACT.

The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for the hot water heater at the UPP.

3.1.9 Coal and Ash Handling at UPP

Source Description: Coal and ash handling system that includes small coal storage pile, conveyors, and coal and ash storage silos. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC.** The RBLC identifies potential technologies for control of fugitive emissions from coal and ash handling as enclosures and water sprays.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 4—Identify BACT.** Enclosures and water sprays are identified as BACT for coal and ash handling at the UPP.

It should be noted, the 2014 actual $PM_{2.5}$ emissions from coal and ash handling at the UPP were 0.92 tpy. Enclosures and water sprays also represent the most stringent measure for coal and ash handling at the UPP.

3.1.10 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted, the 2014 actual VOC emissions for the gasoline fueling stations at the UPP were 0.33 tpy.

The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.1.11 Diesel Fire Pump

Source Description: The UPP operates 175 HP diesel-fired fire pump during emergencies. The fire pump complies with applicable New Source Performance Standards to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. Potential emission control technologies identified in the RBLC and CARB for similar sized diesel fire pumps include good combustion practices and limiting the sulfur content of fuel to 0.0015 percent. Certification and compliance with applicable New Source Performance Standards is an acceptable means of demonstrating BACT for emergency fire pumps.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements are identified as BACT for all pollutants emitted from the emergency fire pump.

It should be noted that the 2014 actual emissions from the fire pump of $PM_{2.5}$ and precursors were 0.12 tpy.

Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements also represent the most stringent measure for the emergency fire pump.

3.1.12 Diesel Engine for Coal Unloading System

Source Description: The UPP had a170 HP diesel-fired engine to operate the coal unloading system. This emission source no longer exists at the UPP. Therefore, a BACT analysis has not been developed for this emission source.

3.2 Tailings Site

3.2.1 Wind Erosion from Tailings Site

Source Description: Tailings are sent to the tailings site via a slurry pipeline. At the facility, tailings are separated by size in a cyclone with the larger particles used to build the embankments and the smaller particles discharged in slurry form in the impoundment. Emissions from the tailings site are mainly from wind erosion of dry tailings on the embankment. The facility has a current dust control plan approved by the UDAQ Executive Director for control of fugitive particulate matter. A copy of the quarterly report that documents dust control measures implemented at the facility is included in the Appendix for reference. The dust control plan requires frequent monitoring of the impoundment for wind erosion potential, applying chemical dust suppressants in the late spring, applying water via water trucks and the dust suppression sprinkler system as needed to maintain adequate moisture content.

In 2013, KUC conducted a study to identify and evaluate the range of dust control practices that have been attempted and successfully applied for mine tailings impoundments. A study also reviewed published literature and available air quality compliance documentation to extend the breadth of the evaluation. The study is included in the Appendix.

The tailings site can be categorized into four operational areas: impoundment, active embankment, inactive embankment, and reclaimed areas. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.2 BACT Analysis for Tailings Impoundment

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

  Watering

  Polymer application

Revegetation

Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists in minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the impoundment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.**

The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.

- **Step 4—Identify BACT.** The impoundment area is saturated with water and does not result in windblown dust emissions. Visual inspections are routinely performed to ensure the impoundment is saturated with water and in the unlikely event an area appears to be drying out, the area would be re-saturated. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions. Additionally, the impoundment area is saturated with water and does not result in windblown dust emissions.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.3 BACT Analysis for Tailings Active (Flat) Embankments

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

Watering

Polymer application

Revegetation

Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the embankment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.
- **Step 4—Identify BACT.** The tailings are actively deposited in the embankment areas. In an active embankment cell, the tailings are deposited every fourth day. The tailings are extremely wet when deposited. Areas can remain moist for several days. Application of water for dust control in active areas is not feasible as it tends to channelize directly to the drain point instead of spreading across the surface. The flat embankment areas will therefore have a potential for wind erosion on days 2, 3, and 4. Emissions are estimated based on days with potential for wind erosion. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions and identified as BACT.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.4 BACT Analysis for Tailings Inactive and Sloped Embankments

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

  Watering

  Polymer application

  Revegetation

  Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the embankment, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.
- **Step 4—Identify BACT.** In the inactive embankment areas, where tailings deposition has been completed for the year, KUC installs sprinklers for watering. Over the past few years, KUC converted this to an automated

sprinkler system that wets the surface at regular intervals. This upgrade allows the surface to maintain its moisture.

The embankment slopes are sprayed with polymers to minimize windblown dust. Polymer is reapplied as necessary to maintain its effectiveness to minimize emissions. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions and identified as BACT.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.5 BACT Analysis for Tailings Reclaimed Areas

- **Step 1—Identify All Control Technologies Listed in RBLC.** The following control technologies were identified in the RBLC for particulate control from impoundment type emissions sources:

  Watering

  Polymer application

  Revegetation

  Enclosures

Watering: Watering increases the moisture content of the surface, which conglomerates particles and reduces their likelihood to become airborne. The control efficiency for watering depends on how fast the area dries after water is added. Frequent watering is necessary to maintain its effectiveness.

Polymer Application: As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. Polymers suppress emissions by changing the physical characteristics of the surface material. The polymers form a hardened surface that binds the particles together, thereby reducing their likelihood to become airborne.

Revegetation: Revegetation assists with minimizing emissions. The vegetation holds the soil surface together and therefore makes it less prone to wind erosion.

Enclosures: Enclosures reduce the wind shear at the surface and thereby reduce wind erosion and emissions.

- **Step 2—Eliminate Technically Infeasible Options.** Because of the size of the reclaimed areas, enclosures are not feasible. All remaining technologies are feasible and are further evaluated below.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The control technologies cannot be ranked based on effectiveness as each control technology is effective for specific areas at the tailings site.
- **Step 4—Identify BACT.** Once released for reclamation, KUC implements a revegetation plan to reclaim the areas. Polymers are applied to areas still waiting to be reclaimed. The current practices of reducing particulate emissions by following the approved dust control plan is most effective in reducing emissions and are identified as BACT.

The current practices of dust management at the tailings site also represent the most stringent measure.

3.2.6 Service Roads

- **Source Description:** Service roads exist throughout the tailings site and are used by KUC personnel daily.
- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies potential technologies for control of fugitive emissions on unpaved roads as; paving the unpaved roads, the application of water and the use of dust suppression chemicals, limiting unnecessary traffic on roads and routine maintenance of roads.

- **Step 2—Eliminate Technically Infeasible Options.** Paving the haul roads is not technically feasible at the tailings site because of the frequently changing road locations over time resulting from tailing placement.
- **Step 3**—**Eliminate Economically/Chronologically Infeasible Options.** The remaining technologies of water application, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are economically and chronologically feasible.
- **Step 4**—**Identify BACT.** The application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads are identified as BACT for the service roads.

The application of water, chemical dust suppressants, limiting unnecessary traffic on roads, and routine maintenance of roads also represent the most stringent measure for the service roads at the tailings site.

3.2.7 Propane Communication Generator

Source Description: The tailings facility operates a propane fired communication generator. This generator is used to support communication systems during emergencies or loss of power at the tailings facility. Emissions are controlled with good combustion practices while operating the generator.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for emergency generators around 75 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- St**ep 3—Eliminate Economically/Chronologically Infeasible Options**. Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generator. The emergency generator also complies with applicable New Source Performance Standards.

Good combustion practices also represent the most stringent measure for the propane communication generator.

3.2.8 Biosolids Application

Source Description: Salt Lake County and Salt Lake City operate small landfill type operations that produce organic material which are used by the Tailings Facility to enhance the reclamation of closed tailings areas. The application of biosolids does not result in any emissions of $PM_{2.5}$, SO_2, NO_X or VOC. Very small quantities of ammonia emissions are estimated from these operations resulting from the natural process of decomposition. Therefore, a BACT analysis is not developed for this emission source. The 2014 actual emissions from the source were 0.021 tpy of ammonia.

3.3 Laboratory

3.3.1 Hot Water Boiler

Source Description: Natural gas-fired water boiler is used for water heating for the laboratory. The water boiler uses low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. The water heater is rated at 7.1 MMBTU/hr.

3.1.8.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from boilers less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC and CARB for controlling NO_x emissions from the boiler (LNB and good combustion practices) are already in use and constitute BACT.

3.1.8.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from the boiler.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from the boiler and these control technologies constitute BACT.

  The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for the hot water boiler at the laboratory.

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SECTION 4

Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

4.1 Utah Power Plant

Unit 5

KUC is proposing the following limitations and monitoring requirements for the UPP. Unit 5 shall not exceed the following emission rates to the atmosphere.

Pollutant	lb/hr	ppmvd (@ 15% O_2)
NO_x		2.0*
$PM_{2.5}$ with duct firing: Filterable and condensable	18.8	

Note:
*Under steady state operation

Stack testing to show compliance with the above Unit 5 emissions limitations shall be performed as follows:

Pollutant	Test Frequency
$PM_{2.5}$	every year
NO_x	every year

The heat input during all compliance testing shall be no less than 90% of the design rate.

Unit 4

The following requirements are applicable to Unit 4 during the period November 1 to February 28/29 inclusive:

During the period from November 1, to the last day in February inclusive, only natural gas shall be used as a fuel, unless the supplier or transporter of natural gas imposes a curtailment. The power plant may then burn coal, only for the duration of the curtailment plus sufficient time to empty the coal bins following the curtailment.

Except during a curtailment of natural gas supply, emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

Pollutant	Grains/dscf	ppmdv (3% O_2) 68˚F, 29.92 in. Hg
$PM_{2.5}$ Filterable	0.004	
Filterable and condensable	0.03	
NO_x		336
NO_x (after 1/1/2018)		60

If operated during the winter months, stack testing to show compliance with the above Unit #4 emissions limitations shall be performed as follows:

Pollutant	Test Frequency
$PM_{2.5}$	every year
NO_x	every year

The heat input during all compliance testing shall be no less than 90% of the maximum average hourly production rate achieved in any 24-hour period during the previous three (3) years. The limited use of natural gas during startup, for maintenance firings and break-in firings does not constitute operation and does not require stack testing.

4.2 Tailings Site

The primary source of emissions at the tailings site is wind-blown dust. The intent of the $PM_{2.5}$ serious nonattainment SIP is to review emissions during winter time inversions. Since these inversions represent stagnant wind conditions, emissions from the tailings site will be minimal and therefore tailings site SIP conditions are not necessary for the $PM_{2.5}$ SIP. Emissions at the tailings site are effectively controlled with the implementation of BACT and the most stringent measure.

4.3 Laboratory

No limitations or monitoring requirements are proposed for the laboratory emission sources as the emissions from the facility are minimal and are effectively controlled with the implementation of BACT and the most stringent measure.

Attachments

- UPP Cooling Tower Vendor Data
- Tailings Quarterly Report
- Tailings Dust Control Practices Study
- Tailings FDCP
- Degreaser Solvent SDS

FINAL

Best Available Control Technology Determinations for the Smelter, Refinery, and Molybdenum Autoclave Process

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July 2017

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Contents

Attachments

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Acronyms and Abbreviations

ACT	Alternative control techniques
AO	approval order
BACT	best available control technology
BCM	Bingham Canyon Mine
CAA	Clean Air Act
CEM	Continuous emissions monitor
CFR	*Code of Federal Regulations*
CHP	Combined heat and power
CO	carbon monoxide
CPI	Consumer Price Index
EPA	Environmental Protection Agency
ESP	Electrostatic precipitator
FGR	Flue gas recirculation
FS	Flash Smelting
GPS	Global Positioning System
gr/dscf	grains per standard cubic feet
KUC	Kennecott Utah Copper
LNB	Low NOx burner
MACT	maximum achievable control technology
MAP	molybdenum autoclave process
MMBtu/hr	million British Thermal Units per hour
NAAQS	National Ambient Air Quality Standard
NH_3	ammonia
NO_x	nitrogen oxides
PM_{10}	particulate matter less than or equal to 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in aerodynamic diameter
ppm	parts per million
PTE	potential to emit
RBLC	RACT/BACT/LAER Clearing house
SCR	Selective catalytic reduction
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOP	Standard operating procedure
TEG	Turbine Electric Generator
tpy	tons per year

UDAQ	Utah Department of Air Quality
ULNB	Ultra-low NOx burner
VOC	volatile organic compound
WRAP	Western Regional Air Partnership

SECTION 1

Introduction

Kennecott Utah Copper LLC (KUC) is submitting best available control technology (BACT) determinations for emission sources at the following KUC facilities: Smelter, Refinery, and the Molybdenum Autoclave Process (MAP). In addition to a BACT analysis, KUC has also documented the most stringent measure for emission sources at these facilities.

The Clean Air Act (CAA) requires that stationary sources implement BACT to demonstrate attainment as expeditiously as possible and meet any reasonable further progress requirements. As requested by the Utah Department of Air Quality (UDAQ), the BACT analysis should identify and evaluate reasonable and available control technologies for each relevant pollutant. The technical and economic feasibility of each potential control technology are components of the BACT analysis that help show whether a control technology is reasonable. The BACT analysis presented in this document was developed in accordance with the guidance established by the Environmental Protection Agency (EPA) and the CAA.

A BACT analysis was developed for emissions of particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). For each emission source, the BACT analysis followed a four-step process:

- **Step 1**—Identify all control technologies listed in the RACT/BACT/LAER Clearinghouse (RBLC) and/or California Environmental Protection Agency – Air Resource Board BACT Clearinghouse (CARB)
- **Step 2**—Eliminate technically infeasible options
- **Step 3**—Eliminate economically/chronologically infeasible options
- **Step 4**—Identify BACT

In addition, KUC reviewed available information, including recent BACT determinations (less than 10 years old by UDAQ) to determine if the permitted emissions represent the most stringent measure.

KUC understands additional controls beyond BACT may be required by UDAQ to demonstrate attainment of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). However, a beyond BACT analysis is a separate and distinct review process from the BACT analysis and requires that a modeling analysis be performed demonstrating that implementation of additional controls beyond BACT would advance the attainment of the standard. It is important that these steps be implemented discretely and sequentially. The modeling of additional controls required to meet the $PM_{2.5}$ NAAQS were combined with the UDAQ State Implementation Plan (SIP) BACT request. KUC contends the BACT is determined and then modeled to determine attainment as part of the preparation of the SIP. KUC understands further controls may be necessary to meet the $PM_{2.5}$ NAAQS as part of the SIP development.

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Recent Permitting Actions

The Smelter, Refinery, and MAP together have over 70 individual significant and insignificant sources. The Smelter recently had UDAQ permitting actions. A modified approval order (AO) was issued for the smelter on June 10, 2014. AO DAQE-AN0103460054-14 allows the Smelter to operate a crushing and screening plant and modifies stack testing requirements for the Smelter emissions sources. No other significant modifications were made to the Smelter AO in the last 5 years.

The EPA performed extensive technology reviews of Smelter emissions in support of the 2002 primary copper smelting major source maximum achievable control technology (MACT) standard (40 *Code of Federal Regulations* [*CFR*] 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC Smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Both standards establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources, not using batch copper converters). Smelter process and emission controlling technologies that contributed to EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred after promulgation of the MACT standards.

AO DAQE-AN01013460045-10 for the Refinery was issued in 2010 to add the combined heat and power (CHP) unit. The CHP unit utilizes $SoLoNO_X^{TM}$ burners minimizing NO_X emissions from the unit. The Smelter and Refinery facilities operate under a single Title V Operating Permit # 3500030003.

The MAP facility will process molybdenum disulfide into molybdenum trioxide and ammonia. The MAP facility was originally permitted in 2008 and was modified in March 2013 (AO DAQE-AN0103460052-13) to reflect the updated design of the plant. The permitting actions require thorough control technology analysis and the plant will implement BACT to minimize emissions from the facility.

Potential to emit (PTE) emissions in tons per year (tpy) for the Smelter, Refinery and MAP are shown in Table 2-1.

Table 2-1. Facility Potential to Emit Emissions

	PM_{10} PTEs (tpy)	$PM_{2.5}$ PTEs (tpy)	NO_x PTEs (tpy)	SO_2 PTEs (tpy)	VOC PTEs (tpy)
Smelter	510.82	426.35	185.29	1,085.72	13.50
Refinery	25.64	25.64	38.57	4.44	8.42
MAP	13.11	9.99	35.57	2.43	6.71

Notes:
PM_{10} = Particulate matter 10 microns or smaller in aerodynamic diameter
NO_x = oxides of nitrogen
SO_2 = sulfur dioxide
VOC = volatile organic compounds
$PM_{2.5}$ = Particulate matter 2.5 microns or smaller in aerodynamic diameter
PTE = potential to emit
tpy = tons per year

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SECTION 3

Best Available Control Technology Determinations

This section provides BACT determinations for emission sources deemed significant at the Smelter, Refinery, and the MAP facility.

3.1 Smelter

The EPA performed extensive technology reviews of Smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC Smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules (e.g., the design of the Smelter is based on the furnace technology). Typical smelting operations require batch processing which intermittently produces high concentrations of SO_2 and particulate in a manner that can reduce the efficiency of the acid plant as a control device. By employing the flash smelting (FS) and flash converting (FC) technologies, KUC can eliminate many of the problems inherent with batch type smelter operations. These improvements include continuous flow of off-gases to the acid plant during the FC process as well as reduced total volume of off-gases. Additionally, the furnaces are stationary which improves the ability to capture the off-gases as well as the ability to capture any fugitive emissions with the secondary capture system, which cleans the gases with baghouses and scrubbers before venting to the main stack. As a result, both MACT standards go so far as to establish a separate category for only the KUC Smelter due to its unique design and emission performance not achievable by conventional technology.

The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources not using batch copper converters). The KUC Smelter employs several technologies to minimize the smelting emissions that report to the main stack.

- The concentrate dryer burns natural gas to heat/dry concentrate for use in the FS furnace. Operation with low-NO_x burners (LNB) along with lower dryer temperatures minimizes the formation of NO_x while also preventing the formation of SO_2. KUC operates both a baghouse and a scrubber as controls for the concentrate dryer.
- The secondary gas system collects fugitive emissions in the hot metals building (typically associated with the furnaces) and vents them through a baghouse and a sodium-based scrubber before they are vented to the main stack.
- The matte grinding circuit crushes and dries granulated matte for use in the FC furnace. The particulate from the ground matte is collected in a baghouse and pneumatically conveyed to the FC furnace feed bin. NO_x emissions from natural gas combustion are minimized with LNB and low temperature firing and PM_{10} emissions are controlled with the production baghouse.
- In the anodes area, blister copper from the FC furnace is refined in two available refining furnaces to remove the final traces of sulfur. Copper production can be supplemented with copper scrap, which can be added to the refining furnaces for re-melt. The anodes refining furnaces are natural gas fired with oxy-fuel burners. Off-gas is vented (in series) to a quench tower, lime injection, baghouse, and scrubber and vented to the main stack. NO_x reduction activities also include maintaining furnaces to prevent ingress of air.

- The shaft furnace and holding furnace are used to re-melt anode scrap and other copper scrap to incorporate into copper production. LNBs are used to reduce NO_x from the natural gas combustion and a baghouse is operated to control PM_{10} emissions. The shaft furnace is in the anodes area, but vents separately to the main stack.

3.1.1 Main Stack

Source Description. Multiple process equipment emissions are routed through the main stack. Such equipment includes the matte granulators, acid plant, anode building, powerhouse, furnaces, dryers, and grinding circuits. Many of these sources of emissions have their own primary control devices (baghouse, scrubbers, etc.). Some are then routed to the secondary gas system and then through the main stack. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

Equipment emissions routed through the main stack at the Ssmelter include:

Equipment	Pollutant Emissions	Primary Emissions Control
Concentrate dryer	$PM_{2.5}$, SO_2, NO_X	LNB, baghouse, and scrubber
Powerhouse superheater	$PM_{2.5}$, SO_2, NO_X, VOC	Ultra-low NOx burner (ULNB), Flue gas recirculation (FGR), fuel throughput limits, and good operational practices
Powerhouse Foster Wheeler aux boiler	$PM_{2.5}$, SO_2, NO_X, VOC	LNB, FGR, fuel throughput limits, and good operational practices
Matte grinding	$PM_{2.5}$, SO_2	LNB, baghouse and good operational practices
Anode refining furnaces	$PM_{2.5}$, SO_2, NO_X, VOC	Oxy-fuel burners, baghouse, and scrubbers
Anode shaft furnace	$PM_{2.5}$, SO_2, NO_X, VOC	Baghouse, LNB and good operational practices
Anode holding furnace	$PM_{2.5}$, SO_2, NO_X, VOC	Baghouse, LNB and good operational practices
Vacuum cleaning system	$PM_{2.5}$	Baghouse
North and south matte granulators	$PM_{2.5}$, SO_2	Scrubber, SGS baghouse, and SGS scrubbers

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC identifies different control technologies for process equipment eventually routed through the main stack. These control technologies are currently in place as previously discussed.

The EPA performed extensive technology reviews of smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC Smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Both standards go so far as to establish a separate category for only the KUC Smelter due to its unique design and emission performance not achievable by conventional technology. The primary copper smelting area source MACT standard specifically identifies the KUC Smelter main stack emission performance as MACT for copper smelters (existing sources not using batch copper converters). Smelter process and emission controlling technologies that contributed to EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred after promulgation of the MACT standards.

Baghouses used to control particulate emissions from the concentrate dryer, matte grinding, anode furnaces and granulators are maintained regulatory and the bags are replaced as recommended by the vendors. The bags currently used by KUC in these baghouses are provided in the Appendix. The exhaust from these processes is at high temperature and low pH due to the acidic nature of the materials. Over the years, KUC has experimented with different types of bags, such as pleated bags, that are more effective in removing particulate. However, these bags could not provide optimum performance due to high temperature and low pH. Therefore, upgrading to different types of bags is not technically feasible for these processes.

Again, KUC maintains and replaces bags in these baghouses as recommended by vendors to maintain performance, pressure differential and particulate removal efficiency.

The KUC Smelter continues to be the cleanest Smelter operations in the world. KUC reviewed emission reductions alternatives for anode furnaces venting through the main stack. The operations at the Smelter are continuously optimized to ensure high efficiency operation of the facility, including periodic upgrades of the burners to maintain optimum operations. KUC performed a pre-feasibility level study to evaluate NO_X emissions reductions options for the anodes furnaces at the Smelter. The study evaluated emission reduction strategies such as SCR, SNCR, oxidation systems and wet scrubbers. Portions of the study are provided as an Attachment. The entire study is not included to ensure project confidentiality.

While all the identified technologies were determined to be feasible, each had significant energy and economic impacts. Based on the pre-feasibility study, the costs per ton of NO_X removed from these technologies ranges from \$55,000 to \$590,000. These costs are based on the prefeasibility study and actual implantation costs are expected to be higher as major process and structural modifications would need to be made to implement these alternatives.

Therefore, NOx emissions reduction technologies such as SCR, SNCR and wet scrubber are not cost effective for BACT for the anode furnaces venting to the main stack.

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 selected as BACT.
- **Step 4—Identify BACT.** Because no new major developments in technologies have occurred after the promulgation of the MACT standards, the control technologies currently in place constitute BACT.

Complying with applicable requirements of the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE) represent the most stringent measure for the main stack.

3.1.2 Powerhouse Holman Boiler

Source Description: The boiler is used to provide process steam at the smelter. Emissions of NO_x are limited with flue gas recirculation (FGR), LNB, opacity limits, an alternative monitoring plan which requires continuous monitoring of operational parameters (fuel use, stack oxygen, steam output), and operational controls with good combustion practices. Emissions of $PM_{2.5}$, CO, SO_2, and VOC are limited with use of pipeline quality natural gas, good combustion practices, gas consumption limit, good design, opacity limits, and proper operation of the boiler. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.2.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies the following as possible control technologies for NO_x for natural gas-fired boilers:

Selective catalytic reduction (SCR)

FGR

LNBs with good combustion practices

Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The Holman boiler is equipped with FGR and LNB to reduce NO_x emissions. The addition of the SCR would reduce the emissions from the boiler from 9.9 tpy (based on 2016 actual emissions) to 2.0 tpy.

From the Alternative Control Techniques (ACT) Document — NO_X Emissions from Industrial/Commercial/ Institutional Boilers, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 100 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.03 lb/MMBtu. From Table 6-5 of the ACT document, the total annualized cost for the 100 MMBtu/hr gas boiler is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from Consumer Price Index (CPI) Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74; therefore, for the Holman boiler, the estimated cost is $487,287.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $62,000 and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** FGR, LNBs with good combustion practices, limited gas consumption, good design, and proper operation constitute BACT for this source.

KUC continuously monitors operational parameters to predict NO_x emissions and ensure proper boiler operation. The parameters monitored are fuel use (to predict NO_x emissions lb/hr), stack oxygen (to monitor proper boiler operation and compliance with NO_x lb/MMBtu emission limit), and steam output (used to estimate heat input if fuel use is unavailable). The ranges for these parameters were developed during a 30-day monitoring campaign where data from a certified NO_x analyzer were used to develop predictive equations with the operation parameters.

3.1.2.2 SO_2, VOC, and $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies listed in the RBLC and CARB**. The RBLC and CARB identifies the following as possible control technologies for boilers:

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 were selected as BACT.
- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, opacity limits, good design, and proper operation of the boiler constitute BACT for this emission source.

  FGR, LNBs with good combustion practices, limited gas consumption, good design, and proper boiler operation represent the most stringent measure for the Holman Boiler.

3.1.3 Feed Process (Wet and Dry)

Source Description: Silica flux, concentrate, and converter slag are transferred directly to feed bins then conveyed to the dryer. Particulate emissions from the loading of the flux and concentrate, and from transfer points of the conveyor, are vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, electrostatic precipitators (ESPs), and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP, because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable as most effective technology identified in Step 1 selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

The use of a baghouse to control particulate emissions also represents the most stringent measure for both the wet and dry feed process.

3.1.4 Matte and Slag Granulators

Source Description: Slag and matte granulators are each equipped with a three-stage impingement plate scrubber. The smelter operates two matte granulators and one slag granulator. The molten matte is granulated with water in two separate granulation tanks (two matte granulators), each equipped with a scrubber. The convertor slag is granulated in a separate granulator (one slag granulator), also equipped with a scrubber. The matte granulators are vented through the main stack. The slag granulator is vented to the atmosphere through a separate stack. $PM_{2.5}$ and SO_2 emissions are controlled by a neutral pH three-stage impingement plate scrubber. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.4.1 $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, other possible particulate control technologies include baghouses, cyclones, ESP, and scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** While baghouses are most effective in controlling particulate emissions, this technology is not feasible for the granulators. The exhaust from the granulators has very high moisture content, which is not suitable for baghouses. Moisture condensation can cause accumulation of mud on the bags and baghouse walls. This results in blinded bags and clogged dust removal equipment. As discussed in the Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, cyclones are mainly used to control large particles. Therefore, scrubbers are the technically feasible option.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most technically feasible technology for this process, identified in Step 2, was selected as BACT.
- **Step 4—Identify BACT.** Scrubbers constitute BACT for the granulators.

3.1.4.2 SO_2 BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB**. The RBLC and CARB do not identify any specific control technologies for the granulators.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** Scrubbers constitute BACT for the granulators.

The use of scrubbers also represents the most stringent measure for both the matte and slag granulators.

3.1.5 Feed Storage Building

Source Description: Wet copper concentrate feed is stored in the enclosed wet feed storage building. Particulate matter from loading materials into the feed storage building, from reclaiming materials, and from conveyor/transfer point SME 002-A, are vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

The use of enclosures and baghouse to control particulate emissions also represents the most stringent measure for the feed storage building.

3.1.6 Anode Area Fugitives

Source Description: Emissions from the anode building process are controlled with a baghouse, quench tower, and scrubber. However, some emissions can escape as fugitives. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB do not identify any specific control technologies for process fugitives. The MACT, however, does address such emissions.

40 *CFR* 63.11147(a)(3) states, "You must operate one or more capture systems that collect the gases and fumes released from each vessel used to refine blister copper, re-melt anode copper, or re-melt anode scrap and convey each collected gas stream to a control device. One control device may be used for multiple collected gas streams."

KUC certified compliance with 63.11147(a)(3), as required by 63.11150(b)(4), in a letter dated and received by UDAQ on January 30, 2007. This document is included as an attachment to this report.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** In addition to opacity limits and required maintenance, current design of anode process units and the collection hoods on anode building processes have been engineered/designed to reduce fugitives and these practices constitute BACT.

The current design of anode process units and the collection hoods on anode building processes were engineered/designed to reduce fugitives and these represent the most stringent measure.

3.1.7 Smelter Fugitives

Source Description: Emissions from Smelter processes are controlled with appropriate control technologies including closed processes, launder hoods and others outlined below. However, some emissions can escape as fugitives. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB do not identify any specific control technologies for such fugitives.

  The EPA performed extensive technology reviews of Smelter emissions in support of the 2002 primary copper smelting major source MACT standard (40 *CFR* 63 Subpart QQQ) and the 2007 primary copper smelting area source MACT standard (40 *CFR* 63 Subpart EEEEEE). Specific discussion of the unique aspects of pollution controls at the KUC smelter are included in the Federal Register notices associated with the draft and final promulgation of both rules. Regarding the design and fugitive emission controls of the KUC smelter, the EPA provided the following discussion when promulgating the final copper smelting MACT standard (FR Vol. 67, No. 113, Page 40488):

> Due to its unique design and operations, most of the process fugitive emission sources associated with smelters using batch converting are eliminated at the Kennecott smelter. There are no transfers of molten material in open ladles between the smelting, converting, and anode refining departments at the Kennecott smelter. In addition, there are no fugitive emissions associated with the repeated rolling-out of converters for charging, skimming, and pouring. Also, only one continuous flash converter is needed at the Kennecott smelter compared with the need for three or more batch copper converters at the other smelters.

Both standards go so far as to establish a separate category for only the KUC smelter due to its unique design and emission performance not achievable by conventional technology. Smelter process and emission controlling technologies that contributed to the EPA's designation of the modernized smelter as a separate MACT category for HAP emissions, including off-gases from furnaces, also contribute to the control of fine particulate and precursor emissions. No new major developments in technologies or costs have occurred after the promulgation of the MACT standards.

Specific notes regarding control techniques listed in Table 5 of Attachment 5 of the EPA comments are listed below:

- KUC Smelter hot metals operations are serviced by an extensive local ventilation (secondary gas) system. This system collects gasses and routes them through baghouses and scrubbers before venting them to the main stack where they are continuously monitored for multiple pollutants.
- KUC Smelter hot metals operations are completely enclosed in a building.
- KUC processes only grade 1 scrap in its melting furnaces.

- A leak detection/prevention/repair program is not applicable to KUC Smelter furnaces and hot metals process units because they are enclosed and operate at negative pressure due to their inherent design.
- Because KUC furnaces are enclosed and do not require open air transfer of molten metal, they are not dependent on hooding systems for process gas collection.
- It is not necessary to add curtains to improve hood performance at the KUC Smelter as the process does not rely on hoods to capture process gasses.
- The KUC process does not require the open-air transfer of molten metal from smelting to converting vessels so it is not necessary to collect these emissions.
- The EPA noted in the primary copper smelting MACT standard, KUC was the first Smelter in the United States to capture and control emissions from anode refining furnaces.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** In addition to opacity limits and required maintenance, current designs of processes were engineered/designed to reduce fugitives and therefore these practices constitute BACT. KUC has implemented best management practices to minimize fugitive emissions. These practices are reviewed frequently and improvements are implemented to minimize emissions.

The current designs of processes were engineered/designed to reduce fugitives and therefore these practices also represent the most stringent measure.

3.1.8 Acid Plant Fugitives

Source Description: The double contact acid plant removes SO_2 from the off-gases of the flash furnaces. The sulfuric acid produced by the plant is sold. Among other technologies, the system is equipped with tubular candle fiber mist eliminators and the tail gas is discharged to the main stack. However, some emissions can escape as fugitives, which are controlled using best operational practices to minimize emissions. Best operational practices to minimize the emissions include opacity limits, weekly visual opacity surveys and the requirement of prompt repair or correction and control to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB do not identify any specific control technologies for such fugitives.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable
- **Step 4—Identify BACT.** Best operational practices may include, (1) placement or adjustment of negative pressure ductwork and collection hoses, (2) welding of process gas leaks, or (3) containment of process gas leaks. These practices and current design of processes were engineered/designed to reduce fugitives and therefore constitute BACT.

The best operational practices currently implemented and the current designs of the processes also represent the most stringent measure for the acid plant fugitives.

3.1.9 Powerhouse Foster Wheeler Boiler

Source Description: This boiler is used to produce superheated steam to start the smelter, drive acid plant compressors, and standby power. Emissions of NO_x are limited with FGR, LNB with good combustion practice, continuous monitoring of NO_x at the smelter main stack, and limitations on fuel throughput. Emissions of $PM_{2.5}$, CO, SO_2, and VOCs are limited with use of pipeline quality natural gas; good combustion practices; good design and proper operation of the boiler; and continuous monitoring of opacity, particulate, and SO_2 at the Smelter main stack. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.9.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** The RBLC and CARB identify the following as possible control technologies for NO_x for natural gas-fired boilers.

  SCR

  FGR

  LNB with good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The powerhouse boiler is equipped with FGR and LNB to reduce NO_x emissions. Emissions from this boiler are vented through the main stack and it is difficult to differentiate the boiler NO_X emissions from the main stack emissions. Based on the understanding of operations at the smelter, the addition of the SCR might reduce the annual emissions from the boiler from 5.3 tpy (based on 2016 actual emissions and engineering estimates) to 1.1 tpy.

From the Alternative Control Techniques Document – NO_X Emissions from Industrial/Commercial/Institutional Boiler, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 100 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.03 lb/MMBtu. From Table 6-5, the total annualized cost for the 100 MMBtu/hr gas boiler is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74; therefore, for the powerhouse boiler the estimated cost is $261,000.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $62,000 and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** FGR, LNB with good combustion practices, good design and proper operation constitute BACT.

3.1.9.2 SO_2, VOC, and $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB**. The RBLC and CARB identify the following as possible control technologies for boilers.

Use of pipeline quality natural gas and good combustion practices

Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified in Step 1 are selected as BACT.

- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the Powerhouse Foster Wheeler Boiler.

3.1.10 Miscellaneous Storage Piles/Loadout

Source Description: Concentrate, granulated matte, slag, and other materials are stored in storage piles on pads. Water sprays or chemicals are applied as necessary to minimize fugitive emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify dry foggers, adding moisture, and enclosures as possible control technologies for fugitive emissions. Other possible technologies available to control fugitive dust emissions that are not identified in the RBLC include chemical dust suppression, baghouse, cyclone, and scrubber.
- **Step 2—Eliminate Technically Infeasible Options.** The emission sources are fugitive in nature and therefore it is not technically feasible to duct emissions to a baghouse, scrubber, or cyclone. Additionally, the locations of the storage piles are always changing, making the construction of permanent enclosures difficult. Therefore, these control technologies are not technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The remaining technology of water or chemical applications is economically and chronologically feasible.
- **Step 4—Identify BACT.** KUC uses water sprays, chemical dust suppressants, and temporary enclosures to minimize particulate emissions from the miscellaneous storage piles, which were demonstrated to be very effective. These business practices constitute BACT for this emission source.

The use of water sprays, chemical dust suppressants, and temporary enclosures to minimize particulate emissions from the miscellaneous storage piles also represent the most stringent measure.

3.1.11 Slag Concentrator

Source Description: Emissions associated with the crushing, grinding, and slag processing at the smelter are minimized with the water sprays and enclosures. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, other possible particulate control technologies include baghouses, cyclones, scrubbers, water sprays, and enclosures.

- **Step 2—Eliminate Technically Infeasible Options.** Baghouses are not feasible for the slag processing equipment. The slag stock piles are sprayed with water frequently to minimize emissions. The material as a result has very high moisture content, which is not suitable for baghouses. Moisture droplets and condensation can cause accumulation of mud on the bags, baghouse walls, and ductwork. This results in blinded bags and clogged dust removal equipment. Further, when ambient temperatures are below freezing, the mud will freeze on the baghouse bags and plug them.

Wet scrubbers are not expected to be effective in minimizing emissions from crushing and grinding operations. Operation of the scrubbers is compromised due to below freezing ambient temperatures and very cold water streams in the scrubber. The duct work of the scrubbers will freeze during subfreezing ambient temperature conditions.

As discussed in the WRAP Fugitive Dust Handbook, cyclones are mainly used to control large particles.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The remaining technology of water sprays and enclosures is economically and chronologically feasible.

- **Step 4—Identify BACT.** KUC uses water sprays and enclosures to minimize particulate emissions from the slag concentrator, which were demonstrated to be very effective. These business practices constitute the BACT for this emission source.

The use of water sprays and enclosures to minimize particulate emissions represent the most stringent measure from the slag concentrator.

3.1.12 Smelter Cooling Towers

Source Description: Three noncontact water cooling towers are used for various Smelter processes. The towers are equipped with drift eliminators with drift loss rated at 0.001 percent. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable, as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.001 percent and good operating practices represent the most stringent measure for the cooling tower. As determined in the BACT analysis for other KUC facilities, upgrading the drift eliminators with lower drift loss is not cost effective for the BACT analysis.

3.1.13 Ground Matte Silo

Source Description: Ground matte material is stored in silos. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.04 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the ground matte silo.

3.1.14 Molding Coatings Storage Silo

Source Description: Coatings material is stored in silos. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.003 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the coatings storage silo.

3.1.15 Lime Storage Silos

Source Description: The Smelter has three lime storage silos. These silos are used to store lime for the hydrometallurgical plant, anode area and the secondary gas system. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the three silo baghouses were 0.01 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the silos used to store lime for the hydrometallurgical plant, anode area and the secondary gas system.

3.1.16 Limestone Storage Silos

Source Description: The silo is used to store limestone for the hydrometallurgical plant. Particulate matter from loading materials into the silos is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.04 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for silo used to store limestone for the hydrometallurgical plant.

3.1.17 Recycle and Crushing Building

Source Description: The matte and slag material is recycled and crushed in a building. Particulate matter from these small-scale operations are minimized as they occur inside the building and are controlled with a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, enclosures, and water sprays.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is most effective at capturing fine particulate and minimizing emissions.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Conducting operations inside the building and use of a baghouse are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the recycle and crushing building were 0.03 tpy. Conducting crushing and recycling operations inside the building and use of a baghouse to control particulate emissions also represents the most stringent measure.

3.1.18 Smelter Laboratory

Source Description: The laboratory at the Smelter is used for preparation of samples for testing which sometimes results in dust. Particulate emissions from the laboratory building are vented through a baghouse.

Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify baghouses and enclosures as possible control technologies for limiting emissions from buildings or enclosed areas.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Baghouses are the most effective in controlling emissions. Therefore, fabric filters (baghouse) constitute BACT for the Smelter Laboratory.

It should be noted that the 2014 actual $PM_{2.5}$ emissions for the laboratory controlled with a baghouse were 0.78 tpy. This emission rate also represents the most stringent measure for the Smelter Laboratory.

3.1.19 Propane Communication Generator

Source Description: The Smelter operates a propane fired communication generator. This generator is used to support communication systems during emergencies or loss of power at the Smelter. Emissions are controlled with good combustion practices while operating the generator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for emergency generators around 75 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not Applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generator. The emergency generator also complies with applicable New Source Performance Standards.

Good combustion practices also represent the most stringent measure for the propane communication generator.

3.1.20 Cold Solvent Degreaser

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identifies operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.

- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed at all times to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for the degreaser.

  A Safety Data Sheet for the degreasing solvent is provided in the Appendix. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found of ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the Smelter were 0.002 tpy.

The previously identified practices also represent the most stringent measure for the degreasers.

3.1.21 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted that the 2014 actual VOC emissions for the gasoline fueling stations at the Smelter were 0.07 tpy. The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.1.22 Diesel Emergency Generator for Pyrometallurgical Process

Source Description: The Smelter operates one 998 HP diesel-fired emergency generator to support the pyrometallurgical process during emergencies. The emergency generator is equipped with turbo charger and after cooling and complies with applicable New Source Performance Standards to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. Potential emission control technologies identified in the RBLC and CARB for similar sized diesel generators include turbo charger and after cooling, good combustion practices and limiting the sulfur content of fuel to 0.0015 percent. Certification and compliance with applicable New Source Performance Standards is an acceptable means of demonstrating BACT for emergency generators.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.

- **Step 4—Identify BACT.** Turbo charger and after cooling, good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements are identified as BACT for all pollutants emitted from the emergency generator.

It should be noted that the 2014 actual emissions from the generator of $PM_{2.5}$ and precursors were 0.78 tpy.

Turbo charger and after cooling, good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements also represent the most stringent measure for the emergency generator.

3.1.23 Space Heaters

Source Description: Natural gas-fired heaters are used throughout the Smelter. The individual heaters are rated at less than 5 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.23.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC for controlling NO_x emissions from heaters of good combustion practices is already in use and constitute BACT.

3.1.23.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The 2014 actual emissions from the heaters for $PM_{2.5}$ and precursors were 0.48 tpy. The use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the space heaters. As discussed in the BACT analysis for other KUC facilities, replacing the existing space heaters with new heaters is not cost effective for the BACT analysis.

3.1.24 Hot Water Boiler

Source Description: Natural gas-fired water boilers are used for water heating throughout the Smelter. The water boilers use low NO_x burners (LNB) and regular inspections are done to the units to ensure optimum combustion performance. The water heaters are rated at less than 10 MMBTU/hr. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.1.24.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identifies LNB and good combustion practices as control technologies for minimizing NO_x emissions from boilers less than 10 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technologies identified in the RBLC and CARB for controlling NO_x emissions from the boilers (LNB and good combustion practices) are already in use and constitute BACT.

3.1.24.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from the boilers.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from the boilers and these control technologies constitute BACT.

The 2014 actual emissions from the boilers for $PM_{2.5}$ and precursors were 0.61 tpy. The use of pipeline quality natural gas, LNB and good combustion practices represent the most stringent measure for the hot water boilers at the Smelter.

3.2 Refinery

3.2.1 Boilers

Source Description: The two boilers are rated at 82 MMBtu/hr (gas) and 79 MMBtu/hr (oil) each and are permitted to operate on natural gas to meet the steam demand at the Refinery. During natural gas curtailment, the boilers are permitted to operate on oil. Emissions of NO_x are limited with FGR and LNB with good combustion practices. Emissions of $PM_{2.5}$, SO_2, and VOCs are limited with good combustion practices, good design, opacity limits, sulfur content limit, and proper operation of the boilers. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.1.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** The RBLC and CARB identifies the following as possible control technologies for NO_x for natural gas-fired boilers

SCR

FGR

LNB with good combustion practices

Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The Refinery boilers are equipped with FGR and LNB to reduce NO_x emissions. The addition of the SCR will reduce the emissions from the boilers from 12.9 tpy (based on based on 2016 actual emissions) to 2.6 tpy.

From the Alternative Control Techniques Document – NO_X Emissions from Industrial/Commercial/Institutional Boilers, 1994 ACT document, Table 6-7 presents controlled NO_x emission rates for various control technologies. For the 50 MMBtu/hr natural gas packaged water tube boiler, the controlled NO_x emission rate utilizing SCR technology is 0.02 lb/MMBtu (the 100 MMBtu/hr boiler controlled NO_x emission rate with SCR is listed at 0.03 lb/MMBtu). From Table 6-5 of the ACT document, the total annualized cost for the 50 MMBtu/hr gas boiler (closest entry to 82 MMBtu/hr Refinery boiler) is $1,500 to $1,900 per MMBtu/hr. To estimate the impact of escalating capital cost from 1992 to 2017 dollars, cost indices from CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) can be used. The escalation multiplier is determined to be 1.74. The estimated cost for the refinery boilers is $428,040 for both boilers.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $42,000 for the Refinery boilers and is, therefore, not cost effective for BACT.

- **Step 4—Identify BACT.** FGR, LNB with good combustion practices, good design, and proper operation constitute BACT for this source.

3.2.1.2 SO_2, VOC, and $PM_{2.5}$ BACT

- **Step 1—Identify All Control Technologies listed in RBLC and CARB**. The RBLC and CARB identifies the following as possible control technologies for natural gas fired boilers:

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the boiler constitute BACT for this emission source.

FGR, LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the boilers.

3.2.2 CHP Unit

Source Description: The CHP unit will generate power and steam to support Refinery operations. The CHP unit uses a low NO_x duct burner and the turbine has $SoLoNO_x$ burners. Emissions of $PM_{2.5}$, SO_2, and VOC are limited with good design and proper operation. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.2.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC.** The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired turbines and duct burners.

  SCR

  LNB with good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The CHP unit is equipped with LNB (SoLoNO$_x$ technology burners on turbine) to reduce NO_x emissions. The addition of the SCR will reduce actual annual emissions from the CHP unit from 12.2 tpy (based on 2014 actual emissions) to 1.2 tpy. The CHP unit had major work performed in 2015 and 2016, therefore 2014 emissions are used for the analysis.

Solar Turbines, Inc. developed an estimation spreadsheet for the Taurus 70 combustion turbine and duct burner arrangement, which utilized vendor quotations for the installation of an SCR system. From the Solar calculations, the annualized capital and operating costs were estimated to be $932,100/yr.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $85,000 for the CHP unit and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** LNB with good combustion practices, good design, and proper operation of the CHP Unit constitute BACT for this source.

3.2.2.2 SO_2, VOC, and $PM_{2.5}$ Best Available Control Technologies

- **Step 1—Identify All Control Technologies listed in RBLC**. The RBLC identifies the following as possible control technologies for small turbines and duct burners:

  Use of pipeline quality natural gas and good combustion practices

  Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, selected as BACT.

- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the CHP unit constitute BACT for this emission source.

LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the CHP unit.

3.2.3 Refinery Cooling Towers

Source Description: Two noncontact water cooling towers are used for various refinery processes. The towers are equipped with drift eliminators with drift loss rated at 0.001 percent. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify drift eliminators and good operating practices as control techniques for minimizing particulate emissions from cooling towers.

- **Step 2—Eliminate Technically Infeasible Options.** Not applicable, as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, are selected as BACT.
- **Step 4—Identify BACT.** Drift eliminators and good operating practices constitute BACT.

The use of drift eliminators with drift loss rated at 0.001 percent and good operating practices represent the most stringent measure for the cooling tower. As determined in the BACT analysis for other KUC facilities, upgrading the drift eliminators with lower drift loss is not cost effective for the BACT analysis.

3.2.4 Propane Communication Generator

Source Description: The Refinery operates a propane fired communication generator. This generator is used to support communication systems during emergencies or loss of power at the Refinery. Emissions are controlled with good combustion practices while operating the generator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as the primary control technology for emergency generators around 75 HP operated on propane. The emergency generators must also comply with the applicable New Source Performance Standards established by EPA.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies are feasible.
- **Step 4—Identify BACT.** Good combustion practices are identified as BACT for the propane fired emergency generator. The emergency generator also complies with applicable New Source Performance Standards.

Good combustion practices also represent the most stringent measure for the propane communication generator.

3.2.5 Cold Solvent Degreaser

Source Description: Cold solvents are used to degrease and clean equipment parts. The degreaser lids are kept closed when the unit is not in use to minimize solvent loss and emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identifies operating practices such as closing the degreaser lids a method to control/minimize VOC emissions.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as the identified control technology is technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** When not in use, the lids on the degreasers are kept closed always to minimize emissions. The solvent is recycled frequently, and no significant loss in volume is observed, implying minimal losses as emissions. These practices constitute BACT for the degreaser.

A Safety Data Sheet for the degreasing solvent is provided as an Attachment. KUC has experimented with low-VOC content degreasers in the past. However, these solvents were found of ineffective in cleaning parts and often resulted in residue on the parts. As a result, transition to low-VOC solvent as a degreasing agent is not further investigated for this analysis. Additionally, the 2014 actual VOC emissions from degreasers at the Refinery were 0.02 tpy.

The above identified practices also represent the most stringent measure for the degreasers.

3.2.6 Gasoline Fueling Stations

Source Description: Adding gasoline to storage tanks and dispensing from the storage tanks into vehicles. The fueling operation is equipped with Stage 1 and Stage 2 vapor recovery systems. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. The RBLC and CARB identify two control techniques for controlling VOC emissions from gasoline fueling operations. They are Stage 1 and Stage 2 vapor recovery systems.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Stage 1 and 2 vapor recovery constitutes BACT for these sources.

It should be noted that the 2014 actual VOC emissions for the gasoline fueling stations at the Refinery were 0.04 tpy.

The use of Stage 1 and Stage 2 vapor recovery systems also represent the most stringent measure for the gasoline fueling stations.

3.2.7 Space Heaters

Source Description: Natural gas-fired heaters are used throughout the Refinery. The individual heaters are rated at less than 5 MMBTU/hr each. The heaters are regularly inspected for optimum combustion performance. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.2.7.1 NO_x BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify good combustion practices as control technologies for minimizing NO_x emissions from heaters less than 5 MMBtu/hr.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The technology identified in the RBLC and CARB for controlling NO_x emissions from heaters of good combustion practices is already in use and constitute BACT.

3.3.7.2 $PM_{2.5}$, SO_2, and VOC BACT

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB.** The RBLC and CARB identify use of pipeline quality natural gas and good combustion practices as a control technology for minimizing $PM_{2.5}$, SO_2, and VOC emissions from heaters.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** The RBLC and CARB identifies use of pipeline quality natural gas and good combustion practices as a means of controlling $PM_{2.5}$, SO_2, and VOC emissions from heaters and these control technologies constitute BACT.

The use of pipeline quality natural gas and good combustion practices also represent the most stringent measure for the space heaters. As discussed in the BACT analysis for other KUC facilities, replacing the existing space heaters with new heaters is not cost effective for the BACT analysis.

3.2.8 Diesel Emergency Generator

Source Description: The Refinery operates one 487 HP diesel-fired emergency generator to support the precious metals plant at the Refinery during emergencies. The emergency generator complies with applicable New Source Performance Standards to minimize emissions. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies Listed in RBLC and CARB**. Potential emission control technologies identified in the RBLC and CARB for similar sized diesel generators include good combustion practices and limiting the sulfur content of fuel to 0.0015 percent. Certification and compliance with applicable New Source Performance Standards is an acceptable means of demonstrating BACT for emergency generators.
- **Step 2—Eliminate Technically Infeasible Options.** Not applicable as all identified control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable because all potential technologies identified in Step 1 are selected as BACT.
- **Step 4—Identify BACT.** Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements are identified as BACT for all pollutants emitted from the emergency generator.

It should be noted, the 2014 actual emissions from the generator of $PM_{2.5}$ and precursors were 0.12 tpy.

Good combustion practices, limiting the sulfur content of fuel to 0.0015 percent and complying with applicable New Source Performance Standards requirements also represent the most stringent measure for the emergency generator.

3.2.9 Soda Ash Storage Silo

Source Description: The Refinery has on soda ash storage silo. The silo is used to store soda ash for the Refinery. Particulate matter from loading materials into the silo is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.

- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses in form of a bin vent filters are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the silo baghouse were 0.004 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the silo.

3.2.10 Precious Metals Packaging Area

Source Description: The Refinery has a small precious metals packaging area. Particulate matter from the process is vented to a baghouse. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses, cyclones, ESP, and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible. The fabric filter (baghouse) is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Cyclones are only effective in capturing larger particulate. Wet scrubbers, although effective at capturing fine particulate, produce a wet sludge requiring disposal. Also, wet scrubbers have higher operating costs and lower removal efficiencies than fabric filters. Based on their control effectiveness, the fabric filter ranks at the top, followed by an ESP, and then by wet scrubbers.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Baghouses are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ emissions from the packaging area baghouses were 0.008 tpy. The use of a baghouse to control particulate emissions also represents the most stringent measure for the precious metals packaging area.

3.2.11 Hydrometallurgical Precious Metals Processing

Source Description: The Refinery has a precious metals processing and recovery area. Particulate matter, ammonia and SO_2 from the process are vented to a scrubber. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible particulate control technologies include baghouses and wet scrubbers.
- **Step 2—Eliminate Technically Infeasible Options.** The fabric filter (baghouse) is more effective at capturing fine particulate. However, due to high temperature of the exhaust steam and its pH, baghouses are not technically feasible. Wet scrubbers are therefore the only technically feasible control of particulate emissions and SO_2.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Scrubbers are the most effective control technology for controlling particulate emissions and constitute BACT.

It should be noted that the 2014 actual $PM_{2.5}$ and precursor emissions from the processes were 0.58 tpy. The use of scrubbers to control particulate emissions, ammonia and SO_2 also represents the most stringent measure for the precious metals processing area.

3.2.13 Tankhouse Sources

Source Description: The Refinery Tankhouse and MPC buildings include liberator, cathode wash and anode scrub wash processes that result in sulfuric acid mist emissions. Potential sulfuric acid mist from the processes are vented to a mist eliminator. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

- **Step 1—Identify All Control Technologies listed in RBLC and CARB.** Although RBLC and CARB did not provide controls for the specific operation, possible sulfuric acid control technologies include scrubbers and mist eliminators.
- **Step 2—Eliminate Technically Infeasible Options.** The presence of electrolytes in the exhaust stream cannot be effectively captured with a wet scrubber. Therefore, wet scrubbers are not technically feasible for these sources. Mist eliminators are technically feasible and effective in minimizing sulfuric acid mist emissions.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, as most effective technology, identified in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Mist eliminators are the most effective control technology for controlling sulfuric acid mist emissions and constitute BACT.

It should be noted that the 2014 actual sulfuric acid mist as $PM_{2.5}$ emissions from the Tankhouse sources were 0.005 tpy. The use of mist eliminators to control sulfuric acid mist emissions also represents the most stringent measure for the Tankhouse sources.

3.3 Molybdenum Autoclave Process

The MAP facility was first permitted in 2008 and was modified in March 2013 (AO DAQE-AN0103460052-13) to reflect the updated design of the plant. The MAP plant has not been operated and most of the equipment at the plant is currently up for sale.

The proposed CHP unit at the MAP plant represents most the emissions. The BACT analysis for CHP unit is presented below. The permitting actions have required thorough control technology analysis that the plant will implement BACT to minimize emissions from the facility. Due to this very recent permitting action, KUC has not developed a detailed BACT analysis for other non-significant emission sources at MAP facility. To assist with the SIP process, KUC has developed the following summary of BACT for other emission sources at the MAP facility.

KUC has attached the Notice of Intent application for the facility submitted to UDAQ in September 2012. The application includes BACT analysis for the emissions sources at the MAP facility.

3.3.1 CHP Unit

Source Description: The CHP unit will generate power and steam to support MAP operations. The CHP unit uses a low NO_x duct burner and the turbine has SoLoNO$_x$ burners. Emissions of $PM_{2.5}$, SO_2, and VOC are limited with good design and proper operation. Potential control technologies in other nonattainment areas in states such as California and Alaska were reviewed for this analysis.

3.3.1.1 NO_x BACT

- **Step 1—Identify All Control Technologies listed in RBLC.** The RBLC identifies the following as possible control technologies for NO_x for natural gas-fired turbines and duct burners.

SCR

LNB with good combustion practices

Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** The CHP unit will be equipped with LNB (SoLoNO$_x$ technology burners on turbine) to reduce NO_x emissions. The addition of the SCR will reduce annual potential to emit emissions from the CHP unit from 26.1 tpy to 2.6 tpy.

Solar Turbines, Inc. developed an estimation spreadsheet for the Taurus 70 combustion turbine and duct burner arrangement, which utilized vendor quotations for the installation of an SCR system. From the Solar calculations, the annualized capital and operating costs were estimated to be $932,100/yr.

Based on the annualized costs for the SCR, the cost of additional control per ton of NO_x removed is $40,000 for the CHP unit and is therefore not cost effective for BACT.

- **Step 4—Identify BACT.** LNB with good combustion practices, good design, and proper operation of the CHP Unit constitute BACT for this source.

3.3.1.2 SO_2, VOC, and $PM_{2.5}$ Best Available Control Technologies

- **Step 1—Identify All Control Technologies listed in RBLC**. The RBLC identifies the following as possible control technologies for small turbines and duct burners:

Use of pipeline quality natural gas and good combustion practices

Good design and proper operation

- **Step 2—Eliminate Technically Infeasible Options.** All control technologies are technically feasible.
- **Step 3—Eliminate Economically/Chronologically Infeasible Options.** Not applicable, because all potential technologies identified, in Step 1, selected as BACT.
- **Step 4—Identify BACT.** Use of pipeline quality natural gas, good combustion practices, good design, and proper operation of the CHP unit constitute BACT for this emission source.

LNB with good combustion practices, good design, and proper operation on pipeline quality natural gas also represent the most stringent measure for the CHP unit.

Table 3-2. Best Available Control Technology Summary for the Molybdenum Autoclave Process Facility

Emission Source ID/Name	Emission Source Description	BACT Summary
CHP Unit	Combined Heat and Power Unit	LNB and use of pipeline quality natural gas will minimize emissions
Cooling Tower	20,000 gallons per minute (gpm) cooling tower	Drift eliminator with efficiency of 0.0005 percent will minimize emissions
IT Building Backup Generator	LPG Communications Generator	Emissions will comply with applicable New Source Performance Standards.
Emergency Fire Pump	Emergency Fire Pump	Emissions will comply with applicable New Source Performance Standards.
Dryers and Re-oxidizer	Three Process dryers and re-oxidizer each rated less than 5 MMBtu/hr	Use of pipeline quality natural gas will minimize emissions

Table 3-2. Best Available Control Technology Summary for the Molybdenum Autoclave Process Facility

Emission Source ID/Name	Emission Source Description	BACT Summary
Calciner	Process calciner rated at 16 MMBtu/hr	LNB and use of pipeline quality natural gas will minimize emissions
Startup Boiler	Process startup boiler rated at 30 MMBtu/hr	LNB and use of pipeline quality natural gas will minimize emissions
Scrubbers	Process ammonia, sulfuric acid and hydrogen sulfide emissions	Emissions will be controlled with scrubbers
Packaging Area	Material Packaging Area	Emissions will be controlled with baghouse and bin vent filters
Reagent Storage	Reagent Storage Tanks and Bins	Emissions will be controlled with bin vent filters and scrubbers
Material Handling	Concentrate transfer and handling	Emission sources will be located inside building and enclosures
Solvent Extraction Lines	Solvent tanks and mixers	Emissions will be minimized through SOPs
Test Laboratory	Laboratory for the MAP operations	Emissions will be controlled with baghouse
Process Boiler	Process boiler rated at 12 MMBtu/hr	LNB and use of pipeline quality natural gas will minimize emissions

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Limitations and Monitoring Requirements

This section provides a summary of appropriate limitations and monitoring requirements for the emission sources included in the BACT analysis.

4.1 Smelter

Emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

Emission Point	Pollutant	Test Frequency
Main Stack (Stack No. 11)	$PM_{2.5}$	• 85 lbs/hr (filterable) • 434 lbs/hr (filterable + condensable)
	SO_2	• 552 lbs/hr (3 hr. rolling average) • 422 lbs/hr (daily average)
	NO_x	• 154 lbs/hr (daily average)
Holman Boiler	NO_x	• 14.0 lbs/hr (calendar-day average)

Stack testing to show compliance with the emissions limitations of Condition (A) above shall be performed as specified below:

Emission Point	Pollutant	Test Frequency
Main Stack	$PM_{2.5}$	Every year
	SO_2	Continuous Emissions Monitor (CEM)
	NO_x	CEM
Holman Boiler	NO_x	Every 3 years and alternate method determined per applicable new source performance standards

Supporting Information

During startup/shutdown operations, NO_x and SO_2 emissions are monitored by CEMs or alternate methods in accordance with applicable NSPS rules. This condition establishes emissions limitations and compliance requirements for the Smelter main stack and the Holman Boiler.

KUC continuously monitors operational parameters to predict NO_x emissions and to ensure proper boiler operation. The parameters monitored are fuel use (to predict NO_x emissions lb/hr), stack oxygen (to monitor proper boiler operation and compliance with NO_x lb/MMBtu emission limit), and steam output (used to estimate heat input if fuel use unavailable). The ranges for these parameters were developed during a 30-day monitoring campaign where data from a certified NO_x analyzer were used to develop predictive equations with the operational parameters. The alternative monitoring method identified in this condition is consistent with the applicable NSPS.

4.2 Refinery

Emissions to the atmosphere from the indicated emission point shall not exceed the following rate:

Emission Point	Pollutant	Maximum Emission
The sum of two (tank house) boilers	NO_x	9.5 lb/hr
Combined heat plant	NO_x	5.96 lbs/hr

Stack testing to show compliance with the above emission limitations shall be performed as follows:

Emission Point	Pollutant	Testing Frequency
Tank house boilers	NO_x	Every 3 years*
Combined heat plant	NO_x	Every year

Note:
*Stack testing shall be performed on boilers that have operated more than 300 hours during a 3-year period.

Supporting Information

KUC must operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions always including during startup, shutdown, and malfunction. Records shall be kept on site which indicate the date, and time of startups and shutdowns. This condition establishes emissions limitations and compliance requirements for the Refinery Boilers and Combined Heat and Power unit.

4.3 Molybdenum Autoclave Process

Emissions to the atmosphere from the natural gas turbine, combined with the duct burner, and with the turbine electric generator (TEG); firing shall not exceed the following rate:

Emission Point	Pollutant	Maximum Emission Rate
Combined heat plant	NO_x	5.01 lbs/hr

Stack testing to show compliance with the above emission limitations shall be performed as follows:

Emission Point	Pollutant	Testing Frequency
Combined heat plant	NO_x	Every year

Supporting Information

Records shall be kept on site which indicate the date and time of startups and shutdowns. This condition establishes emissions limitation and compliance requirements for the MAP facility combined heat and power unit.

Attachments

- Smelter Dryer/Granulator Baghouse Information
- Anodes Furnaces NO_X Study
- Degreaser Solvent SDS
- MAP NOI (Submitted September 2012)
- EPA Compliance Letter

FACT SHEET

Proposed Air Quality Permit #55223 for Rosemont Copper Company

Pursuant to Arizona Administrative Code (A.A.C.) Title 18, Chapter 2 and Arizona Revised Statues, Title 49, Chapter 3, the Arizona Department of Environmental Quality is proposing to issue a Class II air quality permit to Rosemont Copper Company.

OVERVIEW OF ROSEMONT COPPER COMPANY

Rosemont Copper Company (RCC) has proposed to construct and operate an open pit copper mine, milling, leaching, and solvent extraction/electrowinning facility to be located at 21900 South Sonoita Highway, Vail, Arizona 85641. The facility is approximately 30 miles southeast of Tucson, west of State Highway 83, in Pima County, Arizona. The facility is accepting voluntary emissions limitations to stay below major source thresholds. Therefore, a Class II synthetic minor air quality permit is proposed. The proposed mine has an anticipated operating life of 20 years with peak mining rates of ore and waste rock of up to 359,500 tons per day.

JURISDICTION – WHY IS ADEQ ISSUING THIS PERMIT?

RCC's mine is located within Pima County where the local agency, Pima DEQ (PDEQ), has Environmental Protection Agency (EPA) approval to issue air quality permits. RCC submitted an application to PDEQ in July 2010, which was denied in September 2011, after issuing a draft permit for public comment. On July 5, 2012, the Arizona Superior Court in Pima County ruled that the PDEQ's action to deny Rosemont's application was both arbitrary and capricious. To address this uncertainty and to ensure that duplicative air quality permits from PDEQ and ADEQ are not required, ADEQ, pursuant to A.R.S. 49-402(B) and R9-3-1101 of the Arizona State Implementation Plan (SIP), has asserted complete air quality jurisdiction. ADEQ is seeking comments from the public if PDEQ should be offered oversight of the permit after issuance by ADEQ.

HOW DOES THE ADEQ PERMIT DIFFER FROM THE PIMA DEQ PERMT THAT WAS OFFERED FOR PUBLIC COMMENT?

The ADEQ permit establishes very stringent requirements as noted below:

- Replacing six wet scrubbers that are capable of controlling 99 percent of particulate matter emissions with state-of-the-art high-efficiency cartridge filters that will now control 99.99 percent of these emissions
- More stringent particulate matter emission limits
- Additional control requirements at the primary crushing and lime systems that were reconfigured for process optimization
- Paving 3.1 miles of industrial roads within the facility boundary
- Use of EPA certified Tier 4 engines in six non-road engine vehicles and Tier 2 on other vehicles
- Increased monitoring, recordkeeping and reporting requirements

The above additional measures have resulted in emissions reduction of total emissions of particulate matter less than ten microns (PM_{10}) by 47 tons per year (tpy) and emissions of particulate matter less than 2.5 microns ($PM_{2.5}$) by 43 tpy.

WHAT ARE AMBIENT AIR QUALITY IMPACTS FROM THE ROSEMONT COPPER MINE?

The state permitting program requires all new sources to conduct an air quality modeling assessment to ensure compliance with the National Ambient Air Quality Standards. Rosemont's proposed site is located in a "clean air area"–one that has been designated as attainment or unclassifiable for all criteria pollutants under the Clean Air Act. A thorough analysis of ambient air quality impacts from the proposed mine was conducted which demonstrated that the emissions would not cause or contribute to an exceedance of any applicable National Ambient Air Quality Standard.

WHAT ARE ROSEMONT COPPER MINE'S EMISSIONS?

The potential annual non-fugitive and fugitive emissions from the mining operations are listed in Table 1 on the next page.

It should, however, be noted that the fugitive emissions are accounted for in the modeling analysis to determine compliance with the National Ambient Air Quality Standards (NAAQS).

HOW DOES THE EIS AND DEQ MODELING DIFFER?

In the modeling analysis submitted to ADEQ, Rosemont accounted for the additional control measures required by the Department. These controls, however, were not included in the initial EIS documents submitted to the United States Forest Service and those documents will need to be updated to reflect the additional control measures.

Publication Number: FS 12-06

Table 1

Pollutant	Non-Fugitive Emissions (tons per year)	Fugitive Emissions* (tons per year)
PM_{10}	39.51	947
$PM_{2.5}$	10.97	106
NO_X	16.76	154
SO_2	0.055	18
VOC	1.54	3.77
CO	9.0	606
GHG	5,792	5,125
HAPs	0.0132	0.0

PM_{10} -Particulate matter less than 10 microns
$PM_{2.5}$ - Particulate matter less than 2.5 microns
NO_X - Nitrogen Oxides
SO_2 -Sulfur dioxide
VOC-Volatile Organic Compounds
CO -Carbon Monoxide
HAPs-Hazardous Air Pollutants
GHG -Green House Gases

*Pursuant to state law, fugitive emissions are not included in the determination of major source applicability for non-categorical sources such as copper mines

HOW DID ADEQ DEVELOP THE TERMS OF THE PROPOSED PERMIT?

The proposed permit includes emission limits and standards and compliance demonstration requirements from federal, state and local air quality regulations. Federal requirements for the mine come from Title 40 of the Code of Federal Regulations Part 60 New Source Performance Standards, Subpart LL - Metallic Mineral Processing Operations, and Subpart IIII - Internal Combustion Engines. Other requirements set forth in this permit are a result of state and county rules and limitations based upon ambient air dispersion modeling.

HOW WILL ADEQ ENSURE THAT THE ROSEMONT MINE COMPLIES WITH PERMIT REQUIREMENTS?

The proposed permit includes stringent monitoring, testing, recordkeeping, and reporting requirements to provide assurance that emissions from the mine operations are minimized. ADEQ inspectors will also conduct periodic announced and unannounced inspections of the facility if not delegated to PDEQ. ADEQ's preference would be to delegate those responsibilities to PDEQ.

WHAT OTHER REGULATORY REQUIREMENTS DO ROSEMONT HAVE TO MEET?

In addition to this air quality permit, RCC will have to obtain other independent approvals prior to the construction and operation of the mine. They include the Environmental Impact Statement (EIS) Record of Decision from the United States Forest Service, the Aquifer Protection Permit (APP) from ADEQ and the 404 Permit from the Corps of Engineers.

HOW DOES THE PUBLIC COMMENT PROCESS WORK?

ADEQ will hold a **public meeting** to answer questions on the proposed permit on **Monday, October 01, 2012, at 6:00 p.m.** at the Sycamore Elementary School located at 16701 S Houghton Road, Vail, Arizona 85641. At the public meeting, citizens will have an opportunity to have informal discussions about the proposed air permit with agency staff.

ADEQ will hold a public hearing to receive public comments on the proposed permit on Tuesday, October 09, 2012, at 6:00 p.m. at the Sycamore Elementary School located at 16701 S Houghton Road, Vail, Arizona 85641. The public comment period will officially close on October 31, 2012. **Therefore, all comments must be postmarked, emailed, or hand-delivered no later than October 31, 2012.**

E-mails should be sent to rosemontairpermit@azdeq.gov or via postal mail or hand-delivered to 1110 W Washington St, Phoenix, AZ 85007, Mail Code 34.

Additional information on the public notice, and copies of the proposed permits and technical support documents, will be available for review on the ADEQ Web site at:
http://www.azdeq.gov/environ/air/permits/rcc.html.

Citizens can also subscribe to email or text alerts to news and other events related to this proposed permit at https://public.govdelivery.com/accounts/AZDEQ/subscriber/new

ADEQ CONTACT

We encourage you to be informed and involved in ADEQ activities. We need your involvement to help us protect our environment and public health. For more information, please contact:

Mr. Balaji Vaidyanathan
Manager, Air Quality Permits Section
1110 W. Washington St., Phoenix, AZ 85007
E-mail: rosemontairpermit@azdeq.gov
(602) 771-4527 or
toll free (800) 234-5677 Ext. 771-4527
Hearing impaired persons call TDD line: (602) 771-4829

TABLE B1-36
2011–2029 Haul Truck Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Emissions Summary (tpy)	Maximum Annual
HC	259
CO	1400
NO_x	5134
SO_2	5.78
PM_{10}	191
$PM_{2.5}$	186

$PM_{2.5}$ calculated as 97% of PM_{10} emissions, per NONROAD guidance

Estimated Number of Trucks in Operation

Tier Information	Engine		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CAT 793C Fleet (2337 hp)	Tier 0		8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 793D Fleet (2415 hp)	Tier 1		29	29	29	29	29	23	29	23	12	0	0	0	0	0	0	0	0	0
	Tier 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 795F Fleet (3440 hp)	Tier 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 2		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KOM Fleet (3500 hp)	Tier 1		25	30	30	26	29	27	22	27	20	0	0	0	0	0	0	0	0	0
	Tier 2		11	41	47	47	47	47	47	47	47	44	12	9	19	30	28	4	7	5
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	29	29	29	29	29	29	29	16	14	15	15	29	27	29
Total Truck s			67	100	106	102	134	126	127	126	108	73	41	25	33	45	43	33	34	34

It is assumed that all trucks will be repowered in kind every 3 years (~20,000 hours of operation).

Estimated Number of Operational Hours (in thousands)

Tier Information	Engine		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CAT 793C Fleet (2337 hp)	Tier 0		46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 793D Fleet (2415 hp)	Tier 1		203	203	203	203	203	161	203	161	84	0	0	0	0	0	0	0	0	0
	Tier 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 795F Fleet (3440 hp)	Tier 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 2		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KOM Fleet (3500 hp)	Tier 1		179	215	215	186	207	193	157	193	143	0	0	0	0	0	0	0	0	0
	Tier 2		81	301	336	336	336	336	336	336	336	315	86	64	136	215	200	29	50	36
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	213	213	207	207	207	207	207	114	100	107	107	207	193	207
Total Hours			475	719	754	725	960	903	904	897	770	522	293	179	236	322	307	236	243	243

Emission Factors by Tier (g/hp-hr)	Tier 0	Tier 1	Tier 2	Tier 4t	Tier 4f
HC	0.75	0.31	0.18	0.29	0.13
CO	4.90	1.29	1.29	0.88	0.88
NOx	8.15	5.99	3.93	2.41	2.41
SO2	0.0049	0.0049	0.0049	0.0049	0.0049
PM10	0.64	0.26	0.15	0.02	0.02

All Age Factors assumed to be equal to 1.
Hydrocarbon emission factors for tier 4f represent the EPA proposed emission limits, and were not calculated using NONROAD guidance.
All emission factors represent the lesser of EPA emission limits and factors calculated using EPA NONROAD methodology.

TABLE B1-36
2011–2029 Haul Truck Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Emissions by Truck Type (tpy)			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CAT 793C Fleet (2337 hp)	HC		30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CO		197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NO_x		328	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2		0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	PM_{10}		26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793D Fleet (2415 hp)	HC		57	57	57	57	57	45	57	45	24	-	-	-	-	-	-	-	-	-
	CO		237	237	237	237	237	188	237	188	98	-	-	-	-	-	-	-	-	-
	NO_x		1100	1100	1100	1100	1100	872	1100	872	455	-	-	-	-	-	-	-	-	-
	SO_2		0.9	0.9	0.9	0.9	0.9	0.7	0.9	0.7	0.4	-	-	-	-	-	-	-	-	-
	PM_{10}		48	48	48	48	48	38	48	38	20	-	-	-	-	-	-	-	-	-
CAT 795F Fleet (3440 hp)	HC		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CO		20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NO_x		61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	PM_{10}		2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KOM Fleet (3500 hp)	HC		92.2	159.2	167.4	155.8	202.3	196.4	180.8	195.4	175.0	111.5	57.1	35.5	50.0	70.0	66.6	43.5	46.1	45.2
	CO		438	871	930	881	1164	1139	1072	1133	1048	770	384	241	345	486	462	288	307	300
	NO_x		1820	3238	3416	3192	4034	3922	3623	3904	3511	2278	1098	694	1017	1445	1371	803	869	840
	SO_2		1.68	3.33	3.56	3.37	4.87	4.78	4.51	4.74	4.42	3.36	1.88	1.15	1.52	2.07	1.98	1.51	1.56	1.56
	PM_{10}		77.9	134.1	141.0	131.1	142.8	137.9	125.4	137.8	120.5	66.8	21.3	15.1	29.1	44.8	42.0	9.9	13.9	11.4
Total	HC		182	216	225	213	259	242	238	241	199	111	57	36	50	70	67	44	46	45
	CO		892	1108	1166	1118	1400	1327	1309	1320	1146	770	384	241	345	486	462	288	307	300
	NO_x		3309	4337	4516	4292	5134	4794	4723	4776	3966	2278	1098	694	1017	1445	1371	803	869	840
	SO_2		2.9	4.2	4.5	4.3	5.8	5.5	5.4	5.5	4.8	3.4	1.9	1.1	1.5	2.1	2.0	1.5	1.6	1.6
	PM_{10}		154	182	189	179	191	176	174	176	141	67	21	15	29	45	42	10	14	11

Calculation Data

	NONROAD Equipment SCC
Haul Truck	2270002051

All tables and factors are from "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling--Compression-Ignition", EPA, 2004, unless otherwise noted.

Table A2 Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines (>750 hp)

	BSFC	HC	CO	NO_x	PM_{10}
T0	0.367	0.68	2.7	8.38	0.402
T1	0.367	0.2861	0.7642	6.1525	0.1934
T2	0.367	0.1669	0.7642	4.1	0.1316
T4t	0.367	0.2815	0.7642	2.392	0.069
T4f	0.0367	0.1314	0.7642	2.392	0.069

Table A3 Transient Adjustment Factors by Equipment Type for Nonroad CI Equipment

SCC	Cycle	TAF Assign.	HC	CO	NO_x	PM_{10}	BSFC
2270002051	Crawler	Hi LF	1.05	1.53	0.95	1.23	1.01

TAFs are not applied to the emission factors for Tier 4 engines

Table A4 Deterioration Factors for Nonroad Diesel Engines (A)

Pollutant	T0	T1	T2	T3+
HC	0.047	0.036	0.034	0.027
CO	0.185	0.101	0.101	0.151
NO_x	0.024	0.024	0.009	0.008
PM_{10}	0.473	0.473	0.473	0.473

Sulfur Content of Diesel Fuel

sulfur conversion	7.0	grams PM sulfate/gram Sulfur		
soxcnv	0.02247	grams PM sulfur/gram fuel consumed		
default (soxbas)	3300	ppm	0.33	wt %
Diesel Sulfur Conc. (soxdsl)	15	ppm	0.0015	wt %

TABLE B1-36
2011–2029 Haul Truck Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Engine Life at Full Load
7000 hrs
Engine life from Table 1 of "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA, 2004.

Load Factor
0.34
Load factor estimated by KUC using BCM haul truck data.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY CLASS II SYNTHETIC MINOR PERMIT

COMPANY: ***Rosemont Copper Company***
FACILITY: ***Rosemont Copper Project***
PERMIT #: ***55223***
DATE ISSUED: ***January 31, 2013***
EXPIRY DATE: ***January 31, 2018***

SUMMARY

This Class II synthetic minor permit is issued to Rosemont Copper Company for the construction and operation of an open pit copper mine, milling, leaching, and solvent extraction/electrowinning facility to be located at 21900 S Sonoita Highway, Vail, Arizona 85641, which is approximately 30 miles southeast of Tucson, west of State Highway 83, in Pima County, Arizona. The facility is accepting voluntary emissions limitations to stay below major source thresholds. Consequently, a Class II synthetic minor permit is being processed for this facility.

This permit is issued in accordance with an assertion of jurisdiction pursuant to Arizona Revised Statues (ARS) 49-402, 49-426 and applicable provision of the State Implementation Plan. It contains requirements from the Arizona Administrative Code, Title 18, Chapter 2, Pima County Code, Title 17, Code of Federal Regulations (CFR) and applicable State Implementation Plan requirements.

All definitions, terms, and conditions used in this permit conform to those in the Arizona Administrative Code R18-2-101 et. Seq. (A.A.C.) and 40 Code of Federal Regulations (CFR).

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ATTACHMENT "A": GENERAL PROVISIONS

Air Quality Control Permit No. 55223
For
Rosemont Copper Company- Rosemont Copper Project

I. PERMIT EXPIRATION AND RENEWAL

[ARS § 49-426.F; A.A.C. R18-2-304.C.2, & -306.A.1]

A. This permit is valid for a period of five years from the date of issuance.

B. The Permittee shall submit an application for renewal of this permit at least 6 months, but not more than 18 months, prior to the date of permit expiration.

II. COMPLIANCE WITH PERMIT CONDITIONS

[A.A.C. R18-2-306.A.8.a & b]

A. The Permittee shall comply with all conditions of this permit including all applicable requirements of the Arizona air quality statutes A.R.S Title 49, Chapter 3, Pima County and Arizona air quality rules. Any permit noncompliance constitutes a violation of the Arizona Revised Statutes and is grounds for enforcement action; for permit termination, revocation and reissuance, or revision; or for denial of a permit renewal application. In addition, noncompliance with any federally enforceable requirement constitutes a violation of the Clean Air Act.

B It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

III. PERMIT REVISION, REOPENING, REVOCATION AND REISSUANCE, OR TERMINATION FOR CAUSE

[A.A.C. R18-2-306.A.8.c, -321.A.1.c-d, & -321.A.2]

A. The permit may be revised, reopened, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for a permit revision, revocation and reissuance, termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.

B. The permit shall be reopened and revised under any of the following circumstances

1. The Director or the Administrator determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit.

2. The Director or the Administrator determines that the permit needs to be revised or revoked to assure compliance with the applicable requirements.

C. Proceedings to reopen and reissue a permit, including appeal of any final action relating to a permit reopening, shall follow the same procedures as apply to initial permit issuance and shall affect only those parts of the permit for which cause to reopen exists. Such reopenings shall be made as expeditiously as practicable. Permit reopenings shall not result in a resetting of the five-year permit term.

IV. POSTING OF PERMIT [A.A.C. R18-2-315]

A. The Permittee shall post this permit or a certificate of permit issuance where the facility is located in such a manner as to be clearly visible and accessible. All equipment covered by this permit shall be clearly marked with one of the following:

1. Current permit number; or

2. Serial number or other equipment ID number that is also listed in the permit to identify that piece of equipment.

B. A copy of the complete permit shall be kept on site.

V. FEE PAYMENT

[A.A.C. R18-2-306.A.9 & -326]

The Permittee shall pay fees to the Director pursuant to ARS § 49-426(E) and A.A.C. R18-2-326.

VI. ANNUAL EMISSION INVENTORY QUESTIONNAIRE

[A.A.C. R18-2-327.A & B]

A. The Permittee shall complete and submit to the Director an annual emissions inventory questionnaire. The questionnaire is due by March 31st or ninety days after the Director makes the inventory form available each year, whichever occurs later, and shall include emission information for the previous calendar year.

B. The questionnaire shall be on a form provided by the Director and shall include the information required by A.A.C. R18-2-327.

VII. COMPLIANCE CERTIFICATION

[A.A.C. R18-2-309.2.a, -309.2.c-d, and -309.5.d]

A. The Permittee shall submit a compliance certification to the Director semiannually which describes the compliance status of the source with respect to each permit condition. The first certification shall be submitted no later than May 15th, and shall report the compliance status of the source during the period between October 1st of the previous year and March 31st of the current year. The second certification shall be submitted no later than November 15th, and shall report the compliance status of the source during the period between April 1st and September 30th of the current year.

The compliance certifications shall include the following:

1. Identification of each term or condition of the permit that is the basis of the certification;

2. Identification of the methods or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period;

3. The status of compliance with the terms and conditions of the permit for the period covered by the certification, including whether compliance during the period was continuous or intermittent. The certification shall be based on the methods or means designated in Condition VII.A.2 above. The certifications shall identify each deviation and take it into account for consideration in the compliance certification;

4. All instances of deviations from permit requirements reported pursuant to Condition XII.B of this Attachment; and

5. Other facts the Director may require to determine the compliance status of the source.

B. A progress report on all outstanding compliance schedules shall be submitted every six months beginning with six months after permit issuance.

VIII. CERTIFICATION OF TRUTH, ACCURACY AND COMPLETENESS

[A.A.C. R18-2-304.H]

Any document required to be submitted by this permit, including reports, shall contain a certification by a responsible official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

IX. INSPECTION AND ENTRY

[A.A.C. R18-2-309.4]

Upon presentation of proper credentials, the Permittee shall allow the Director or the authorized representative of the Director to:

A. Enter upon the Permittee's premises where a source is located, emissions-related activity is conducted, or where records are required to be kept under the conditions of the permit;

B. Have access to and copy, at reasonable times, any records that are required to be kept under the conditions of the permit;

C. Inspect, at reasonable times, any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit;

D. Sample or monitor, at reasonable times, substances or parameters for the purpose of assuring compliance with the permit or other applicable requirements; and

E. Record any inspection by use of written, electronic, magnetic and photographic media.

X. PERMIT REVISION PURSUANT TO FEDERAL HAZARDOUS AIR POLLUTANT STANDARD

[A.A.C. R18-2-304.C]

If this source becomes subject to a standard promulgated by the Administrator pursuant to Section 112(d) of the Act, then the Permittee shall, within twelve months of the date on which the standard is promulgated, submit an application for a permit revision demonstrating how the source will comply with the standard.

XI. ACCIDENTAL RELEASE PROGRAM

[40 CFR Part 68]

If this source becomes subject to the provisions of 40 CFR Part 68, then the Permittee shall comply with these provisions according to the time line specified in 40 CFR Part 68.

XII. EXCESS EMISSIONS, PERMIT DEVIATIONS, AND EMERGENCY REPORTING

[A.A.C. R18-2-310.01.A & -310.01.B]

A. Excess Emissions Reporting

1. Excess emissions shall be reported as follows:

   a. The Permittee shall report to the Director any emissions in excess of the limits established by this permit. Such report shall be in two parts as specified below:

      (1) Notification by telephone or facsimile within 24 hours of the time when the Permittee first learned of the occurrence of excess emissions including all available information from Condition XII.A.1.b below.

      (2) Detailed written notification by submission of an excess emissions report within 72 hours of the notification pursuant to Condition XII.A.1.a.(1) above.

   b. The report shall contain the following information:

      (1) Identity of each stack or other emission point where the excess emissions occurred;

      (2) Magnitude of the excess emissions expressed in the units of the applicable emission limitation and the operating data and calculations used in determining the magnitude of the excess emissions;

      (3) Date, time and duration, or expected duration, of the excess emissions;

      (4) Identity of the equipment from which the excess emissions emanated;

      (5) Nature and cause of such emissions;

      (6) If the excess emissions were the result of a malfunction, steps taken to remedy the malfunction and the steps taken or planned to prevent the recurrence of such malfunctions; and

(7) Steps taken to limit the excess emissions. If the excess emissions resulted from start-up or malfunction, the report shall contain a list of the steps taken to comply with the permit procedures.

2. In the case of continuous or recurring excess emissions, the notification requirements of this Section shall be satisfied if the source provides the required notification after excess emissions are first detected and includes in such notification an estimate of the time the excess emissions will continue. Excess emissions occurring after the estimated time period, or changes in the nature of the emissions as originally reported, shall require additional notification pursuant to Condition XII.A.1 above.

[A.A.C. R18-2-310.01.C]

B. Permit Deviations Reporting

[A.A.C. R18-2-306.A.5.b]

The Permittee shall promptly report deviations from permit requirements, including those attributable to upset conditions as defined in the permit, the probable cause of such deviations, and any corrective actions or preventive measures taken. Prompt reporting shall mean that the report was submitted to the Director/Control Officer by certified mail, facsimile, or hand delivery within two working days of the time when the owner or operator first learned of the occurrence of a deviation from a permit requirement.

C. Emergency Provision

[A.A.C. R18-2-306.E]

1. An “emergency” means any situation arising from sudden and reasonable unforeseeable events beyond the control of the source, including acts of God, that require immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.

2. An emergency constitutes an affirmative defense to an action brought for noncompliance with such technology-based emission limitations if Condition XII.C.3 is met.
3. The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An emergency occurred and that the Permittee can identify the cause(s) of the emergency;

   b. The permitted facility was being properly operated at the time;

   c. During the period of the emergency, the Permittee took all reasonable steps to minimize levels of emissions that exceeded the emissions standards or other requirements in the permit; and

d. The Permittee submitted notice of the emergency to the Director by certified mail, facsimile, or hand delivery within two working days of the time when emission limitations were exceeded due to the emergency. This notice shall contain a description of the emergency, any steps taken to mitigate emissions, and corrective action taken.

4. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an emergency has the burden of proof.

5. This provision is in addition to any emergency or upset provision contained in any applicable requirement.

D. Compliance Schedule

[ARS § 49-426.I.5]

For any excess emission or permit deviation that cannot be corrected within 72 hours, the Permittee is required to submit a compliance schedule to the Director within 21 days of such occurrence. The compliance schedule shall include a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance with the permit terms or conditions that have been violated.

E. Affirmative Defenses for Excess Emissions Due to Malfunctions, Startup, and Shutdown

[A.A.C. R18-2-310]

1. Applicability

This rule establishes affirmative defenses for certain emissions in excess of an emission standard or limitation and applies to all emission standards or limitations except for standards or limitations:

a. Promulgated pursuant to Sections 111 or 112 of the Act;

b. Promulgated pursuant to Titles IV or VI of the Clean Air Act;

c. Contained in any Prevention of Significant Deterioration (PSD) or New Source Review (NSR) permit issued by the U.S. EPA;

d. Contained in A.A.C. R18-2-715.F; or

e. Included in a permit to meet the requirements of A.A.C. R18-2-406.A.5.

2. Affirmative Defense for Malfunctions

Emissions in excess of an applicable emission limitation due to malfunction shall constitute a violation. When emissions in excess of an applicable emission limitation are due to a malfunction, the Permittee has an affirmative defense to a civil or administrative enforcement proceeding based on that violation, other than a judicial action seeking injunctive relief, if the Permittee has complied with the reporting requirements of A.A.C. R18-2-310.01 and has demonstrated all of the following:

a. The excess emissions resulted from a sudden and unavoidable breakdown of process equipment or air pollution control equipment beyond the reasonable control of the Permittee;

b. The air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good practice for minimizing emissions;

c. If repairs were required, the repairs were made in an expeditious fashion when the applicable emission limitations were being exceeded. Off-shift labor and overtime were utilized where practicable to ensure that the repairs were made as expeditiously as possible. If off-shift labor and overtime were not utilized, the Permittee satisfactorily demonstrated that the measures were impracticable;

d. The amount and duration of the excess emissions (including any bypass operation) were minimized to the maximum extent practicable during periods of such emissions;

e. All reasonable steps were taken to minimize the impact of the excess emissions on ambient air quality;

f. The excess emissions were not part of a recurring pattern indicative of inadequate design, operation, or maintenance;

g. During the period of excess emissions there were no exceedances of the relevant ambient air quality standards established in Title 18, Chapter 2, Article 2 of the Arizona Administrative Code that could be attributed to the emitting source;

h. The excess emissions did not stem from any activity or event that could have been foreseen and avoided, or planned, and could not have been avoided by better operations and maintenance practices;

i. All emissions monitoring systems were kept in operation if at all practicable; and

j. The Permittee's actions in response to the excess emissions were documented by contemporaneous records

3. Affirmative Defense for Startup and Shutdown

a. Except as provided in Condition XII.E.3.b below, and unless otherwise provided for in the applicable requirement, emissions in excess of an applicable emission limitation due to startup and shutdown shall constitute a violation. When emissions in excess of an applicable emission limitation are due to startup and shutdown, the Permittee has an affirmative defense to a civil or administrative enforcement proceeding based on that violation, other than a judicial action seeking injunctive relief, if the Permittee has complied with the reporting requirements of A.A.C. R18-2-310.01 and has demonstrated all of the following:

(1) The excess emissions could not have been prevented through careful and prudent planning and design;

(2) If the excess emissions were the result of a bypass of control equipment, the bypass was unavoidable to prevent loss of life, personal injury, or severe damage to air pollution control equipment, production equipment, or other property;

(3) The air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good practice for minimizing emissions;

(4) The amount and duration of the excess emissions (including any bypass operation) were minimized to the maximum extent practicable during periods of such emissions;

(5) All reasonable steps were taken to minimize the impact of the excess emissions on ambient air quality;

(6) During the period of excess emissions there were no exceedances of the relevant ambient air quality standards established in Title 18, Chapter 2, Article 2 of the Arizona Administrative Code that could be attributed to the emitting source;

(7) All emissions monitoring systems were kept in operation if at all practicable; and

(8) Contemporaneous records documented the Permittee's actions in response to the excess emissions.

b. If excess emissions occur due to a malfunction during routine startup and shutdown, then those instances shall be treated as other malfunctions subject to Condition XII.E.2 above.

4. Affirmative Defense for Malfunctions During Scheduled Maintenance

If excess emissions occur due to a malfunction during scheduled maintenance, then those instances will be treated as other malfunctions subject to Condition XII.E.2 above.

5. Demonstration of Reasonable and Practicable Measures

For an affirmative defense under Condition XII.E.2 or XII.E.3 above, the Permittee shall demonstrate, through submission of the data and information required by Condition XII.E and A.A.C. R18-2-310.01, that all reasonable and practicable measures within the Permittee's control were implemented to prevent the occurrence of the excess emissions.

XIII. RECORD KEEPING REQUIREMENTS

[A.A.C. R18-2-306.A.4]

A. The Permittee shall keep records of all required monitoring information including, but not limited to, the following:

1. The date, place as defined in the permit, and time of sampling or measurements;
2. The date(s) analyses were performed;
3. The name of the company or entity that performed the analyses;
4. A description of the analytical techniques or methods used;
5. The results of such analyses; and
6. The operating conditions as existing at the time of sampling or measurement.

B. The Permittee shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records and all original strip-chart recordings or other data recordings for continuous monitoring instrumentation, and copies of all reports required by the permit.

C. All required records shall be maintained either in an unchangeable electronic format or in a handwritten logbook utilizing indelible ink.

XIV. REPORTING REQUIREMENTS

[A.A.C. R18-2-306.A.5.a]

The Permittee shall submit the following reports:

A. Compliance certifications in accordance with Section VII of Attachment "A".

B. Excess emission; permit deviation, and emergency reports in accordance with Section XII of Attachment "A".

C. Other reports required by any condition of Attachment "B".

XV. DUTY TO PROVIDE INFORMATION

[A.A.C. R18-2-304.G & -306.A.8.e]

A. The Permittee shall furnish to the Director, within a reasonable time, any information that the Director may request in writing to determine whether cause exists for revising, revoking and reissuing, or terminating the permit, or to determine compliance with the permit. Upon request, the Permittee shall also furnish to the Director copies of records required to be kept by the permit. For information claimed to be confidential, the Permittee shall furnish an additional copy of such records directly to the Administrator along with a claim of confidentiality.

B. If the Permittee has failed to submit any relevant facts or has submitted incorrect information in the permit application, the Permittee shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information.

XVI. PERMIT AMENDMENT OR REVISION

[A.A.C. R18-2-317.01, -318, -319, & -320]

The Permittee shall apply for a permit amendment or revision for changes to the facility which do not qualify for a facility change without revision under Section XVII, as follows:

A. Facility Changes that Require a Permit Revision - Class II (A.A.C. R18-2-317.01);

B. Administrative Permit Amendment (A.A.C. R18-2-318);

C. Minor Permit Revision (A.A.C. R18-2-319); and

D. Significant Permit Revision (A.A.C. R18-2-320)

The applicability and requirements for such action are defined in the above referenced regulations.

XVII. FACILITY CHANGE WITHOUT A PERMIT REVISION

[A.A.C. R18-2-306.A.4 & -317.02]

A. Except for a physical change or change in the method of operation at a Class II source requiring a permit revision under A.A.C. R18-2-317.01, or a change subject to logging or notice requirements in Conditions XVII.B and XVII.C below, a change at a Class II source shall not be subject to revision, notice, or logging requirements under this Section.

B. Except as otherwise provided in the conditions applicable to an emissions cap created under A.A.C. R18-2-306.02, the following changes may be made if the source keeps on site records of the changes according to Appendix 3 of the Arizona Administrative Code:

1. Implementing an alternative operating scenario, including raw materials changes;

2. Changing process equipment, operating procedures, or making any other physical change if the permit requires the change to be logged;

3. Engaging in any new insignificant activity listed in A.A.C. R18-2-101.57.a through A.A.C. R18-2-101.57.i but not listed in the permit;

4. Replacing an item of air pollution control equipment listed in the permit with an identical (same model, different serial number) item. The Director may require verification of efficiency of the new equipment by performance tests; and

5. A change that results in a decrease in actual emissions if the source wants to claim credit for the decrease in determining whether the source has a net emissions increase for any purpose. The logged information shall include a description of the change that will produce the decrease in actual emissions. A decrease that has not been logged is creditable only if the decrease is quantifiable, enforceable, and otherwise qualifies as a creditable decrease.

C. Except as provided in the conditions applicable to an emissions cap created under A.A.C. R18-2-306.02, the following changes may be made if the source provides written notice to the Department in advance of the change as provided below:

1. Replacing an item of air pollution control equipment listed in the permit with one that is not identical but that is substantially similar and has the same or better pollutant removal efficiency: 7 days. The Director may require verification of efficiency of the new equipment by performance tests;

2. A physical change or change in the method of operation that increases actual emissions more than 10% of the major source threshold for any conventional pollutant but does not require a permit revision: 7 days;

3. Replacing an item of air pollution control equipment listed in the permit with one that is not substantially similar but that has the same or better efficiency: 30 days. The Director may require verification of efficiency of the new equipment by performance tests;

4. A change that would trigger an applicable requirement that already exists in the permit: 30 days unless otherwise required by the applicable requirement;

5. A change that amounts to reconstruction of the source or an affected facility: 7 days. For the purposes of this subsection, reconstruction of a source or an affected facility shall be presumed if the fixed capital cost of the new components exceeds 50% of the fixed capital cost of a comparable entirely new source or affected facility and the changes to the components have occurred over the 12 consecutive months beginning with commencement of construction; and

6. A change that will result in the emissions of a new regulated air pollutant above an applicable regulatory threshold but that does not trigger a new applicable requirement for that source category: 30 days. For purposes of this requirement, an applicable regulatory threshold for a conventional air pollutant shall be 10% of the applicable major source threshold for that pollutant.

D. For each change under Condition XVII.C above, the written notice shall be by certified mail or hand delivery and shall be received by the Director the minimum amount of time in advance of the change. Notifications of changes associated with emergency conditions, such as malfunctions necessitating the replacement of equipment, may be provided with less than required notice, but must be provided as far in advance of the change, or if advance notification is not practicable, as soon after the change as possible. The written notice shall include:

1. When the proposed change will occur;

2. A description of the change;

3. Any change in emissions of regulated air pollutants; and

4. Any permit term or condition that is no longer applicable as a result of the change.

E. A source may implement any change in Condition XVII.C above without the required notice by applying for a minor permit revision under A.A.C. R18-2-319 and complying with subsection A.A.C. R18-2-319.D.2 and A.A.C. R18-2-319.G.

F. The permit shield described in A.A.C. R18-2-325 shall not apply to any change made under this Section, other than implementation of an alternate operating scenario under Condition XVII.B.1.

G. Notwithstanding any other part of this Section, the Director may require a permit to be revised for any change that, when considered together with any other changes submitted by the same source under this Section over the term of the permit, constitutes a change under subsection A.A.C. R18-2-317.01.A.

H. If a source change is described under both Conditions XVII.B and XVII.C above, the source shall comply with Condition XVII.C above. If a source change is described under both Condition XVII.C above and A.A.C. R18-2-317.01.B, the source shall comply with A.A.C. R18-2-317.01.B.

I. A copy of all logs required under Condition XVII.B shall be filed with the Director within 30 days after each anniversary of the permit issuance date. If no changes were made at the source requiring logging, a statement to that effect shall be filed instead.

J. Logging Requirements

[A.A.C. R18-2-306.A.4]

1. Each log entry required by a change under Condition XVII.B shall include at least the following information:

   a. A description of the change, including:

      (1) A description of any process change;

      (2) A description of any equipment change, including both old and new equipment descriptions, model numbers, and serial numbers, or any other unique equipment ID number; and

      (3) A description of any process material change.

   b. The date and time that the change occurred.

   c. The provision of A.A.C. R18-2-317.02.B that authorizes the change to be made with logging.

   d. The date the entry was made and the first and last name of the person making the entry.

2. Logs shall be kept for 5 years from the date created. Logging shall be performed in indelible ink in a bound log book with sequentially number pages, or in any other form, including electronic format, approved by the Director.

XVIII. TESTING REQUIREMENTS

[A.A.C. R18-2-312]

A. The Permittee shall conduct performance tests as specified in the permit and at such other times as may be required by the Director.

B. Operational Conditions During Testing

Tests shall be conducted during operation at the maximum possible capacity of each unit under representative operational conditions unless other conditions are required by the applicable test method or in this permit. With prior written approval from the Director, testing may be performed at a lower rate. Operations during periods of start-up, shutdown, and malfunction (as defined in A.A.C. R18-2-101) shall not constitute representative operational conditions unless otherwise specified in the applicable standard.

C. Tests shall be conducted and data reduced in accordance with the test methods and procedures contained in the Arizona Testing Manual unless modified by the Director pursuant to A.A.C. R18-2-312.B.

D. Test Plan

At least 14 calendar days prior to performing a test, the Permittee shall submit a test plan to the Director in accordance with A.A.C. R18-2-312.B and the Arizona Testing Manual. This test plan must include the following:

1. Test duration;
2. Test location(s);
3. Test method(s); and
4. Source operation and other parameters that may affect test results.

E. Stack Sampling Facilities

The Permittee shall provide, or cause to be provided, performance testing facilities as follows:

1. Sampling ports adequate for test methods applicable to the facility;
2. Safe sampling platform(s);
3. Safe access to sampling platform(s); and
4. Utilities for sampling and testing equipment.

F. Interpretation of Final Results

Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic mean of the results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs is required to be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the Permittee's control, compliance may, upon the Director's approval, be determined using the arithmetic mean of the results of the other two runs. If the Director or the Director's designee is present, tests may only be stopped with the Director's or such designee's approval. If the Director or the Director's designee is not present, tests may only be stopped for good cause. Good cause includes: forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the Permittee's control. Termination of any test without good cause after the first run is commenced shall constitute a failure of the test. Supporting documentation, which demonstrates good cause, must be submitted.

G. Report of Final Test Results

A written report of the results of all performance tests shall be submitted to the Director within 30 days after the test is performed. The report shall be submitted in accordance with the Arizona Testing Manual and A.A.C. R18-2-312.A.

XIX. PROPERTY RIGHTS

[A.A.C. R18-2-306.A.8.d]

This permit does not convey any property rights of any sort, or any exclusive privilege.

XX. SEVERABILITY CLAUSE

[A.A.C. R18-2-306.A.7]

The provisions of this permit are severable. In the event of a challenge to any portion of this permit, or if any portion of this permit is held invalid, the remaining permit conditions remain valid and in force.

XXI. PERMIT SHIELD

[A.A.C. R18-2-325]

Compliance with the conditions of this permit shall be deemed compliance with all applicable requirements identified in the portions of this permit subtitled "Permit Shield". The permit shield shall not apply to any minor revisions pursuant to Condition XVI.C of this Attachment and any facility changes without a permit revision pursuant to Section XVII of this Attachment.

XXII. APPLICABILITY OF NSPS/NESHAP GENERAL PROVISIONS

[40 CFR Part 60, Part 63]

For all equipment subject to a New Source Performance Standard, the Permittee shall comply with all applicable requirements contained in Subpart A of Title 40, Chapter 60 and Chapter 63 of the Code of Federal Regulations.

ATTACHMENT "B": SPECIFIC CONDITIONS

Air Quality Control Permit No. 55223
For
Rosemont Copper Company - Rosemont Copper Project

I. RELATIONSHIP OF PERMIT TO APPLICABLE STATE IMPLEMENTATION PLAN

This permit is issued pursuant to the provisions of the Arizona Revised Statutes (ARS) and constitutes an installation permit for the purpose of the applicable State Implementation Plan.

[ARS § 49-404.c and -426]

II. FACILITY WIDE REQUIREMENTS

A. Operating Limitations

1. Upon start-up of operations, the Permittee shall have a person on site certified in EPA Reference Method 9 for the observation and evaluation of visible emissions.
[A.A.C. R18-2-306.A.3.c]

2. The Permittee shall operate and maintain all equipment identified in Attachment "C" in accordance with vendor-supplied operations and maintenance instructions. If vendor-supplied operations and maintenance instructions are not available or not applicable, the Permittee shall prepare an Operation and Maintenance Plan (O&M) at least 90 days prior to the start-up of operations, which provides adequate information to properly operate and maintain the equipment. The Permittee shall operate the equipment in accordance with the O&M plan. [A.A.C. R18-2-306.A.3.c]

3. The Permittee shall perform comprehensive preventative maintenance checks according to vendor-supplied O&M instructions or the facility's O&M plan on all dust control equipment used at the facility. These maintenance checks shall be conducted at least annually. [A.A.C. R18-2-306.A.2]

4. Nothing in this Attachment shall be so construed as to prevent the utilization of measurements from emissions monitoring devices or techniques not designated as performance tests as evidence of compliance with applicable good maintenance and operating requirements. [A.A.C. R18-2-312(I)]

5. The Permittee shall comply with the dust control plan included in Attachment "D" of this permit to control particulate matter emissions from activities identified in the dust control plan. The Permittee may implement proposed changes to the dust control plan upon submission to the Director if necessary to further minimize fugitive dust. Nothing in this permit prohibits the Permittee from implementing additional dust control measures not set forth in the dust control plan.
[A.A.C. R18-2-306.A.2]

6. *<u>The Permittee shall limit the amount of rock mined (waste rock and ore combined) to no more than 359,500 tons per day as calculated on a calendar day basis</u>.*
[A.A.C. R18-2-306.A.2 and -331.A.3.a]
[Material Permit Conditions are indicated by underline and italics]

7. *<u>The Permittee shall limit the amount of Ammonium Nitrate and Fuel Oil (ANFO) used during blasting to no more than 52 tons per day.</u>*
[A.A.C. R18-2-306.A.2 and -331.A.3.a]

8. The Permittee shall not cause or permit emissions from malodorous matter during processing, storing, use or transporting to cross a property line between the facility and a residential, recreational, institutional, education, retail sales, hotel, or business premise without minimizing the emissions by applying good modern practices. Malodorous matter shall include but not be limited to paints, acids, alkalis, pesticides, fertilizer, and manure. [Pima SIP Rule 344]

9. Visibility Limiting Standard [Pima County SIP Rule 343]

   a. The Permittee shall not cause or permit the airborne diffusion of visible emissions, including fugitive dust, beyond the property boundary line within which the emissions become airborne. Within actual practice, the airborne diffusion of visible emissions across property lines shall be prevented by appropriately controlling the emissions at the point of discharge, or ceasing entirely the activity or operation which is causing or contributing to the emissions.

   b. Condition II.A.9.a. above shall not apply when wind speeds exceed twenty-five (25) miles per hour as estimated by a certified visible emissions evaluator using the Beaufort Scale of Wind-Speed equivalents, or as recorded by a U.S. weather Bureau Stations or a U.S. government military installation. This exception does not apply to the demolition, destruction, transport, or pulverization of structures containing friable asbestos materials, and all dust-producing activities associated with such sources shall be halted when the wind is causing or contributing visible emissions to cross beyond the property lines within which the emissions discharge.

   c. Any disregard of, neglect of, or inattention to other controls required herein, during any time when this condition is in effect, shall automatically waive the exception and such relaxation of controls shall be a violation to the generation of airborne particulate matter from undisturbed land.

B. Visible Emissions Observation Methodology [A.A.C.R18-2-306.A.3.c]

The Permittee shall comply with the Visible Emissions Observation requirements referenced in the later sections of this permit using the methodology stated below:

1. At least 30 days prior to start of operations, the Permittee shall submit a visual observation plan to be approved by the Director. The observation plan shall identify a central lookout station or multiple observation points, as appropriate, from where the visible emission sources shall be monitored. When multiple observation points are used, all the visible emission sources associated with each observation point shall be specifically identified within the observation plan.

2. A certified Method 9 observer shall conduct a visual survey of visible emissions from the emission sources under normal representative operating conditions. The survey shall be conducted at the frequency specified in the permit conditions that refer to this procedure. The Permittee shall keep a record of the name of the observer, the date and time on which the observation was made, the location(s) of the observation, and the results of the observation.

3. If the observer sees a plume from a visible emission source that on an instantaneous basis appears to exceed the applicable opacity standard, then the observer shall, if practicable, take a six-minute Method 9 observation of the plume.

4. If the six-minute Method 9 observation of the plume is less than the applicable opacity standard, then the observer shall make a record of the following:

   a. Location, date, and time of the observation; and

   b. The results of the Method 9 observation.

5. If the six-minute Method 9 observation of the plume exceeds the applicable opacity standard, then the Permittee shall do the following:

   a. Adjust or repair the controls or equipment to reduce opacity to below the applicable opacity standard;

   b. Report as an excess emission in accordance with Section XII of Attachment "A" of this permit; and

   c. Conduct a six-minute Method 9 observation reading within 48 hours after taking corrective action. The results of this observation, date, time, and location shall be recorded.

C. Monitoring, Recordkeeping, and Reporting Requirements

1. The Permittee shall keep records of dates and times when blasting is conducted and the amount of ANFO in tons used during each blast. The records of each day's blasting activity shall be available in a central log no later than 5:00pm the following business day. [A.A.C. R18-2-306.A.3.c]

2. The Permittee shall record the total tons of daily rock mined (ore and waste rock) as the sum of the following: concentrate ore loaded plus leach ore loaded plus waste rock loaded. The records of each day's mined rock total shall be available in a central log no later than 5:00 pm the following business day. [A.A.C. R18-2-306.A.3.c]

3. The Permittee shall maintain, on-site, records of the manufacturer's specifications or O&M plan for all equipment listed in Attachment "C" of this permit. [A.A.C. R18-2-306.A.4]

4. All records, analyses, and reports required by this permit shall be retained for a minimum of five years from the date of generation. The most recent two years of data shall be kept on-site. All records shall be made available for inspection by authorized Department personnel during normal working hours. [A.A.C. R18-2-306.A.4]

5. The Permittee shall conduct a daily visible emissions survey at places where the facility fugitive dust generating activities are within 300 feet of the property boundary line in accordance with EPA Reference Method 22. When such emissions are observed to cross the property boundary line, the Permittee shall follow the excess emissions reporting procedures in Section XII of Attachment "A" of this permit. [A.A.C R18-2-306.A.4, -306(A)(2)]

6. At the time the compliance certifications required by Section VII of Attachment "A" are submitted, the Permittee shall submit summary reports of all monitoring activities required by this Attachment performed in the same six month period as applied to the compliance certification period. The summary report shall identify each monitoring activity, state whether monitoring was conducted as required by the permit, list any deviations with dates, nature of the deviation and any explanation and/or corrective action, and identify any exceedances to excursions of relevant standards. [A.A.C.R18-2-306.A.5]

7. The Permittee shall notify the Director in writing within 30 days of purchase of the equipment listed in Attachment "C". Equipment purchases within a specified period may be grouped and reported together. This notification shall contain all the information required to complete Attachment "C". [A.A.C.R18-2-306.A.5]

III. METALLIC MINERAL PROCESSING SUBJECT TO NEW SOURCE PERFORMANCE STANDARDS (NSPS) SUBPART LL

A. Applicability

This Section is applicable to equipment identified in Attachment "C" as subject to New Source Performance Standards (NSPS), 40 CFR 60 Subpart LL ("Subpart LL").

B. Notification Requirements

The Permittee shall furnish to the Director written notification as follows:

1. A notification of the date of construction of an affected facility is commenced postmarked no later than 30 days after such date. This condition is satisfied by the notice given pursuant to Condition II.C.7 above. [40 CFR 60.7(a)(1)]

2. A notification of the actual date of initial startup of an affected facility postmarked within 15 days after such date. [40 CFR 60.7(a)(3)]

3. A notification of the anticipated date for conducting the opacity observations required by 40 CFR 60.11(e)(1) of this part. The notification shall also include, if appropriate, a request for the Director to provide a visible emissions reader during a performance test. The notification shall be postmarked not less than 30 days prior to such date. [40 CFR 60.7(a)(6)]

C. Operating Requirements

At all times, including periods of startup, shutdown, and malfunction, the Permittee shall, to the extent practicable, maintain and operate any affected facility in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. [40 CFR 60.11(d)]

D. Particulate Matter

1. Emission Limitations

   a. On and after the date on which the performance test required to be conducted by 40 CFR 60.8 is completed, the Permittee shall not cause to be discharged into the atmosphere from equipment subject to this Section but not identified under Table 1, any stack emissions that contain particulate matter in excess of 0.05 grams per dry standard cubic meter.

   [40 CFR 60.382(a)(1)]

   b. *On and after the date on which the performance test required to be conducted by 40 CFR 60.8 is completed, the Permittee shall not cause to be discharged into the atmosphere from the control devices any emissions which contain particulate matter less than 10 microns (PM_{10}) in excess of the limits identified in the table below corresponding to each control device:*

   [A.A.C. R18-2-306.01 and -331.A.3.a]
   [Material Permit Conditions are indicated by underline and italics]

Table 1: Emissions Limits

Emission Unit ID	***Emission Points Controlled***	***PM_{10} Emissions Limit***
PCL01	*Process Equipment* • *Primary Crusher* *Material Handling Emission Points:* • *Crusher Discharge Hopper to Crusher Discharge Feeder* • *Crusher Discharge Feeder to Stockpile Feed Conveyor No.1*	*0.64 lbs/hour*
PCL02	*Material Handling Emission Points:* • *Stockpile Feed Conveyor No. 2 to Covered Coarse Ore Stockpile* • *Reclaim Feeders to Reclaim Conveyors* *General Ventilation of Stockpile building*	*1.47 lbs/hour*
PCL03	*Material Handling Emission Point:* • *Stockpile Feed Conveyor No. 1 to Stockpile Feed Conveyor No. 2*	*0.36 lbs/hour*
PCL04	*Process Equipment:* • *Pebble Crusher* *Material Handling Emission Points:* • *Reclaim Conveyor* • *Pebble Conveyor No.2 to SAG Oversize Surge Bin* • *SAG Oversize Surge Bin to Pebble Crusher Feeder* • *Pebble Crusher to Pebble Conveyor No. 3*	*0.32 lbs/hour*

Emission Unit ID	*Emission Points Controlled*	*PM_{10} Emissions Limit*
PCL05	*Material Handling Emission Points:* • *Copper Concentrate Conveyor to Copper Concentrate Loadout Stockpile* • *Copper Concentrate Loadout Stockpile to Shipment Truck via Front End Loader* *General Ventilation of Copper Concentrate Loadout Building*	*1.78 lbs/hour*
PCL06	*Material Handling Emission Points:* • *Copper Concentrate Conveyor to Copper Concentrate Loadout Stockpile* • *Copper Concentrate Loadout Stockpile to Shipment Truck via Front End Loader*	*1.78 lbs/hour*
PCL07	*Process Equipment:* • *Molybdenum Concentrate Dryer*	*0.014 lbs/hour*
PCL08	*Material Handling Emission Points:* • *Molybdenum Concentrate Dryer to Molybdenum Concentrate Bin* • *Copper Concentrate Conveyor to Molybdenum Packaging and Weigh System*	*0.053 lbs/hour*
PCL12	*Material Handling Emission Points:* • *Reclaim Conveyor to SAG Mill Feed Conveyor* • *Pebble Conveyor No. 3 to SAG Mill Feed Conveyor*	*0.46 lbs/hour*

2. Air Pollution Control Requirements

The Permittee shall install the following control equipment prior to start-up of the corresponding process unit(s) and shall operate it at all times any of the corresponding process unit(s) is in operation.

a. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL01) to control particulate matter emissions from the following sources*:

(1) *Primary Crusher;*

(2) *Material Transfer from Crusher Discharge Hopper to Crusher Discharge Feeder;*

(3) *Material Transfer from Crusher Discharge Feeder to Stockpile Feed Conveyor No.1.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

b. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL02) to control particulate matter emissions from the following sources*:

(1) *Stockpile Feed Conveyor No. 2 to Covered Coarse Ore Stockpile;*

(2) *Reclaim Feeders to Reclaim Conveyors; and*

(3) *General Ventilation of Stockpile Building*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

c. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL03) to control particulate matter emissions during material transfer from Stockpile Feed Conveyor No. 1 to Stockpile Feed Conveyor No. 2.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

d. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL04) to control particulate matter emissions from the following sources*:

(1) *Pebble Crusher;*

(2) *Material Transfer from Reclaim Conveyor and Pebble Conveyor No.2 to SAG Oversize Surge Bin;*

(3) *Material Transfer from SAG Oversize Surge Bin to Pebble Crusher Feeder; and*

(4) *Material Transfer from Pebble Crusher to Pebble Conveyor No. 3.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

e. *The Permittee shall install, operate* and maintain *cartridge filter dust collectors (PCL05 and PCL06) to control particulate matter emissions from the following sources*:

(1) *Copper Concentrate Conveyor to Copper Concentrate Loadout Stockpile;*

(2) *Copper Concentrate Loadout Stockpile to Shipment Truck via Front End Loader; and*

(3) General Ventilation of Copper Concentrate Loadout Building

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

f. *The Permittee shall install, operate* and maintain *a scrubber and an electrostatic precipitator in series (PCL07) to control particulate matter emissions from the Molybdenum Concentrate Dryer.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

g. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL08) to control particulate matter emissions during material* *transfer from:*

(1) *Molybdenum Concentrate Dryer to Molybdenum Concentrate Bin; and*

(2) *Copper Concentrate Conveyor to Copper Packaging and Weigh System.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

h. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL12) to control particulate matter emissions from the following sources:*

(1) *Reclaim Conveyor to SAG Mill Feed Conveyor; and*

(2) *Pebble Crusher No. 3 to SAG Mill Feed Conveyor.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

i. *The material that is fine enough to contribute to PM_{10} emissions that accumulates around process equipment shall be minimized. At points where such material does accumulate, it shall be collected and removed either manually or by using a vacuum equipped truck as expeditiously as practicable. Clean-up shall be performed on an as-needed basis*.

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

j. *The Permittee shall install, operate* and maintain *water sprays when unloading ore to the Primary Crusher Dump Hopper from Haul Trucks or the Run of Mine Stockpile to control particulate matter emissions*.

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

k. *The Permittee shall install chutes at the conveyor-to-conveyor transfer points to minimize particulate emissions*.

[A.A.C. R18-2-306.A.2 and -331.A.3.d]
[Material Permit Conditions are indicated by underline and italics]

l. *The Permittee shall install rubber sealing strips and rubber curtains on all material transfer associated with the affected facilities to minimize fugitive emissions.*

[A.A.C. R18-2-306.01 and -331.A.3.d]
[Material Permit Conditions are indicated by underline and italics]

3. Monitoring, Recordkeeping, and Reporting Requirements

a. *The Permittee shall install, calibrate,* maintain, *and operate a monitoring device for the continuous measurement of the change in pressure of the gas stream through the operating scrubber PCL07. The monitoring device must be certified by the manufacturer to be accurate within ±250 pascals (± 1 inch water) gauge pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions.*

[40 CFR 60.384(a) and A.A.C. R18-2-331.A.3.c]
[Material Permit Conditions are indicated by underline and italics]

b. *The Permittee shall install, calibrate*, maintain, *and operate a monitoring device for the continuous measurement of the scrubbing liquid flow rate to the operating scrubber PCL07. The monitoring device must be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid flow rate and must be calibrated on at least an annual basis in accordance with manufacturer's instructions.*

[40 CFR 60.384(b) and A.A.C. R18-2-331.A.3.c]

[Material Permit Conditions are indicated by underline and italics]

c. The Permittee shall record on a weekly basis the measurements of both the change in pressure of the gas stream across the operating scrubber and the scrubbing liquid flow rate. [40 CFR 60.385(b)]

d. The Permittee shall submit semi-annual reports of occurrences when the measurements of the scrubber pressure loss (or gain) or liquid flow rate differ by more than ±30 percent from the average obtained during the most recent performance test. These reports shall be postmarked within 30 days following the end of the second and fourth calendar quarters.

[40 CFR 60.385(c) and (d)]

e. The Permittee shall use the monitoring devices required by Conditions III.D.3.a and b to determine the pressure loss of the gas stream through the scrubber PCL07 and the scrubber (PCL07) liquid flow rate at any time during each particulate matter performance test run and the average of the three determinations shall be computed. [40 CFR 60.386(c)]

f. The Permittee shall continuously measure and record the electrostatic precipitator primary and secondary voltage and current and either alarm them or check once per shift. If an excursion from the manufacture's specifications is detected, the Permittee shall commence corrective action no later than the following shift to return the unit to proper operation. Proper operation shall be restored as expeditiously as practicable.

[A.A.C. R18-2-306.A.3.c]

4. Testing Requirements

a. Within 60 days of achieving the maximum production rate at the facility, but no later than 180 days after initial start-up, the Permittee shall conduct an initial performance tests for emissions of particulate matter from the stacks of the control equipment. Subsequent tests shall be performed annually. [40 CFR 60.8(a) and 60.386(a)]

b. EPA Reference Method 5, 17 or 201A shall be used to determine the concentration of particulate matter emissions from the control equipment stacks as specified in 40 CFR 51, Appendix M. Unless using Method 201A, all particulate matter measurements using Method 5 shall be considered to have an aerodynamic diameter less than 10 microns. The performance test shall be used to demonstrate compliance with the voluntarily accepted limits. The sampling volume for each run shall be at least 1.7dscm (60dscf). The sampling probe and filter holder of Method 5 may be operated without heaters if the gas stream being sampled is at ambient temperature. For gas streams above ambient temperature, the Method 5 sampling train shall be operated with a probe and filter temperature slightly above the effluent temperature (up to a maximum filter temperature of 121˚C (250˚F) in order to prevent water condensation on the filter. [40 CFR 60.386(b)(1)]

5. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.382(a)(1), 60.386(a), and 60.386(b)(1). [A.A.C. R18-2-325]

E. Opacity

1. Emission Limitations

a. On and after the date on which the performance test required to be conducted by 40 CFR 60.8 is completed, *the Permittee shall not cause to be discharged into the atmosphere from equipment subject to this Section, any stack emissions that exhibit greater than 7 percent opacity, unless the stack emissions are discharged from unit using a wet scrubbing emission control device (PCL07).*

[40 CFR 60.382(a)(2), A.A.C. R18-2-331A.3.f]
[Material Permit Conditions are indicated by underline and italics]

b. On or after the sixtieth day after achieving the maximum production rate at which the affected facility will be operated but not later than 180 days after initial startup, *the Permittee shall not cause to be discharged into the atmosphere from an affected facility subject to NSPS Subpart LL any process fugitive emissions that exhibit greater than 10 percent opacity.*

[40 CFR 60.382(b) and A.A.C. R18-2-331.A.3.f]
[Material Permit Conditions are indicated by underline and italics]

c. The opacity standards set forth in Conditions III.E.1.a & b shall apply at all times except during periods of startup, shutdown, and malfunction.

[40 CFR 60.11(c)]

d. The Permittee shall not cause, allow or permit the effluent from affected wet scrubber (NSPS applicable) PCL07 stack to have an average optical density equal to or greater than 20 percent opacity. [PCC 17.16.040]

2. Monitoring, Reporting and Recordkeeping Requirements

[A.A.C. R18-2-306.A.3.c and 306.A.4]

A certified Method 9 observer shall conduct a weekly visual survey of emissions from the dust collector stacks and from process fugitive emissions covered by this Section during normal operation mode. The survey shall be conducted in accordance with the Visible Emissions Observations Methodology identified in Condition II.B of this Attachment.

3. Testing Requirements

a. For the purpose of demonstrating initial compliance with Conditions III.E.1.a and b, opacity observations shall be conducted concurrently with the initial performance test required in Condition III.D.4.a above, except as allowed in 40 CFR 60.11(e)(1). The minimum total time of observations shall be 3 hours (thirty 6-minute averages).

[40 CFR 60.11(b) and 386(b)(2)]

b. EPA Reference Method 9 and the procedures in 40 CFR 60.11 shall be used to determine opacity from stack emissions and process fugitive emissions. The observer shall read opacity only when emissions are clearly identified as emanating solely from the affected facility being observed. [40 CFR 60.386(b)(2)]

4. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.382(a)(2), 60.382(b), 60.386(b)(2) and P.C.C 17.16.040.
[A.A.C. R18-2-325]

IV. METALLIC MINERAL PROCESSING NOT SUBJECT TO NSPS SUBPART LL

A. Applicability

This Section applies to the metallic mineral processing equipment identified in Attachment "C" as subject to A.A.C. R18-2-721.

B. Operational Requirements

1. The Permittee shall maintain records of the daily process rate and hours of operation of all material handling equipment. [A.A.C. R18-2-721.F]

2. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-721.F. [A.A.C. R18-2-325]

C. Particulate Matter

1. Emission Limitations

a. The Permittee shall not cause, allow or permit the discharge of particulate matter into the atmosphere in any one hour from any process source subject to the provisions of this Section in total quantities in excess of the amounts calculated by one of the following equations:

(1) For process sources having a process weight rate of 60,000 pounds per hour (30 tons per hour) or less, the maximum allowable emissions shall be determined by the following equation:

$E = 3.59P^{0.62}$

Where:

E = the maximum allowable particulate emissions rate in pounds-mass per hour.

P = the process weight rate in tons-mass per hour.
[AZ SIP R9-3-521.A.2.a]

(2) For process sources having a process weight rate greater than 60,000 pounds per hour (30 tons per hour), the maximum allowable emissions shall be determined by the following equation:

$$E = 17.31P^{0.16}$$

Where E and P are defined above.

[AZ SIP R9-3-521.A.2.b]

b. For purposes of this Section, the total process weight from all similar units employing a similar type process shall be used in determining the maximum allowable emissions of particulate matter.

[AZ SIP R9-3-521.A.4]

2. Air Pollution Control Equipment

a. *The material that is fine enough to contribute to PM_{10} emissions that accumulates around process equipment shall be minimized. At points where such material does accumulate, it shall be collected and removed either manually or by using a vacuum equipped truck as expeditiously as practicable. Clean-up shall be performed on an as-needed basis*.

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

b. *The Permittee shall install, operate* and maintain *water sprays to control particulate matter emissions from process sources*.

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

c. *The Permittee shall install chutes at the conveyor-to-conveyor transfer points to minimize particulate emissions*.

[A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

d. *The Permittee shall install, operate* and maintain *cartridge filter dust collectors (PCL09, PCL10 & PCL11) to control particulate matter emissions from the analytical laboratory building.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with AZ SIP R9-3-521.

[A.A.C. R18-2-325]

D. Opacity

1. Emission Limitations

a. The opacity of any plume or effluent from any process source shall not be greater than 20%. [A.A.C. R18-2-702.B.3]

b. If the presence of uncombined water is the only reason for an exceedance of the visible emissions requirements in Condition IV.D.1.a above, the exceedance shall not constitute a violation of the applicable opacity limit.

[A.A.C. R18-2-702.C]

2. Monitoring, Reporting and Recordkeeping Requirements

[A.A.C. R18-2-306.A.3.c and 306.A.4]

A certified Method 9 observer shall conduct a weekly visual survey of emissions from all sources covered by this Section while they are in operation and in accordance with the Visible Emissions Observations Methodology identified in Condition II.B of this Attachment.

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-702.B.3 and 702.C. [A.A.C. R18-2-325]

V. BOILER AT SOLVENT EXTRACTION/ ELECTROWINNING (SX/EW) PROCESS

A. Applicability

This Section applies to the SX/EW boiler as identified in the equipment list in Attachment "C" of this permit.

B. Fuel Limitations

1. The Permittee shall burn only diesel fuel with a sulfur content of 0.05% or less in the boiler. [A.A.C. R18-2-306.A.2]

2. Recordkeeping Requirements

The Permittee shall maintain fuel supplier documentation or certifications to demonstrate compliance with the fuel limitations above.

[A.A.C. R18-2-306.A.3.c]

C. Particulate Matter

1. Emission Limitation

The Permittee shall not cause, allow or permit the emission of particulate matter, caused by combustion of fuel, from the boiler in excess of the amounts calculated by the following equation:

$E = 1.02Q^{0.769}$

Where:

E = the maximum allowable particulate emissions rate in pounds-mass per hour

Q = the heat input in million Btu per hour.

[A.A.C.R18-2-724.C.1]

2. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-724.C.1. [A.A.C. R18-2-325]

D. Opacity

1. Emission Limitations

The Permittee shall not cause, allow or permit the opacity of any plume or effluent from the boiler to exceed 15 percent.

[A.A.C.R18-2-724.J]

2. Monitoring, Recordkeeping and Reporting Requirements

a. The Permittee shall report all six-minute periods in which the opacity of any plume or effluent exceeds 15 percent.

[A.A.C.R18-2–724.J]

b. A certified EPA Reference Method 9 observer shall conduct a weekly survey of visible emissions emanating from the stack of the boiler when in operation. If the opacity of the emissions observed appears on an instantaneous basis to exceed 15%, the observer shall conduct a certified EPA Reference Method 9 observation. The Permittee shall keep records of the initial survey and any EPA Reference Method 9 observations performed. These records shall include the emission point observed, location of observer, name of observer, date and time of observation, and the results of the observation. If the observation shows a Method 9 opacity reading in excess of 15%, the Permittee shall report this to ADEQ as an excess emission and initiate appropriate corrective action to reduce the opacity below 15%. The Permittee shall keep a record of the corrective action performed.

[A.A.C. R18-2-306.A.3.c, .306.A.4.a and 306.A.5]

3. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-724.J.

[A.A.C. R18-2-325]

E. Sulfur Dioxide

1. Emission Limitation

The Permittee shall not cause to be discharged into the atmosphere from the boiler any emissions that contain more than 1.0 pounds of sulfur dioxide per million Btu heat input.

[A.A.C.R18-2-724.E]

2. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-724.E.

[A.A.C. R18-2-325]

F. Hazardous Air Pollutants

1. Applicability

This Section applies to the diesel fuel fired boiler as identified in the equipment list in Attachment “C”.

[40 CFR 63.11194]

2. Operating Requirements

a. The Permittee shall operate and maintain the boiler, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Director or Administrator that may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source. [40 CFR 63.11205(a)]

b. Work-Practice Standard [40 CFR 63.11201(b)]

(1) Boiler Tune-up

(a) The Permittee shall conduct biennially tune-ups of the boiler to demonstrate continuous compliance according to the procedures stated in Condition V.F.2.c and 40 CFR 63.7(a)(2)(ix). Each biennial tune-up shall be conducted no more than 25 months after the previous tune-up. The first biennial tune-up shall be conducted no later than 25 months after the initial startup.
[40 CFR 63.11210(f), 11223(b)]

(b) If the boiler is installed with an oxygen trim system that maintains an optimum air-to-fuel ratio, the Permittee shall conduct a tune-up of the boiler every 5 years according to the procedures stated in Condition V.F.2.c. Each 5-year tune-up shall be conducted no more than 61 months after the previous tune-up. The first 5-year tune-up shall be conducted no later than 61 months after the initial startup. The Permittee may delay the burner inspection specified in Condition V.F.2.c.(1) and inspection of the system controlling the air-to-fuel ratio specified in Condition V.F.2.C.(3) until the next scheduled unit shutdown, but shall inspect each burner and system controlling the air-to-fuel ration at least once every 72 months.
[40 CFR 63.11223(c)]

c. Tune-up Procedures

The Permittee shall conduct a boiler tune-up according to the following procedures:

(1) As applicable, inspect the burner, and clean or replace any components of the burner as necessary (this may be delayed until the next scheduled unit shutdown, but the burner must be inspected at least once every 36 months from the previous inspection).

(2) Inspects the flame pattern, as applicable, and adjust the burner as necessary to optimize the flame pattern. The adjustment should be

consistent with the manufacturer's specifications, if available.

(3) Inspect the system controlling the air-to-fuel ratio, as applicable, and ensure that it is correctly calibrated and functioning properly (this may be delayed until the next scheduled unit shutdown, not to exceed 36 months from the previous inspection).

(4) Optimize total emissions of carbon monoxide. This optimization should be consistent with the manufacturer's specifications, if available, and with any nitrogen oxide requirement to which the unit is subject.

(5) Measure the concentrations in the effluent stream of carbon monoxide in parts per million, by volume, and oxygen in volume percent, before and after the adjustments are made (measurements may be either on a dry or wet basis, as long as it is the same basis before and after the adjustments are made). Measurements may be taken using a portable CO analyzer.

(6) Maintain onsite and submit, if requested by the Director or Administrator, a report containing the following information:

(a) The concentrations of CO in the effluent stream in parts per million, by volume, and oxygen in volume percent, measured at high fire or typical operating load, before and after the tune-up of the boiler.

(b) A description of any corrective actions taken as a part of the tune-up of the boiler.

[40 CFR 63.11223(b)]

(7) If the unit is not operating on the required date for a tune-up, the tune-up must be conducted within 30 days of startup.

[40 CFR 63.11223(b)]

4. Notification, Reporting and Recordkeeping Requirements

a. As required in 40 CFR 63.9(b)(2), the Permittee shall submit the initial notification no later than January 2014, or within 120 calendar days after commencing construction of the boiler. The notification shall be submitted to the Director and the Administrator.

[40 CFR 63.11225(a), 63.1125(a)(2)]

b. The Permittee shall submit a Notice of Compliance Status no later than 120 days of boiler startup and shall include certification(s) of compliance statement signed by a responsible official. The Notification of Compliance Status shall include information required in 40 CFR 63.9(h)(2), except for the information listed in 40 CFR 63.9(h)(2)(i)(B),(D),(E) and (F). The notification to the Administrator shall be submitted electronically using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). However, if the reporting form specific to this subpart is not available in CEDRI at the time that the report is due, the written Notification of Compliance Status shall be submitted to the Administrator at the appropriate address listed in 40 CFR 63.13.

[40 CFR 63.11225(a)(4), 63.112259(a)(4)(vi)]

c. The Permittee shall include a statement that the facility complies with the requirements of Condition V.F.2.b to conduct a biennial or five-year tune-up, as applicable, of the boiler in the semiannual compliance certifications required under Attachment "A" of this permit:

[40 CFR 63.11225(b)]

d. The Permittee shall keep the following records:

(1) Copy of each notification and report submitted under this section and all documentation supporting the Notification of Compliance Status.

(2) Documents showing conformance with work practices. Records shall identify the date of boiler tune-up, the procedures followed for the tune-up, and the manufacturer's specifications to which the boiler was tuned.

[40 CFR 63.11225(c)(1), (c)(2)]

d. The Permittee shall maintain onsite and submit, if requested by the Director or Administrator, a report containing the following information about the tune-ups.

(1) The concentrations of CO in the effluent stream in parts per million, by volume, and oxygen in volume percent, measured before and after the tune-up of the boiler.

(2) A description of any corrective actions taken as a part of the tune-up of the boiler.

(3) Records of occurrence, duration, and corrective action taken for each malfunction of the boiler.

[40 CFR 63.11223(b)(6), 11225(c)(4), and -(c)(5)]

5. Permit Shield

Compliance with this Section shall be deemed compliance 40 CFR 63.11205(a), -63.11201(b), 63.11214(d), 63.11223(a), -11223(b), -11223(b)(6), 63.11225(a)(2), -11225(a)(4), -11225(c)(2), (c)4, (c)5, and 63.11223(b)(6),.

[A.A.C. R18-2-325]

VI. SOLVENT EXTRACTION / ELECTORWINNING (SX/EW) PROCESS

A. Applicability

This Section applies to the equipment used in the SX/EW process, excluding the Hot Water Generator, as identified in the equipment list in Attachment "C" of this permit.

B. Emission Limitations

1. Opacity

   The Permittee shall not cause, allow or permit visible emissions from the SX/EW process in excess of 20% opacity, as measured by EPA Reference Method 9.
   [A.A.C. R18-2-702.B]

2. Volatile Organic Compounds

   a. Materials including solvents or other volatile compounds, acids and alkalis utilized shall be processed, stored, used and transported in such a manner and by such means that they will not evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices or other equipment shall be mandatory. [A.A.C. R18-2-730.F]

   b. Where a stack, vent or other outlet is at such a level that fumes, gas mist, odor, smoke, vapor or any combination thereof constituting air pollution is discharged to adjoining property, the Director may require the installation of abatement equipment or the alteration of such stack, vent or other outlet by the Permittee to a degree that will adequately dilute, reduce or eliminate the discharge of air pollution to adjoining property. [A.A.C. R18-2-730.G]

   c. The Permittee shall not cause or permit the emission of gaseous or odorous materials from equipment, operations, and premises under its control in such quantities or concentrations as to cause air pollution.
   [A.A.C. R18-2-730.D]

C. Air Pollution Control Requirements

1. *The Permittee shall install, operate* and maintain *two scrubbers at all times the electrowinning process is in operation to control emissions of sulfuric acid in the electrowinning process.*
   [A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
   [Material permit conditions are indicated by underline and italics]

2. The Permittee shall add dilute sulfuric acid to the leach pad either through low-pressure wobblers or a drip system to minimize acid mist emissions.
   [A.A.C. R18-2-306.A.2]

3. *The Permittee shall install*, maintain and *use covers in the designed fashion on the SX mixer settler tanks to control acid mist emissions from the Solution Extraction Plant*.
   [A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
   [Material permit conditions are indicated by underline and italics]

4. *The Permittee shall use one or more of the following methods to control emissions from the Electrowinning Tankhouse Cells*:

   a. *Foam;*

   b. *Dispersion Balls/Poly Balls;*

c. *Surfactants;*

d. *Other effective means of controlling sulfuric acid emissions approved by the Director*.

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

D. Recordkeeping Requirements

The Permittee shall keep a record of the method that is used to control emissions from the electrowinning tankhouse cells. [A.A.C. R18-2-306.A.4.a]

E. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-730.D, F, G and -702.B. [A.A.C. R18-2-325]

VII. INTERNAL COMBUSTION ENGINES (ICE)

A. Applicability

This Section is applicable to the generators identified as subject to New Source Performance Standards (NSPS) Subpart IIII in the equipment list in Attachment "C".

B. General Requirements

1. The Permittee shall not install any new stationary compression ignition internal combustion engine (CI ICE) (excluding fire pump engines) that does not meet the applicable requirements for 2007 model year engines. [40 CFR 60.4208]

2. An emergency CI ICE shall be limited to emergency situations and required testing and maintenance only such as to produce power for critical networks or equipment (including power supplied to portions of a facility) when electric power from the local utility (or the normal power source, if the facility runs on its own power production) is interrupted, or used to pump water in the case of fire or flood, etc. Stationary CI ICE used to supply power to an electric grid or that supply power as part of a financial arrangement with another entity shall not be considered to be emergency engines. Notwithstanding the foregoing, emergency stationary ICE may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Maintenance checks and readiness testing of such units is limited to 100 hours per year. There is no time limit on the use of emergency stationary ICE in emergency situations. The owner or operator may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner or operator maintains records indicating that Federal, State, or local standards require maintenance and testing of emergency ICE beyond 100 hours per year. Emergency stationary ICE may operate up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing. The 50 hours per year for non-emergency situations cannot be used for peak shaving or to generate income for a facility to supply power to an electric grid or otherwise supply non-emergency power as part of a financial arrangement with another entity. For owners and operators of emergency engines, any operation other than

emergency operation, maintenance and testing, and operation in non-emergency situations for 50 hours per year, as permitted in this condition, is prohibited.

[40 CFR 60.4219, 60.4211(f)]

C. Operating Requirements

1. *The Permittee shall not operate any emergency CI ICE for any reason other than emergency operation, or maintenance and testing, and in non-emergency situations for no more than 50 hours per year.* [40 CF 60.4211(f), A.A.C.R18-2-331.A.3.a]

   [Material permit conditions are indicated by underline and italics]

2. *The Permittee shall install a non-resettable hour meter prior to startup of the engine.*

   [A.A.C.R18-2-306.A.3.C, and -331.A.3.a]

   [Material Permit Conditions are indicated by underline and italics]

3. The Permittee shall operate and maintain the CI ICE and the control device according to the manufacturer's written instructions, over the entire life of the engine.

   [40 CFR 60.4211(a), 60.4206]

4. The Permittee shall only change those engine settings that are permitted by the manufacturer. [40 CFR 60.4211(a)]

5. The Permittee shall meet the applicable requirements of 40 CFR Part 89, 94 and/or 1068, as they may apply to the Permittee. [40 CFR 60.4211(a)]

6. The Permittee may operate the stationary ICE for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State, or local government, the manufacturer, the vendor, or the insurance company associated with the engine. [40 CFR 60.4211(f)]

7. Maintenance checks and readiness testing of such units is limited to 100 hours per year. The Permittee may petition the Administrator and the Director for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the Permittee maintains records indicating that Federal, State, or local standards require maintenance and testing of emergency ICE beyond 100 hours per year. The Permittee may operate the emergency stationary ICE for up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing.

   [40 CFR 60.4211(f)]

8. Permit Shield

   Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4206, and 60.4211(a) and (f). [A.A.C. R18-2-325]

D. Fuel Requirements

1. The Permittee shall use only diesel fuel that meets the requirements of nonroad diesel fuel listed in 40 CFR 80.510(b) and listed below:

   a. Sulfur content: 15 ppm maximum; and

   b A minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

   [40 CFR 60.4207(b)]

2. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4207(b). [A.A.C. R18-2-325]

E. Emission Limitations and Standards

1. The Permittee shall comply with the emission standards listed in the corresponding applicable regulations as stated in the Table below:

[40 CFR 60.4205(a), (b), (c), and (f)]

Table: Emission Standards for Emergency ICE

Engine Type	Displacement (Liters per cylinder)	Applicable regulations
Non-Fire Pump Engines	Less than 30	New Nonroad engines in 40 CFR 60.4202
Fire Pump	Less than 30	Table 4 of 40 CFR Part 60 Subpart IIII

2. Permit Shield [A.A.C. R18-2-325]

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4205(a), 40 CFR 60.4205(b), 40 CFR 60.4205(f), and 40 CFR 60.4205(c).

F. Compliance Requirements

1. The Permittee operating a 2007 model year and later stationary CI ICE or a CI fire pump engine that is manufactured during or after the model year that applies to the fire pump engine power rating in Table 3 of 40 CFR Part 60, Subpart IIII, shall comply by purchasing an engine certified to the emission standards in 40 CFR 60.4205(b) or (c), as applicable, for the same model year and maximum (or in the case of fire pumps, NFPA nameplate) engine power. The engine must be installed and configured according to the manufacturer's specifications. [40 CFR 60.4211 (c)]

2. If the Permittee does not install, configure, operate, and maintain the CI ICE and control device according to the manufacturer's emission-related written instructions, or change the emission-related setting in a way that is not permitted by the manufacturer, the Permittee shall demonstrate compliance as following:

   a. CI ICE less than 100 HP

   The Permittee shall keep a maintenance plan and records of conducted maintenance to demonstrate compliance and shall, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, if the Permittee does not install and configure the engine and control device according to the manufacturer's emission-related written instructions, or change the emission-related settings in a way that is not permitted by the manufacturer, the Permittee shall conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of such action.

b. CI ICE greater than or equal to 100 HP and less than or equal to 500 HP

The Permittee shall keep a maintenance plan and records of conducted maintenance and shall, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, the Permittee shall conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of such action or within 1 year after the engine and control device is no longer installed, configured, operated, and maintained in accordance with the manufacturer's emission-related written instructions, or within 1 year after you change emission-related settings in a way that is not permitted by the manufacturer.

c. CI ICE greater than 500 HP

The Permittee shall keep a maintenance plan and records of conducted maintenance to demonstrate compliance and shall, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, the Permittee shall conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of startup, or within 1 year after changing any non-permitted emission-related setting on the engine. Subsequent tests shall be conducted every 8760 hours of engine operation or 3 years, whichever comes first.
[40 CFR 60.4211(g)]

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4211(c), and 40 CFR 60.4211(g). [A.A.C.R18-2-325]

G. Recordkeeping Requirements [40 CFR 60.4214(b)]

1. Starting with model years in Table 5 of 40 CFR Subpart IIII, the Permittee operating an emergency ICE that does not meet the standards applicable to non-emergency engines in the applicable model year, shall keep records of the operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter.

2. The Permittee shall record the dates and start and stop times when the ICE is operated and the reason it was in operation during that time.

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4214(b). [A.A.C. R18-2-325]

VIII. FUGITIVE DUST REQUIREMENTS

A. Applicability

This Section applies to any source of fugitive dust at the facility.

B. Particulate Matter and Opacity

1. Open Areas, Roadways & Streets, Storage Piles, and Material Handling

a. Emission Limitations

(1) Opacity of emissions from any fugitive dust non-point source shall not be greater than 40% measured in accordance with the Arizona Testing Manual, Reference Method 9.

[A.A.C. R18-2-614]

(2) The Permittee shall not cause, allow or permit visible emissions from any fugitive dust point source, in excess of 20 percent opacity. [A.A.C-R18-2-702.B]

(4) The Permittee shall employ the following reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne:

(a) Keep dust and other types of air contaminants to a minimum in an open area where construction operations, repair operations, demolition activities, clearing operations, leveling operations, or any earth moving or excavating activities are taking place, by good modern practices such as using an approved dust suppressant or adhesive soil stabilizer, paving, covering, landscaping, continuous wetting, detouring, barring access, or other acceptable means; [A.A.C. R18-2-604.A]

(b) Keep dust to a minimum from driveways, parking areas, and vacant lots where motor vehicular activity occurs by using an approved dust suppressant, or adhesive soil stabilizer, or by paving, or by barring access to the property, or by other acceptable means;

[A.A.C. R18-2-604.B]

(c) Keep dust and other particulates to a minimum by employing dust suppressants, temporary paving, detouring, wetting down or by other reasonable means when a roadway is repaired, constructed, or reconstructed;

[A.A.C. R18-2-605.A]

(d) Take reasonable precautions, such as wetting, applying dust suppressants, or covering the load when transporting material likely to give rise to airborne dust;

[A.A.C. R18-2-605.B; PCC 17.16.050.A]

(e) Take reasonable precautions, such as the use of spray bars, wetting agents, dust suppressants, covering the load, and hoods when crushing, handling, or conveying material likely to give rise to airborne dust;

[A.A.C. R18-2-606; PCC 17.16.100.A]

(f) Take reasonable precautions such as chemical stabilization, wetting, or covering when organic or inorganic dust producing material is being stacked, piled, or otherwise stored; [A.A.C. R18-2-607.A]

(g) Operate stacking and reclaiming machinery utilized at storage piles at all times with a minimum fall of material, or with the use of spray bars and wetting agents; [A.A.C. R18-2-607.B]

(h) Any other method as proposed by the Permittee and approved by the Director. [A.A.C. R18-2-306.A.3.c]

(i) Operate mineral tailings piles by taking reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne. Reasonable precautions shall mean wetting, chemical stabilization, revegetation or such other measures as are approved by the Director. [A.A.C R18-2-608]

(5) The Permittee shall not construct new unpaved service roads or unpaved haul roads such that the total lengths of operational unpaved roads do not exceed the estimates in the permit application. [A.A.C R18-2-306.A.3]

b. Air Pollution Control Requirements

(1) *The Permittee shall pave the entrance road leading to RCP from the State Route 83 and light duty roads as described in the map listed in Attachment "E".*

[A.A.C. R18-2-306.01 and -331.A.3. d]
[Material Permit Conditions are indicated by underline and italics]

(2) *Water, or an equivalent control, shall be used to control visible emissions from haul roads and storage piles.*

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

(3) *The Permittee shall comply with the dust control measures identified in the Dust Control Plan specified in Attachment "D" of this permit.*

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

(4) *The Permittee shall use appropriate means, such as berms, signs or other effective procedures, to restrict traffic usage to the treated areas*. Should there be a rock spill on a roadway such that traffic is blocked, the Permittee shall clean up the spill; under no circumstances is traffic to be diverted to untreated areas to avoid the spill. This condition does not prohibit cleanup equipment from using untreated areas in the course of cleanup activities.

[A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

(5) Mineral Tailings

(a) ***At least 180 days prior to start of dry tailings deposition in the mineral tailings area, the Permittee shall submit a dry tailings management plan (TMP) to minimize fugitive dust from the tailings. The plan shall be submitted as part of a significant permit revision application. Upon approval by the Director, the Permittee shall comply with the plan.*** [A.A.C. R18-2-306.A.2 and -331.A.3.e]

[Material Permit Conditions are indicated by underline and italics]

(b) The TMP shall address the following operational requirements:

1) Tailings dust control during normal non-perimeter buttress construction operations;

2) Tailings dust control during perimeter buttress construction;

3) Tailings dust control at all other times.

4) Additional tailings dust control and monitoring methods during periods of high winds.

(6) The Permittee shall effectively control dust emissions from the transportation of materials by covering stock loads in open-bodied trucks, limiting vehicular speeds, or other equivalently effective controls. [P.C.C. 17.16.100.C]

c. Speed Limits on Haul Roads

(1) The Permittee shall post, provide training, and implement a speed limit of 35 mph for all vehicles travelling on the property. [A.A.C. R18-2-306.A.2]

(2) Notwithstanding (1) above, the speed for haul trucks shall not exceed 15 mph. [A.A.C. R18-2-306.A.2]

d. Monitoring Requirements

(1) The Permittee shall keep records to demonstrate compliance with the speed limit in Condition VIII.B.1.c.(2). [A.A.C. R18-2-306.A.2 and 306.A.3.c]

(2) The Permittee shall maintain records of the dates on which any of the activities listed in Conditions VIII.B.1.a.(4)(a) through VIII.B.1.a.(4)(i) above were performed and the control measures that were utilized. [A.A.C. R18-2-306.A.3.c]

(3) Opacity Monitoring Requirements

(a) A certified Method 9 observer shall conduct a weekly visual survey of visible emissions from the fugitive dust sources excluding the mineral tailings. The survey shall be conducted in accordance with the Visible Emissions Observations Methodology identified in Condition II.B of this Attachment.

(b) A certified Method 9 observer shall conduct at least twice daily, surveys of visible emissions from the mineral tailings starting from the day the buttress construction begins. The observations shall be conducted from strategic locations to be identified and submitted to the Director. The locations shall be identified as an attachment to the TMP titled Fugitive Lookout Points.

(4) Mineral Tailings

(a) The Permittee shall follow all the monitoring provisions identified in the approved TMP. [A.A.C. R18-2-306.A.3.c]

(b) When wind speeds are at or above 15 mph, or gusts at or above 20 mph, the Permittee shall physically inspect the tailings at least once daily for easily erodible areas. [A.A.C. R18-2-306.A.3.c]

(c) The Permittee shall review the TMP annually for its effectiveness in controlling fugitive emissions. The review shall be submitted to the Director by January 31st of each year (covering the period January 1st through December 31st of the previous year). If the review of the plan shows ineffectiveness in controlling emissions, the Permittee shall submit a revised plan for approval by April 1 following the annual review. The revised TMP shall show improved methods/techniques for reducing emissions in order to minimize or prevent further violations. The annual review shall take into account past compliance issues, resolved/unresolved including validated complaints reported the Department and propose how those issues can be avoided in the future. Recommendations or stricter requirements will be prescribed by the Department should the Permittee's annual review show that changes are required but not proposed by the Permittee. [A.A.C. R18-2-306.A.3.c]

e. Recordkeeping Requirements [A.A.C.R18-2-306.A.3.c]

(1) The Permittee shall record the results of the required monitoring as detailed in the approved TMP.

(2) When the wind speeds are at or above 15 mph, or gusts are at or above 20 mph, the Permittee shall maintain a record of all meteorological data, all tailings inspections, all control measures used and corrective action(s) taken to demonstrate compliance with the opacity limitations.

(3) The Permittee shall maintain a copy of watering schedules per shift basis.

f. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-604.A and B, 605.A and B, 606, 607.A and B, 614, 702.B and P.C.C17.16.040.A.1, 17.16.100.A&C., 17.16.050.A, and Pima County SIP Rule 343. [A.A.C. R18-2-325]

IX. GASOLINE STORAGE AND DISPENSING

A. Applicability

1. This Section applies to the following:

a. Gasoline Dispensing Facilities (GDFs), Storage tanks at the GDFs listed in Equipment List, Attachment "C", associated equipment components in vapor or liquid gasoline service, pressure/vacuum vents on gasoline storage tanks, and equipment necessary to unload product from cargo tanks into storage tanks at GDFs. The equipment used for the refueling of motor vehicles is not covered. [40 CFR 63.11111 (a), (b), & (c), and 63. 11112(a)]

b. Each gasoline cargo tank during the delivery of product to a GDF. [40 CFR 63.11111(a)]

2. Definition of Monthly Throughput

Monthly throughput means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at each GDF during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the current day, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the previous 364 days, and then dividing that sum by 12. [40 CFR 63.11132]

B. Operating Requirements

1. The Permittee shall at all times, operate and maintain any affected source, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Director or Administrator which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source. [40 CFR 63.11115(a)]

2. The Permittee shall not allow gasoline to be handled in a manner that would result in vapor releases to the atmosphere for extended periods of time. Measures to be taken include, but are not limited to, the following:

a. Minimize gasoline spills;

b. Clean up spills as expeditiously as practicable;

c. Cover all open gasoline containers and all gasoline storage tank fill-pipes with a gasket seal when not in use;

d. Minimize gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices, such as oil/water separators.

[40 CFR 63.11116(b)]

3. Submerged Fill Pipes [40 CFR 63.11117(a)]

a. The Permittee shall only load gasoline into storage tanks by utilizing submerged fill pipes that are no more than 6 inches from the bottom of the storage tank.

b. If the submerged fill pipes do not meet the specifications specified above, the Permittee shall demonstrate that the liquid level in the tank is always above the entire opening of the fill pipe. Documentation providing such demonstration must be made available for inspection by the Director or Administrator's delegated representative during the course of a site visit.

4. If any GDF referenced above increases the monthly throughput over 100,000 gallons per month, the Permittee shall comply with new applicable provisions of Subpart CCCCCC within 3 years of the GDF unit becoming subject to the new requirements. [40 CFR 63.11113(c)]

5. All gasoline storage tanks shall be equipped with a submerged filling device, or acceptable equivalent, for the control of hydrocarbon emissions. [A.A.C. R18-2-710.B]

6. All pumps and compressors which handle volatile organic compounds (VOCs) shall be equipped with mechanical seals or other equipment of equal efficiency to prevent the release of organic contaminants into the atmosphere.

[A.A.C. R18-2-710.D]

C. Recordkeeping Requirements [A.A.C. R18-2-710.E.3]

1. The Permittee shall maintain monthly record of the gasoline throughput of each GDF as detailed in Condition IX.A.2. [A.A.C. R18-2-306.A.3.c]

2. The Permittee shall have records available within 24 hours of request by the Director or Administrator documenting the gasoline throughput. [40 CFR 63.11117(d)]

3. The Permittee shall, for the gasoline storage tanks, maintain a file of the typical Reid vapor pressure of gasoline stored and of dates of storage. Dates on which the storage vessel is empty shall be shown. [A.A.C. R18-2-710.E.1]

4. If the gasoline stored has a true vapor pressure greater than 470 mm Hg (9.1 psia), the Permittee shall record the average monthly temperature, and true vapor pressure of gasoline at such temperature. [A.A.C. R18-2-710.E.2.b]

5. The average monthly storage temperature shall be an arithmetic average calculated for each calendar month, or portion thereof, if storage is for less than a month, from bulk liquid storage temperature determined at least once every seven days.

6. The true vapor pressure shall be determined by the procedures in American Petroleum Institute Bulletin 2517, amended as of February 1980 (and no future editions), which is incorporated herein by reference and on file with the Office of the Secretary of State. This procedure is dependent upon determination of the storage temperature and the Reid vapor pressure, which requires sampling of the petroleum liquids in the storage vessels. Unless the Director requires in specific cases that the stored petroleum liquid be sampled, the true vapor pressure may be determined by using the average monthly storage temperature and the typical Reid vapor pressure. For those liquids for which certified specifications limiting the Reid vapor pressure exist, the Reid vapor pressure may be used. For other liquids, supporting analytical data must be made available upon request to the Director when typical Reid vapor pressure is used. [A.A.C. R18-2-710.E.4]

D. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-710.B, D, E.1, E.2.b, E.3 and E.4, 40 CFR 63.11111(a),(b),(c), 40 CFR 63.11112(a), 63.11113(c), 40 CFR 63.11115(a), 40 CFR 63.11116(b), and 40 CFR 63.11117(a), (d).
[A.A.C. R18-2-325]

X. STORAGE TANKS

A. Applicability

This Section is applicable to the storage tanks identified in the equipment list in Attachment "C" of this permit.

B. Operating Requirements

1. The Permittee shall not emit gaseous or odorous materials from the diesel storage tanks in such quantities or concentrations as to cause air pollution.
[A.A.C.R18-2-730.D]

2. Materials including solvents or other volatile compounds, paints, acids, and alkalies shall be processed, stored, used and transported in such a manner and by such means that they will not evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices, or equipment shall be mandatory.
[A.A.C. R18-2-730.F]

3. Where a stack, vent, or other outlet is at such a level that odor, smoke, vapor or any combination thereof constituting air pollution is discharged to adjoining property, the Director may require the installation of abatement equipment or the alteration of such stack, vent, or other outlet by the Permittee to a degree that will adequately dilute, reduce, or eliminate the discharge of air pollution into adjoining property. [A.A.C. R18-2-730.G]

C. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-730.D, -730.F, and -730.G. [A.A.C. R18-2-325]

XI. OTHER PERIODIC ACTIVITY REQUIREMENTS

A. Abrasive Blasting

Particulate Matter and Opacity

1. Emission Limitations

   a. The Permittee shall not cause or allow sandblasting or other abrasive blasting without minimizing dust emissions to the atmosphere through the use of good modern practices. Good modern practices include:

      (1) wet blasting;

      (2) effective enclosures with necessary dust collecting equipment; or

      (3) any other method approved by the Director.

      [A.A.C. R18-2-726]

   b. Opacity

      The Permittee shall not cause, allow or permit visible emissions from sandblasting or other abrasive blasting operations in excess of 20% opacity, as measured by EPA Reference Method 9.

      [A.A.C. R18-2-702.B]

2. Monitoring and Recordkeeping Requirement

   Each time an abrasive blasting project is conducted, the Permittee shall keep records of the following:

   a. The date the project was conducted;

   b. The duration of the project; and

   c. Type of control measures employed.

   [A.A.C. R18-2-306.A.3.c]

3. Permit Shield

   Compliance with this Section shall be deemed compliance with A.A.C. R18-2-726, A.A.C. R18-2-702.B. [A.A.C.R18-2-325]

B. Use of Paints

1. Volatile Organic Compounds

   a. Emission Limitations

      While performing spray painting operations, the Permittee shall comply with the following requirements:

      (1) The Permittee shall not conduct or cause to be conducted any spray painting operation without minimizing organic solvent emissions. Such operations, other than architectural coating and

spot painting, shall be conducted in an enclosed area equipped with controls containing no less than 96 percent of the overspray.

[A.A.C.R18-2-727.A]

(2) The Permittee or their designated contractor shall not either:

(a) Employ, apply, evaporate, or dry any architectural coating containing photochemically reactive solvents for industrial or commercial purposes; or

(b) Thin or dilute any architectural coating with a photochemically reactive solvent.

[A.A.C.R18-2-727.B]

(3) For the purposes of Condition XI.B.1.a.(2), a photochemically reactive solvent shall be any solvent with an aggregate of more than 20 percent of its total volume composed of the chemical compounds classified in Conditions XI.B.1.a.(3).(a) through XI.B.1.a.(3).(c) below, or which exceeds any of the following percentage composition limitations, referred to the total volume of solvent:

(a) A combination of the following types of compounds having an olefinic or cyclo-olefinic type of unsaturation-hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones: 5 percent.

(b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent.

(c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent.

[A.A.C.R18-2-727.C]

(4) Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the groups of organic compounds described in Conditions XI.B.1.a.(3)(a) through XI.B.1.a.(3)(c) above, it shall be considered to be a member of the group having the least allowable percent of the total volume of solvents.

[A.A.C.R18-2-727.D]

b. Monitoring and Recordkeeping Requirements

(1) Each time a spray painting project is conducted, the Permittee shall keep records of the following:

(a) The date the project was conducted;

(b) The duration of the project;

(c) Type of control measures employed;

(d) Material Safety Data Sheets for all paints and solvents used in the project; and

(e) The amount of paint consumed during the project.

(2) Architectural coating and spot painting projects shall be exempt from the recordkeeping requirements of Condition X.B.1.b.(1) above. [A.A.C. R18-2-306.A.3.c]

c. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-727.A, B, C, and D. [A.A.C.R18-2-325]

2. Opacity

a. Emission Limitations

The Permittee shall not cause, allow or permit visible emissions from painting operations in excess of 20% opacity, as measured by EPA Reference Method 9. [A.A.C. R18-2-702.B]

b. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C.R18-2-702.B. [A.A.C. R18-2-325]

C. Demolition/Renovation - Hazardous Air Pollutants

1. Emission Limitations

The Permittee shall comply with all of the requirements of 40 CFR 61 Subpart M (National Emissions Standards for Hazardous Air Pollutants - Asbestos). Notices shall be filed with the Pima County Department of Environmental Quality. [A.A.C. R18-2-1101.A.8]

2. Monitoring and Recordkeeping Requirement

The Permittee shall keep all required records in a file. The required records shall include the "NESHAP Notification for Renovation and Demolition Activities" form and all supporting documents. [A.A.C. R18-2-306.A.3.c]

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-1101.A.8. [A.A.C. R18-2-325]

XII. MOBILE SOURCE REQUIREMENTS

A. Applicability

The requirements of this Section are applicable to mobile sources which either move while emitting air contaminants or are frequently moved during the course of their utilization but are not classified as motor vehicles, agricultural vehicles, or agricultural equipment used in normal farm operations. Mobile sources shall not include portable sources as defined in A.A.C. R18-2-101.90. [A.A.C.R18-2-801.A]

B. Particulate Matter and Opacity

1. Emission Limitations

a. Off-Road Machinery

The Permittee shall not cause, allow, or permit to be emitted into the atmosphere from any off-road machinery, smoke for any period greater than ten consecutive seconds, the opacity of which exceeds 40%. Visible emissions when starting cold equipment shall be exempt from this requirement for the first ten minutes. Off-road machinery shall include trucks, graders, scrapers, rollers, and other construction and mining machinery not normally driven on a completed public roadway.
[A.A.C.R18-2-802.A and -802.B]

b. Roadway and Site Cleaning Machinery

(1) The Permittee shall not cause, allow or permit to be emitted into the atmosphere from any roadway and site cleaning machinery smoke or dust for any period greater than ten consecutive seconds, the opacity of which exceeds 40%. Visible emissions when starting cold equipment shall be exempt from this requirement for the first ten minutes. [A.A.C.R18-2-804.A]

(2) The Permittee shall take reasonable precautions, such as the use of dust suppressants, before the cleaning of a site, roadway, or alley. Earth or other material shall be removed from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water or by other means.

c. Unless otherwise specified, no mobile source shall emit smoke or dust the opacity of which exceeds 40%. [A.A.C.R18-2-801.B]

2. Recordkeeping Requirement

The Permittee shall keep a record of all emissions related maintenance activities performed on the Permittee's mobile sources stationed at the facility as per manufacturer's specifications. [A.A.C.R18-2-306.A.5.a]

3. Permit Shield [A.A.C.R18-2-325]

Compliance with this Section shall be deemed compliance with A.A.C. R18-2-801.A and B, A.A.C. R18-2-802.A and B, and A.A.C. R18-2-804.A and B.

XIII. PUBLIC ACCESS RESTRICTIONS

At least 90 days prior to beginning construction of the mine, the Permittee shall submit to the Director a Public Access Restriction Plan (Plan) that include measures such as fencing, natural topographic barriers, signage, security patrols, and access restrictions to adjacent private property to restrict public access to the RCC site. The Plan shall be implemented within 30 days after approval by the Director. [A.A.C.R18-2-306.A.2]

XIV. AMBIENT MONITORING REQUIREMENTS

[A.A.C.R18-2-306.A.3.d]

A. Meteorological Monitoring Requirements

1. Within 180 days of permit issuance, the Permittee shall develop and submit to the Director a monitoring and reporting protocol and a quality assurance project plan (QAPP) for the installation and operation of a meteorological monitoring station. The Permittee shall utilize appropriate EPA guidance for the collection of the meteorological data to be used in air quality dispersion models.

2. Within 90 days prior to the startup of the mine operations, the Permittee shall install, maintain and operate a meteorological monitoring station to record wind speed, vector wind direction, standard deviation of wind direction, Δt, and relative humidity. This monitoring shall be installed, maintained, and operated in accordance with applicable sections and appendices of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Measurements and consistent with the monitoring protocol approved by the Director, addressing all general requirements, meteorological station operations, and quality assurance initiatives.

3. The meteorological data measurements shall be collected continuously. One hour averages of all data including wind data and wind gust shall be collected. In the event of system malfunction, the unit shall be repaired or replaced as expeditiously as practicable to restore normal monitoring. If the repair of the unit is not feasible within 24 hours of the time when the Permittee first learned of the malfunction, the Permittee shall notify the Department of any such malfunction and expected duration.

4. The Permittee shall conduct annual audits of the meteorological monitoring stations consistent with applicable sections and appendices of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Measurements, utilizing a qualified auditor that is independent of the Permittee.

5. The Permittee shall provide before the 90th day of the following quarter, electronic files of the validated meteorological data in the Department's Data Collection System (DCS) format

   a. The validated data submitted for upload to the ADEQ database shall contain the following:

      (1) Date and hour of each measurement at each site; and

      (2) Hourly average meteorological parameters specified above, in the appropriate measurement units, per the monitoring protocol.

      (3) Qualifier and validation codes as necessary to support the data validation.

6. Meteorological Monitoring Reports

   a. An electronic report summarizing the meteorological data measurements collected pursuant to this section shall be submitted before the 90th day of the following quarter. An annual summary of quality assurance data shall be included in Meteorological Monitoring Report for the fourth quarter of the calendar year.

b. The quarterly reports shall contain the following information:

(1) Hourly meteorological data in DCS format quality assured and corrected by the Permittee, including appropriate DCS flags;

(2) Data recovery reports;

(3) Any field service activities; and

(4) Any other information required in the monitoring protocol.

(5) Description of any instrument problems affecting the data, any data validation concerns, and any comments on meteorological conditions occurring during the quarter.

c. Two electronic copies of the quarterly and annual reports shall be mailed to the Air Assessment Section and the report's cover letter without attachments shall be copied to the Air Compliance Section of the Air Quality Division of the Department.

B. PM_{10} Monitoring

1. General Requirements

a. Within 180 days of permit issuance, the Permittee shall develop and submit to the Director a monitoring and reporting protocol and a quality assurance plan for the PM_{10} monitor. The PM10 method shall be an Federal Reference Method (FRM) or a Federal Equivalent Method (FEM) as defined by U.S. EPA.

b. Within 90 days prior to the startup of mine operations, the Permittee shall install, operate and maintain a continuous particulate matter monitor at the Rosemont Copper Project site to monitor ambient concentrations of PM_{10}.

c. If the monitored daily average of PM_{10} is greater than 150 $\mu g/m^3$, the Permittee shall notify the Director of the event by a FAX communication within 24 hours of discovery. The cause of the exceedance shall be included in the notification, if known. It shall be the responsibility of the Permittee to demonstrate to the satisfaction of the Director whether the exceedance was or was not primarily caused by the Permittee's operations. If such concentrations are not shown to be primarily the result of emissions from a source or sources other than the Permittee, the Permittee shall implement immediate actions, including, but not limited to, a reduction in the level of operations, with the intention of avoiding a repeat of the exceedance. The immediate corrective actions shall be continued until the alternative control plan is implemented. The Permittee shall be required to develop an alternative control plan to eliminate the problem(s). The additional corrective actions to be taken shall be reported to the Director with a schedule for implementing those actions.

2. Sampling Frequency

   a. The Permittee shall operate the monitor continuously, collecting consecutive hourly readings except during periods of routine maintenance, instrument calibration or malfunction.

   b. In the event of system malfunction, the unit shall be repaired or replaced as soon as possible. Monitoring shall resume as soon as practicable after the correction of the malfunction problem. The Permittee shall report the malfunction to the Director within 24 hours of discovery. A malfunction shall mean equipment or operation issues other than routine maintenance or instrument calibration that result in invalidating a 24-hour sampling day. The report shall contain the probable reason for malfunction and a plan for repairing or replacing the affected equipment

3. PM_{10} Monitoring Quality Assurance/Quality Control

   a. The monitor shall be operated, calibrated, and maintained in accordance with applicable sections and appendices of 40 CFR Parts 50 and 58 and Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, U.S. Environmental Protection Agency and in accordance with the procedures set forth in the respective manufacturer's instruction manuals.

   b. The Permittee shall conduct monthly flow checks on the monitoring equipment during the 1st half of every calendar month.

   c. The Permittee shall conduct semi-annual (every six months) performance audits of the monitoring equipment in accordance with the requirements pertaining to sampler accuracy as specified in Appendix A of 40 CFR Part 58. The performance audits shall be conducted by a qualified auditor that is independent of the Permittee.

   d. The Permittee shall conduct technical systems audits of the PM_{10} ambient air monitoring program consistent with the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, U.S. Environmental Protection Agency. The technical systems audits shall be conducted by a qualified auditor that is independent of the Permittee at least once in every three (3) years.

   e. The Permittee and/or its monitoring contractor shall participate in technical systems audits or performance audits periodically conducted by the Department. The Department shall provide a minimum of 30 days notice of a technical systems audit and a minimum of 48 hours notice of a performance audit.

4. PM_{10} Monitoring Reporting Requirements

   a. The Permittee shall calculate the quarterly and annual summary statistics in accordance with the procedures of 40 CFR Part 50 and Appendices.

b. The Permittee shall calculate the precision and accuracy statistics in accordance with the procedures of 40 CFR Part 58 Appendix A.

c. Valid data recovery shall meet the EPA minimum data completeness requirement of 75 percent per quarter or the percentage specified in 40 CFR Part 50. Valid data shall refer to all observations collected for the specific monitoring purpose. Data collected during precision, audit, flow checks and during servicing shall not be considered valid for data completeness purposes.

d. Before the 90th day of the following quarter, the Permittee shall submit to the Director, a quarterly report pertaining to the PM_{10} measurements and the quality control and assurance (QA/QC) data collected pursuant to this section. An annual summary of PM_{10} measurements and the QA/QC data shall be included in the PM_{10} Monitoring Report for the fourth quarter of the calendar year The quarterly reporting schedule should follow the EPA reporting schedule as described in 40 CFR Part 58. Summary data and reporting frequencies shall be consistent with EPA reporting requirements; the frequency of reporting and the due date depends on type of data. Two electronic copies of the quarterly and annual reports shall be mailed to the Air Assessment Section and the report's cover letter without attachments shall be sent to the Air Compliance Section of the Air Quality Division of the Department.

e. The quarterly reports shall contain the following information, as appropriate. All concentration data shall be presented in micrograms per cubic meter.

(1) Sample date;

(2) Site name, place and time;

(3) Individual sample data that include every sample scheduled to be collected during the reporting period or the reason why the sample is missing;

(4) Data summaries based on EPA data rules,

(5) Data recovery statistics

(6) Analytical techniques or methods used for sampling

f. In addition, to confirm data validation by the Permittee, all data reports should include copies of all appropriate supporting documentation (field data sheets, flow checks, calibrations etc.), including, but not limited to, the following:

(1) Copies of all applicable quality control and field reports (e.g., precision checks, flow checks, and calibrations, audit reports); and

(2) Documentation of problems and corrective actions, and explanations for discrepancies.

g. All data and quarterly reports shall be submitted electronically as follows:

(1) Hourly data in DCS format, quality assured and corrected by the Permittee, including appropriate DCS flags;

(2) Data recovery reports;

(3) Any field service activities; and

(4) Any other information required in the monitoring protocol.

(5) Description of any instrument problems affecting the data, any data validation concerns, and any comments on meteorological conditions occurring during the quarter.

h. Notwithstanding the reporting and data submittal requirements of this section, units shall be consistent with EPA standards (NAAQS) and reporting requirements. If EPA standards or reporting requirements change, the data reporting format and units shall be changed accordingly.

i. All data submitted to the Director shall be reviewed, quality assured, and certified by the Permittee. All of the field documents, QC check documents, etc. need to be submitted with the quarterly report.

ATTACHMENT "C": EQUIPMENT LIST

Air Quality Control Permit No. 55223
For
Rosemont Copper Company – Rosemont Copper Project

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C
Primary Crushing, Conveying, Coarse Ore Storage, & Reclaim Conveying						
Crusher Dump Hopper	1	680 tons			H-CDp	NSPS Subpart LL
Primary Crusher	1	6950 tons per hour			PCr	NSPS Subpart LL
Crusher Discharge Hopper	1	725 tons			H-CDs	NSPS Subpart LL
Crusher Discharge Feeder	1	25' L x 96" W			F-CD	NSPS Subpart LL
Stockpile Feed Conveyor No. 1	1	2690' L x 60" W			CV-SF1	NSPS Subpart LL
Crushing Area Dust Collector	1	18,000 acfm	Cartridge Filter		PCL01/ PC-CADC	NSPS Subpart LL
Stockpile Feed Conveyor No. 2	1	2690' L x 60" W			CV-SF2	NSPS Subpart LL
Reclaim Feeders	4	20' L X 48" W			F-R1/R4	NSPS Subpart LL
Reclaim Conveyors	1	932' L X 60" W			CV-R	NSPS Subpart LL
Stockpile Feed Conveyor Transfer Point Dust Collector	1	10,000 acfm	Cartridge Filter		PCL03/ PC-SFCDC	NSPS Subpart LL
Stockpile Area and Reclaim Tunnel Dust Collector	1	41,500 acfm	Cartridge Filter		PCL02/ PC-SARTDC	NSPS Subpart LL
SAG Mill Feed Conveyor	1	660' L x 60" W			CV-SMF	NSPS Subpart LL
SAG Mill	1	36' D x 17.5' EGL			M-SAG	NSPS Subpart LL
Trommel Screen	1	16' L x 16' W	Polysius		Sn-T	NSPS Subpart LL
Pebble Conveyor No.1	1	135.5' L x 60" W			CV-Pb1	NSPS Subpart LL
Pebble Wash Screen	1	10' L x 20' W			Sn-PbW	NSPS Subpart LL
Pebble Conveyor No.2	1	675' L x 36" W			CV-Pb2	NSPS Subpart LL
SAG Oversize Surge Bin	1	500 Tons			B-SAGOS	NSPS Subpart LL
SAG Feed Conveyor Dust Collector	1	13,000 acfm	Cartridge Filter		PCL12 / PC-SFDC	NSPS Subpart LL
Pebble Crusher Feeder	1	31.5' x 48" W			F-PbC	NSPS Subpart LL
Pebble Crusher	1	1,771 tons per hour			PbC	NSPS Subpart LL

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C.
Pebble Conveyor No.3	1	170.5' x 36" W			CV-Pb3	NSPS Subpart LL
Pebble Crusher Area Dust Collector	1	9000 acfm	Cartridge Filter		PCL04 / PC-PCADC	NSPS Subpart LL
Ball Mills	2	26' D x 40' EGL			M-B1/B2	NSPS Subpart LL
Flotation, Regrind, and Concentration						
Copper/ Molybdenum/ Tailings Floatation and Concentrating Equipment (Flotation cells, column cells, thickeners, filters)	N/A	N/A			Various	A.A.C. 721
Copper Regrind Mills	2	11'-8" L x 13'-4" W			M-CR1/CR2	NSPS Subpart LL
Molybdenum Regrind Mill	1	4' L x 4'-4" W			M-MR	NSPS Subpart LL
Molybdenum Cleaner Regrind Mill	1	4 tons per hour			M-MCR	NSPS Subpart LL
Molybdenum Cleaner Area Scrubber	1	12,500 acfm			PC-MCAS	A.A.C. 730
Copper Concentrate Dewatering and Stacking						
Filter Feed Trash Screen	1	60" L x 48" W			Sn-FFT	NSPS Subpart LL
Copper Concentrate Loadout Building	1	175'L x 101'W x 60'H			BD-CCL	NSPS Subpart LL
Copper Concentrate Conveyor	1	330' L x 24" W			CV-CC	NSPS Subpart LL
Copper Concentrate Dust Collectors	2	50,000 acfm each	Cartridge Filter		PCL05 & PCL06 PC-CCDC1/ PC-CCDC2	NSPS Subpart LL
Molybdenum Dewatering and Packing						
Molybdenum Concentrate Dryer	1	N/A			D-MC	NSPS Subpart LL
Molybdenum Scrubber	1				PC-MS	NSPS Subpart LL
Electorstatic Precipitator	1	139 acfm			PC-EP	NSPS Subpart LL
Molybdenum Concentrate Bin	1	20 Tons			B-MC	NSPS Subpart LL
Molybdenum Dust Collector	1	1,500 acfm	Cartridge Filter		PCL08/ PC-MDC	NSPS Subpart LL
Molybdenum Concentrator Hopper	1	20 ft3			H-MC	NSPS Subpart LL
Molybdenum Concentrate Conveyor	1	90 tons per hour			CV-MC	NSPS Subpart LL
Molybdenum Packing & Weigh System	1	Variable			MPS	NSPS Subpart LL

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C.
Tailings Dewatering and Placement						
Tailings Belt Feeders	14				F-T1/T14	A.A.C 730
Fixed Tailings Conveyor No. 1	1				CV-F1	A.A.C 730
Fixed Tailings Conveyor No. 2	1				CV-F2	A.A.C 730
Fixed Tailings Conveyor No. 3	1				CV-F3	A.A.C 730
Relocatable Conveyors	2				CV-R1/R2	A.A.C 730
Shiftable Conveyors with Cross Conveyor Trippers	2				CV-S1/S2	A.A.C 730
Belt Wagon Conveyor on Crawlers (moveable)	1				CV-BW1	A.A.C 730
Spreader Crawler Mounted Conveyors (movable)	2				CV-SP1/SP2	A.A.C 730
Solvent Extraction and Electrowinning						
SX Primary Mix Tanks	4	7.75' D x 9.75' H			T-E1P, E1PP, E2P, S1P	A.A.C 730
SX Secondary Mix Tanks	4	9.5' D x 9.75'H			T-E1S, E1PS, E2S, S1S	A.A.C 730
SX Tertiary Mix Tanks	3	9.5' D x 9.75			T-E1T, E1PT, E2T	A.A.C 730
SX Settlers	4	64' L x 33' W x 3.33' H			ES-E1, E1P, E2, SS-S1	A.A.C 730
Electrowinning Commercial Cells	30	22' L x 4' W X 5' H			EWCC	A.A.C 730
Cell Ventilation Wet Scrubbers	3	5000 acfm each			PC-EWCVS1/ EWCVS3	A.A.C 730
Fuel Burning Equipment						
Diesel Electrowinning Hot Water Generator	1	6.0 MMBtu per hour			HWG	A.A.C 703
Thickener Area Emergency Generator	1	1000 kilowatt			TEG	NSPS Subpart IIII
PLS Pond Area Emergency Generator	1	1000 kilowatt			PEG	NSPS Subpart IIII
Main Substation Emergency Generator	1	750 kilowatt			MEG	NSPS Subpart IIII
Administration Building Emergency Generator	1	750 kilowatt			AEG	NSPS Subpart IIII
Electrowinning Building Emergency Generator	1	50 kilowatt			EWEG	NSPS Subpart IIII
Primary Crusher Fire Water Pump	1	400 horsepower			PCFWP	NSPS Subpart IIII
SX/EW Fire Water Pump	1	400 horsepower			SXFWP	NSPS Subpart IIII

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C.
Miscellaneous Sources						
Lime Storage Bin	1				B-L	A.A.C 730
Lime Storage Bin Vent	1	750 / 1750 acfm			PC-LSBV	A.A.C 730
Lime Transfer Screw Conveyors	1				CV-LTS1/2	A.A.C 730
Lime Slakers	2				T-LS1/2	A.A.C 730
Lime Slaker Scrubber	1	500 acfm			PC-LSS	A.A.C 730
Sodium Metascilicate Storage Bin	1				B-SM	A.A.C 730
Sodium Metascilicate Storage Bin Vent	1				PC-SMSBV	A.A.C 730
Flocculant Storage Bin 1	1				B-F1	A.A.C 730
Flocculant Storage Bin 2	1				B-F2	A.A.C 730
Guar Feeder	1				F-Gu	A.A.C 730
Cobalt Sulfate Feeder	1				F-CoS	A.A.C 730
Tanks						
C7 Distribution Tank	1	11,845 gallons			T-C7D	A.A.C 730
MIBC Storage Tank	1	11,845 gallons			T-MIBCS	A.A.C 730
Diesel Fuel Storage Tanks – heavy Vehicles	2	100,000 gallons			T-DFS-HV1/HV2	A.A.C 730
Gasoline Storage Tank	1	10,000 gallons				A.A.C 710
Mix Tank	1	1,692 gallons				A.A.C 710
Other Pollution Control Equipment						
Laboratory Dust Collectors	3	10,000 acfm each			PC-L1/L3	A.A.C 721
Laboratory Wet Scrubber	1	9,000 acfm			PC-LWS	A.A.C.721

NOTE:
All missing equipment data will be updated upon purchase of equipment

ATTACHMENT "D": DUST CONTROL PLAN

Air Quality Control Permit No. 55223
For
Rosemont Copper Company- Rosemont Copper Project

(See Attached)

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D.1 INTRODUCTION

As described in the Calculation Methodology presented in the Emission Inventory Information, Volume I, a 90% control efficiency is utilized during the calculation of fugitive dust emissions from regularly traveled unpaved haul roads servicing the open pit as well as from the general facility roads around the RCP. Additionally, the RCP plans to implement reasonable dust control measures to prevent excessive fugitive emissions from open areas and storage piles created by the mining operations. This document constitutes the RCP's dust control plan for achieving a 90% control of fugitive dust emissions from unpaved roads and preventing excessive fugitive emissions from open areas.

D.2 FUGITIVE DUST EMISSIONS FROM UNPAVED ROADS

D.2.1 Unpaved Road Network

The RCP has a network of unpaved haul roads for transporting concentrating ore, leaching ore, and waste rock from the open pit mine to the primary crushing area, leaching area, and waste rock areas, respectively. Additionally, the RCP has general roads around the facility used by support vehicles. Site diagrams of the RCP are presented in Appendix D. Primary roads include: (a) haul roads located in the pit, (b) haul roads for transporting concentrating ore from the pit to the primary crusher/run of mine stockpile, (c) haul roads for transporting leaching ore from the pit to the leach pad, (d) haul roads for transporting waste rock from the pit to the waste rock storage area, and (e) general facility roads around the RCP for support vehicles.

The RCP dust control plan for unpaved roads includes the use of chemical dust suppressants and/or road watering. The control efficiency achieved by chemical dust suppressants depends upon the strength of the ground inventory, whereas the control efficiency achieved by watering depends upon the amount of water that is used (gallons/yd^2) and the traffic volume. Since the chemical dust suppressant usage does not depend on traffic volumes, the ground inventory value determined for a 90% control efficiency can be applied on a periodic basis to any unpaved road at the facility, regardless of the rate of vehicles traveling on the road. However, because the control efficiency achieved by unpaved road watering depends upon traffic volume, in this dust control plan, the haul trucks traveling on haul roads during Year 5 operations at the RCP (the year when haul road travel rates are greatest) is used as an example in determining the application intensity of water used to control fugitive emissions. Additionally, the road network at the RCP is divided into four categories to account for each road network category having a different maximum traffic volume.

During actual operation, the RCP will evaluate the haul truck traffic rates at different time periods throughout the life of the mine to correctly identify the application intensity needed for road watering to achieve a 90% control efficiency on haul roads. Also, the RCP will evaluate the traffic rate of support vehicles to determine the water application intensity needed to control the general unpaved facility roads to a 90% control efficiency.

The calculation methodology used to estimate traffic volume is presented in Appendix D1. The road network categories and the average hourly haul truck traffic rates at the maximum production, assuming operations of 24 hours per day, are presented below:

a) Roadways that will be used to transport concentrating ore, leaching ore, and waste rock from the mining location inside the pit to the exit point of the pit. These roadways are expected to experience an average traffic rate of 120.0 vehicles per hour;

b) Roadways that will be used to transport concentrating ore from the exit of the pit to the primary crusher dump hopper / run of mine stockpile. These roadways are estimated to experience an average traffic rate of 30.0 vehicles per hour;

c) Roadways that will be used to transport leaching ore from the exit of the pit to the leaching area. These roadways are estimated to experience an average traffic rate of 2.0 vehicles per hour; and

d) Roadways that will be used to transport waste rock from the exit of the pit to the waste rock storage area. These roadways are estimated to experience an average traffic rate of 88.0 vehicles per hour.

D.2.2 Description of Dust Control Plans

Optimal dust control measures depend upon the characteristics of the road network and its use, and upon meteorological considerations. Additionally, dust control measures are continuously evolving with new products becoming available on a regular basis. In order to provide flexibility to change dust control measures while achieving the desired control efficiency, this document proposes three programs, each designed to achieve a 90% control of PM_{10} emissions. The RCP dust control plan includes the flexibility to alternate from one dust control program to another or to use a separate dust control program for an individual roadway system.

The RCP dust control plan ensures that at least a 90% control of PM_{10} emissions is achieved on the unpaved road network. The RCP is also required to maintain no greater than a 40% or 20% opacity for all non-point sources (see Table 4.1). A 90% control efficiency is considered sufficient to ensure that the 40% or 20% opacity limit will be met.

D.2.2.1 Dust Control Program A

Dust Control Program A consists of the application of sufficient chemical dust suppressant to achieve a ground inventory of 0.25 gallons/yard^2 with a reapplication frequency of 1-month (where reapplication frequency refers to the time interval between applications used to maintain a specific ground inventory). The term “ground inventory” represents the residual accumulation of a dust suppressant from previous applications. (For a detailed definition of “ground inventory” see page 3-20 of *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures*, EPA-450/2-92-004, in Appendix D2). Dust suppressants which could be used for this purpose include, among others, lignosulfonates, petroleum resins, asphalt emulsions, and acrylic cement.

D.2.2.2 Dust Control Program B

Dust Control Program B consists of periodic watering in sufficient amounts to achieve 90% control for PM_{10}. The program will be applied only during days with precipitation of less than 0.01 inches. The water application intensities necessary to achieve a 90% particulate control efficiency during daylight and nighttime hours are presented in Tables D.2.1 and D.2.2, respectively. The roadway network categories are presented in Section D.2.1 and a description on how the application intensities are calculated is presented in Section D.4.2.

Table D.2.1 Average Hourly Watering Requirements During Daylight Hours for Dust Control Program B

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter²	gallons/yard²
From Mining Location to Pit Boundary	120.0	4.87	1.08
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	1.22	0.27
From Pit Boundary to Leach Pad	2.0	0.08	0.02
From Pit Boundary to Waste Rock Storage Area	88.0	3.57	0.79

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.2.2 Average Hourly Watering Requirements During Nighttime Hours for Dust Control Program B

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter²	gallons/yard²
From Mining Location to Pit Boundary	120.0	2.43	0.54
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	0.61	0.13
From Pit Boundary to Leach Pad	2.0	0.04	0.009
From Pit Boundary to Waste Rock Storage Area	88.0	1.79	0.39

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

D.2.2.3 Dust Control Program C

Dust Control Program C consists of the application of sufficient chemical dust suppressant to achieve a ground inventory of 0.05 gallons/yard^2 with a 1-month reapplication frequency (the ground inventory of 0.05 gallons/yard^2 provides a base control efficiency of 62%.) plus periodic watering to increase the base control efficiency achieved by chemical dust suppressants alone to 90%. A summary of the roadway traffic volume and corresponding annual average watering requirements of Dust Control Program C is presented in Table D.2.3 (Daylight Hours) and Table D.2.4 (Nighttime Hours). If any type of water adhesion enhancing material, such as a surfactant, is used with Dust Control Program C, application intensities will be re-evaluated.

Table D.2.3 Average Hourly Watering Requirements During Daylight Hours for Dust Control Program C

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter^2	gallons/yard^2
From Mining Location to Pit Boundary	120.0	1.85	0.41
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	0.46	0.10
From Pit Boundary to Leach Pad	2.0	0.03	0.007
From Pit Boundary to Waste Rock Storage Area	88.0	1.36	0.30

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.2.4 Average Hourly Watering Requirements During Nighttime Hours for Dust Control Program C

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter^2	gallons/yard^2
From Mining Location to Pit Boundary	120.0	0.93	0.20
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	0.23	0.05
From Pit Boundary to Leach Pad	2.0	0.02	0.003
From Pit Boundary to Waste Rock Storage Area	88.0	0.68	0.15

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

D.3 PLAN FOR THE CONTROL OF FUGITIVE DUST EMISSIONS FROM OPEN AREAS AND STORAGE PILES

D.3.1 Open Areas and Storage Piles

Open areas and storage piles include mined areas, overburden storage areas, as well as waste rock storage areas. Open areas and storage areas which are subject to generating fugitive emissions exclude ore, waste rock, and other similar areas because these areas are characterized by a low silt content and therefore, are not dust producing areas. Consequently, dust control measures are not necessary for such areas.

D.3.2 Description of Dust Control Plan

Open areas and storage piles which are in active use and subject to generating fugitive emissions will be controlled by the application of water as required by Title 18, Chapter 2, Article 6 of the A.A.C. and Chapter 17.16, Article III of the P.C.C.. Open areas and storage piles which are not actively used will be controlled by applying the methods required by A.A.C. R18-2-604 and R18-2-607 and P.C.C. Sections 17.16.080 and 17.16.110, respectively. This includes the application of sufficient chemical dust suppressant and/or water to develop and maintain a visible crust. Periodic inspections of the open areas will be performed to evaluate the condition of the visible crust and, if necessary, additional chemical dust suppressant and/or water will be applied. Other means which may be applied include use of an adhesive soil stabilizer, paving covering, landscaping, detouring, or other acceptable means. Access to such areas will also be minimized by the construction of berms or other barriers to prevent re-disturbance of the areas.

D.4 DEMONSTRATION THAT THE DUST CONTROL PLAN WILL PROVIDE A 90% CONTROL EFFICIENCY

D.4.1 Dust Control Program A

The control efficiency of a chemical dust suppressant is dependent upon the ground inventory of the dust suppressant and the frequency between applications. A model developed by EPA, and published in *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures* (see Appendix D2), provides the relationship between these parameters and PM_{10} control performance for dust suppressants in general. A graph representing this model is presented in Figure D.4.1.

The sufficiency of Dust Control Program A to achieve a control efficiency of 90% for PM_{10} is verified by considering this figure. Using a chemical dust suppressant, a ground inventory of 0.25 gallons/yd^2 with a 1-month reapplication frequency will provide a control efficiency for PM_{10} of 90%. It should be noted that the model for PM_{10} control efficiency of petroleum-based dust suppressants published in the AP-42, Section 13.2.2 (11/06), agrees with the EPA model used to determine the sufficiency of Dust Control Program A.

The control efficiencies in the above mentioned models are averages and not maximums. Therefore, it can be assumed that using a chemical dust suppressant with a ground inventory of 0.25 gallons/yd^2 could result in control efficiencies higher than 90%.

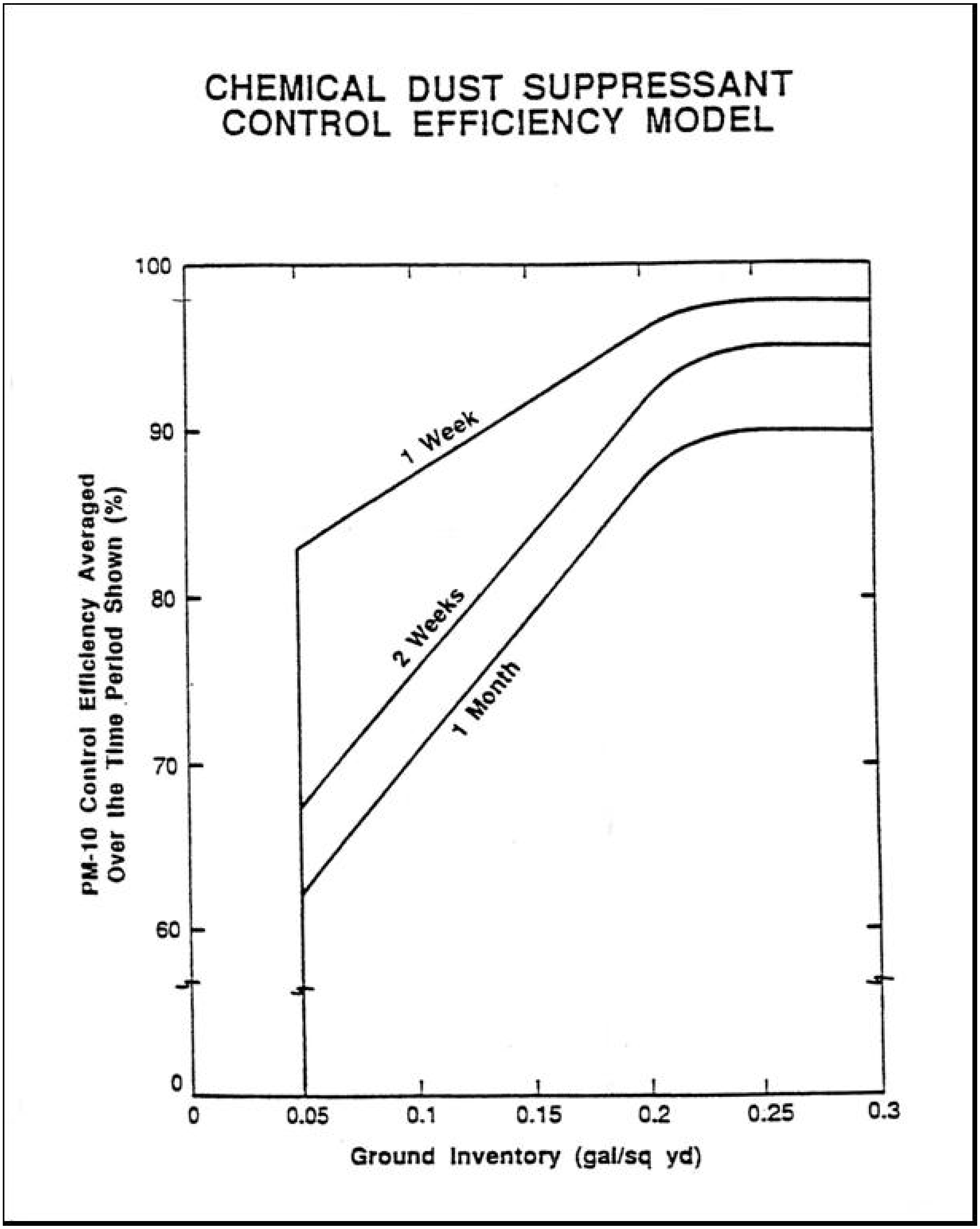

Figure D.4.1 Model for Control Efficiency of PM_{10} when Using Chemical Dust Suppressants.

D.4.2 Dust Control Program B

The application intensity of water during daylight and nighttime hours required to achieve a 90% control efficiency for each road category is calculated using an empirical model developed by EPA (*Control of Open Fugitive Sources*, EPA-U50/3-88-008, September, 1988, presented in Appendix D3). The following equations were derived from this model:

$$i = \frac{0.8 \times p \times d \times t}{(100 - W_c)} \qquad \text{Equation 1}$$

$$p = 0.0049 \times PER \qquad \text{Equation 2}$$

where:

- i = application intensity (liters/m^2);
- p = potential average hourly daytime evaporation rate (mm/hr, 0.507 for Tucson, AZ);
- d = average hourly daytime traffic (vehicles/hr; see Section D.2.1);
- t = time between applications (hours, 1 for hourly applications)
- W_c = average particulate control efficiency (%, 90 in this case); and
- PER = mean annual pan evaporation rate (inches/year, 103.51 for Tucson, AZ from Western Region Climate Center data from 1894-2005).

As shown by Equation 1, the application intensity is dependent upon the pan evaporation rate. Because the pan evaporation rate differs between daytime and nighttime conditions, as well as meteorological conditions, application intensities will also vary with daylight hours and nighttime hours and with meteorological conditions. Nighttime hour application intensities are calculated assuming the average hourly nighttime pan evaporation rate is equal to 50% of the average hourly daytime pan evaporation rate.

The application intensity required to achieve a 90% control efficiency is calculated using Equation 1. However, the application intensities are for illustration purposes due to the varying conditions of evaporation rates and traffic volumes. A summary of the input variables and resulting application intensities during daylight hours and nighttime hours derived from the above equation are presented in Tables D.4.1 and D.4.2, respectively.

The application intensities in Tables D.4.1 and D.4.2 are based upon an hourly frequency of application. The RCP may reduce the frequency of application by increasing the application intensity. A frequency of once every two hours, for example, would require that the application intensities in Tables D.4.1 and D.4.2 to be increased by a factor of 2.

Table D.4.1 Summary of Data Used to Verify Dust Control Program B During Daylight Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ $meter^2$	gallons/ $yard^2$
From Mining Location to Pit Boundary	90	0.507	120.0	1.0	4.87	1.08
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	90	0.507	30.0	1.0	1.22	0.27
From Pit Boundary to Leach Pad	90	0.507	2.0	1.0	0.08	0.02
From Pit Boundary to Waste Rock Storage Area	90	0.507	88.0	1.0	3.57	0.79

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.4.2 Summary of Data Used to Verify Dust Control Program B During Nighttime Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ $meter^2$	gallons/ $yard^2$
From Mining Location to Pit Boundary	90	0.254	120.0	1.0	2.43	0.54
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	90	0.254	30.0	1.0	0.61	0.13
From Pit Boundary to Leach Pad	90	0.254	2.0	1.0	0.04	0.009
From Pit Boundary to Waste Rock Storage Area	90	0.254	88.0	1.0	1.79	0.39

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

It should be noted that the pan evaporation rates used to calculate the application intensities in Tables D.4.1 and D.4.2 represent annual averages which, when used with Equation 1, will result in an application intensity that is too high for winter months and too low for summer months. Actual application intensities will be determined based on actual pan evaporation rates as determined for the different climatological periods of the year. Additionally, the calculated intensities are based on the maximum mine production rates. Lower production rates characterized by lower traffic rates will be characterized by lower application intensities. If any type of water adhesion enhancing material, such as a surfactant, is used with Dust Control Plan B, application intensities will be reevaluated.

D.4.3 Dust Control Program C

The sufficiency of Dust Control Program C to achieve a control efficiency of 90% for fugitive dust emissions is verified by considering Figure D.4.1. Using a chemical dust suppressant, a ground inventory of 0.05 gallons/yard^2 with a 1-month reapplication frequency provides a control efficiency of 62% for PM_{10}. The additional 28% control necessary to increase the control efficiency to 90% will be attained through periodic watering. The control efficiency of the watering program, W_c, necessary to increase the chemical dust suppressant control efficiency, CDS_c, of 62% to a combined dust suppressant/watering control efficiency of 90% is derived from the following equation:

$$W_c = \left(\frac{\text{Additional Control Necessary (\%)}}{(100\% - CDS_c)} \right) \times 100\% \qquad \text{Equation 3}$$

$$W_c = \left(\frac{28\%}{(100\% - 62\%)} \right) \times 100\%$$

$$W_c = 73.7\%$$

This value, 73.7%, is used in conjunction with the model described in Section D.4.2 to determine the average application intensity of watering that is necessary to achieve a 73.7% control efficiency. A summary of the input variables and resulting hourly application intensities during daylight and nighttime hours derived from the model is given in Tables D.4.3 and D.4.4, respectively.

Table D.4.3 Summary of Data Used to Verify Dust Control Program C During Daylight Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ $meter^2$	gallons/ $yard^2$
From Mining Location to Pit Boundary	73.7	0.507	120.0	1.0	1.85	0.41
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	73.7	0.507	30.0	1.0	0.46	0.10
From Pit Boundary to Leach Pad	73.7	0.507	2.0	1.0	0.03	0.007
From Pit Boundary to Waste Rock Storage Area	73.7	0.507	88.0	1.0	1.36	0.30

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.4.4 Summary of Data Used to Verify Dust Control Program C During Nighttime Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ $meter^2$	gallons/ $yard^2$
From Mining Location to Pit Boundary	73.7	0.254	120.0	1.0	0.93	0.20
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	73.7	0.254	30.0	1.0	0.23	0.05
From Pit Boundary to Leach Pad	73.7	0.254	2.0	1.0	0.02	0.003
From Pit Boundary to Waste Rock Storage Area	73.7	0.254	88.0	1.0	0.68	0.15

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

D.5 DEMONSTRATION OF COMPLIANCE WITH THE REQUIREMENTS OF ARTICLE 6 OF THE A.A.C. AND CHAPTER 17.16, ARTICLE III OF THE P.C.C.

Section R18-2-604 of the A.A.C. and Section 17.16.080 of the P.C.C. require, in part, that fugitive dust from open areas be kept to a minimum by good modern practices such as using an approved dust suppressant.

Section D.3 of this document describes the control measures for wind-blown fugitive dust from open areas and storage piles at the RCP. By developing and maintaining a visible crust on the soil in all open areas and applicable storage piles, implementing best management practices (e.g., watering), and minimizing access to these areas, the RCP Dust Control Plan complies with the requirements of Article 6 of the A.A.C and Chapter 17.16, Article III of the P.C.C. for the control of fugitive dust emissions from open areas and storage piles.

D.6 PERIODIC REAPPLICATION

D.6.1 Chemical Dust Suppressants

Dust control programs that utilize chemical dust suppressants require periodic application of the chemical dust suppressant in order to replenish dust suppressants that are removed from the road due to the abrasion of the vehicles on the treated road surface. Each successive application will correspond to:

a) The manufacturer's recommendation if available; or

b) If manufacturer's recommendations are not available, the amount necessary to completely replenish the initial ground inventory every six months.

D.6.2 Road Watering

The frequency of reapplication of water used in Dust Control Programs B and C will depend upon the operational plans of the RCP. The frequency can be hourly, less frequent or more frequent, depending upon the traffic density, meteorological conditions, and operational considerations. The application intensities for water should be treated as annual averages as some days will require a greater water application whereas others will require a lesser water application due to seasonal climatic condition changes. The models introduced in Sections D.4.2 and D.4.3 predict the same control efficiency independent of whether the water is applied during one pass per hour of the water truck or during multiple passes during the 1-hour period. Additionally, watering will not be required for days when natural precipitation equals or exceeds 0.01 inches or when roads are moist due to recent rain, as the control efficiency during such days is assumed to be 100% by AP-42.

D.7 RECORD KEEPING REQUIREMENTS

D.7.1 Records of the Application of Chemical Dust Suppressants

Records will be maintained demonstrating the RCP's compliance with the initial chemical dust suppressant ground inventory required by Dust Control Programs A and C by recording the information necessary to demonstrate a 90% control efficiency.

D.7.2 Records of Reapplication of Chemical Dust Suppressants

Records will be maintained demonstrating the RCP's compliance with the periodic reapplication of dust suppressants to replace losses as identified in Section D.6.1. Records will be maintained concurrently with the records described in Section D.7.1.

D.7.3 Records of Application of Water

Records will be maintained demonstrating the RCP's compliance with the watering requirements of Dust Control Programs B and C by recording the information necessary to demonstrate a 90% control efficiency.

APPENDIX D1

ROADWAY NETWORK TRAFFIC VOLUME CALCULATION METHODOLOGY

D1. ROADWAY SYSTEM TRAFFIC VOLUME CALCULATION METHODOLOGY

Because the control efficiency of unpaved road watering is dependent upon traffic volume, the roadway system at the RCP was divided into four road network categories based on average hourly traffic rates. Traffic volume estimates for the road network categories are calculating by dividing the anticipated hourly amount of material transferred by the haul trucks on each road network category by the average haul truck load (250 tons) and multiplying this number by two to account for the haul trucks returning empty to the mining location. This methodology is shown in the following equation:

$$\text{Traffic Volume}\left(\frac{\text{vehicles}}{\text{hour}}\right)=\left(\text{Material Transferred by Haul Trucks}\left(\frac{\text{tons}}{\text{hour}}\right)\times\frac{1\,\text{trip}}{250\,\text{tons}}\times\frac{2\,\text{passes}}{\text{trip}}\right)$$

The process rates and resulting traffic volume estimates for each roadway system are listed in Table D1.1. The traffic volumes in this table are presented for Year 5 operations at the RCP. However, since process rates vary hourly, daily, and annually, traffic volumes will be monitored on an on-going basis so that accurate water application intensities are determined and a 90% control efficiency will be met.

Table D1.1 Summary of Data Used to Calculate Roadway System Traffic Volume (Year 5)

Roadway System Category	Maximum Process Rate (tons/hour)	Traffic Volume (vehicles/hour)
From Mining Location to Pit Boundary	15,000	120.0
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	3,750	30.0
From Pit Boundary to Leach Pad	250	2.0
From Pit Boundary to Waste Rock Storage Area	11,000	88.0

ATTACHMENT "E": MAP OF PAVED ROADS

Air Quality Control Permit No. 55223
For
Rosemont Copper Company- Rosemont Copper Project

(See Attached)

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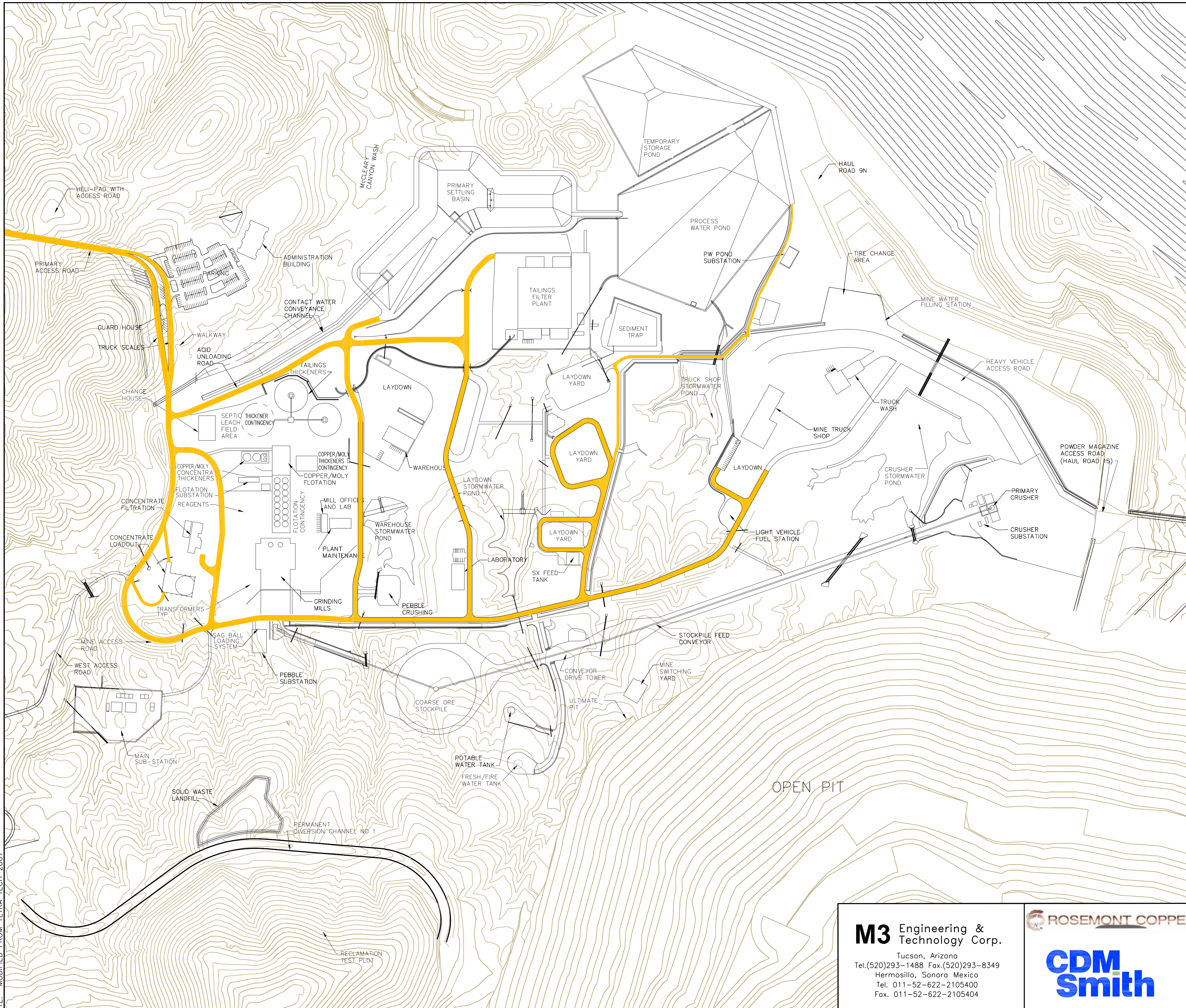

LEGEND:

EXISTING 10' CONTOUR

PERMANENT DIVERSION CHANNEL

PROPOSED PAVED ROADS

NOTES:

1. PLANT, CRUSHER, ACCESS ROADS, PIT LIMITS, AND WASTE ROCK STORAGE AREA DESIGNED BY OTHERS.
2. CONTOURS SHOWN FOR DRY PIT ARE IN 100' INTERVALS. CONTOURS SHOWN FOR EXISTING GROUND ARE IN 10' INTERVALS.
3. TEMPORARY ROM STOCKPILE LOCATION SHOWN FOR CLARITY ONLY.

N

450 0 900 1800

M3 Engineering & Technology Corp.
Tucson, Arizona
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Hermosillo, Sonora Mexico
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Fax. 011-52-622-2105404

ROSEMONT COPPER

CDM Smith

ROSEMONT COPPER PROJECT
AIR PERMIT

PROPOSED PAVED ROADS
ATTACHMENT E

LOCATION:	PIMA COUNTY, ARIZONA
DATE:	01.29.13
PROJECT NO.	91146
FILE NAME:	FIGURE 1
FIGURE NO.	1

ADEQ
Arizona Department of Environmental Quality

FACT SHEET

Proposed Air Quality Permit #55223 for Rosemont Copper Company

Pursuant to Arizona Administrative Code (A.A.C.) Title 18, Chapter 2 and Arizona Revised Statues, Title 49, Chapter 3, the Arizona Department of Environmental Quality is proposing to issue a Class II air quality permit to Rosemont Copper Company.

OVERVIEW OF ROSEMONT COPPER COMPANY

Rosemont Copper Company (RCC) has proposed to construct and operate an open pit copper mine, milling, leaching, and solvent extraction/electrowinning facility to be located at 21900 South Sonoita Highway, Vail, Arizona 85641. The facility is approximately 30 miles southeast of Tucson, west of State Highway 83, in Pima County, Arizona. The facility is accepting voluntary emissions limitations to stay below major source thresholds. Therefore, a Class II synthetic minor air quality permit is proposed. The proposed mine has an anticipated operating life of 20 years with peak mining rates of ore and waste rock of up to 359,500 tons per day.

JURISDICTION – WHY IS ADEQ ISSUING THIS PERMIT?

RCC's mine is located within Pima County where the local agency, Pima DEQ (PDEQ), has Environmental Protection Agency (EPA) approval to issue air quality permits. RCC submitted an application to PDEQ in July 2010, which was denied in September 2011, after issuing a draft permit for public comment. On July 5, 2012, the Arizona Superior Court in Pima County ruled that the PDEQ's action to deny Rosemont's application was both arbitrary and capricious. To address this uncertainty and to ensure that duplicative air quality permits from PDEQ and ADEQ are not required, ADEQ, pursuant to A.R.S. 49-402(B) and R9-3-1101 of the Arizona State Implementation Plan (SIP), has asserted complete air quality jurisdiction. ADEQ is seeking comments from the public if PDEQ should be offered oversight of the permit after issuance by ADEQ.

HOW DOES THE ADEQ PERMIT DIFFER FROM THE PIMA DEQ PERMT THAT WAS OFFERED FOR PUBLIC COMMENT?

The ADEQ permit establishes very stringent requirements as noted below:

- Replacing six wet scrubbers that are capable of controlling 99 percent of particulate matter emissions with state-of-the-art high-efficiency cartridge filters that will now control 99.99 percent of these emissions
- More stringent particulate matter emission limits
- Additional control requirements at the primary crushing and lime systems that were reconfigured for process optimization
- Paving 3.1 miles of industrial roads within the facility boundary
- Use of EPA certified Tier 4 engines in six non-road engine vehicles and Tier 2 on other vehicles
- Increased monitoring, recordkeeping and reporting requirements

The above additional measures have resulted in emissions reduction of total emissions of particulate matter less than ten microns (PM_{10}) by 47 tons per year (tpy) and emissions of particulate matter less than 2.5 microns ($PM_{2.5}$) by 43 tpy.

WHAT ARE AMBIENT AIR QUALITY IMPACTS FROM THE ROSEMONT COPPER MINE?

The state permitting program requires all new sources to conduct an air quality modeling assessment to ensure compliance with the National Ambient Air Quality Standards. Rosemont's proposed site is located in a "clean air area"–one that has been designated as attainment or unclassifiable for all criteria pollutants under the Clean Air Act. A thorough analysis of ambient air quality impacts from the proposed mine was conducted which demonstrated that the emissions would not cause or contribute to an exceedance of any applicable National Ambient Air Quality Standard.

WHAT ARE ROSEMONT COPPER MINE'S EMISSIONS?

The potential annual non-fugitive and fugitive emissions from the mining operations are listed in Table 1 on the next page.

It should, however, be noted that the fugitive emissions are accounted for in the modeling analysis to determine compliance with the National Ambient Air Quality Standards (NAAQS).

HOW DOES THE EIS AND DEQ MODELING DIFFER?

In the modeling analysis submitted to ADEQ, Rosemont accounted for the additional control measures required by the Department. These controls, however, were not included in the initial EIS documents submitted to the United States Forest Service and those documents will need to be updated to reflect the additional control measures.

Publication Number: FS 12-06

Table 1

Pollutant	Non-Fugitive Emissions (tons per year)	Fugitive Emissions* (tons per year)
PM_{10}	39.51	947
$PM_{2.5}$	10.97	106
NO_X	16.76	154
SO_2	0.055	18
VOC	1.54	3.77
CO	9.0	606
GHG	5,792	5,125
HAPs	0.0132	0.0

PM_{10} -Particulate matter less than 10 microns
$PM_{2.5}$ - Particulate matter less than 2.5 microns
NO_X - Nitrogen Oxides
SO_2 -Sulfur dioxide
VOC-Volatile Organic Compounds
CO -Carbon Monoxide
HAPs-Hazardous Air Pollutants
GHG -Green House Gases

*Pursuant to state law, fugitive emissions are not included in the determination of major source applicability for non-categorical sources such as copper mines

HOW DID ADEQ DEVELOP THE TERMS OF THE PROPOSED PERMIT?

The proposed permit includes emission limits and standards and compliance demonstration requirements from federal, state and local air quality regulations. Federal requirements for the mine come from Title 40 of the Code of Federal Regulations Part 60 New Source Performance Standards, Subpart LL - Metallic Mineral Processing Operations, and Subpart IIII - Internal Combustion Engines. Other requirements set forth in this permit are a result of state and county rules and limitations based upon ambient air dispersion modeling.

HOW WILL ADEQ ENSURE THAT THE ROSEMONT MINE COMPLIES WITH PERMIT REQUIREMENTS?

The proposed permit includes stringent monitoring, testing, recordkeeping, and reporting requirements to provide assurance that emissions from the mine operations are minimized. ADEQ inspectors will also conduct periodic announced and unannounced inspections of the facility if not delegated to PDEQ. ADEQ's preference would be to delegate those responsibilities to PDEQ.

WHAT OTHER REGULATORY REQUIREMENTS DO ROSEMONT HAVE TO MEET?

In addition to this air quality permit, RCC will have to obtain other independent approvals prior to the construction and operation of the mine. They include the Environmental Impact Statement (EIS) Record of Decision from the United States Forest Service, the Aquifer Protection Permit (APP) from ADEQ and the 404 Permit from the Corps of Engineers.

HOW DOES THE PUBLIC COMMENT PROCESS WORK?

ADEQ will hold a **public meeting** to answer questions on the proposed permit on **Monday, October 01, 2012, at 6:00 p.m.** at the Sycamore Elementary School located at 16701 S Houghton Road, Vail, Arizona 85641. At the public meeting, citizens will have an opportunity to have informal discussions about the proposed air permit with agency staff.

ADEQ will hold a public hearing to receive public comments on the proposed permit on Tuesday, October 09, 2012, at 6:00 p.m. at the Sycamore Elementary School located at 16701 S Houghton Road, Vail, Arizona 85641. The public comment period will officially close on October 31, 2012. **Therefore, all comments must be postmarked, emailed, or hand-delivered no later than October 31, 2012.**

E-mails should be sent to rosemontairpermit@azdeq.gov or via postal mail or hand-delivered to 1110 W Washington St, Phoenix, AZ 85007, Mail Code 34.

Additional information on the public notice, and copies of the proposed permits and technical support documents, will be available for review on the ADEQ Web site at:
http://www.azdeq.gov/environ/air/permits/rcc.html.

Citizens can also subscribe to email or text alerts to news and other events related to this proposed permit at https://public.govdelivery.com/accounts/AZDEQ/subscriber/new

ADEQ CONTACT

We encourage you to be informed and involved in ADEQ activities. We need your involvement to help us protect our environment and public health. For more information, please contact:

Mr. Balaji Vaidyanathan
Manager, Air Quality Permits Section
1110 W. Washington St., Phoenix, AZ 85007
E-mail: rosemontairpermit@azdeq.gov
(602) 771-4527 or
toll free (800) 234-5677 Ext. 771-4527
Hearing impaired persons call TDD line: (602) 771-4829

TECHNICAL REVIEW AND EVALUATION
OF APPLICATION FOR
AIR QUALITY PERMIT NO. 55223

Rosemont Copper Company

I. INTRODUCTION

This Class II synthetic minor permit is issued to Rosemont Copper Company (RCC) for the construction and operation of an open pit copper mine, milling, leaching, and solvent extraction and electrowinning facility to be located approximately 30 miles southeast of Tucson, west of State Highway 83, within Pima County, Arizona. The facility has an anticipated lifetime production of 123 million tons of ore and waste rock and an anticipated operating life of 20 years.

A. Company Information

Facility Name:	Rosemont Copper Project
Facility Location:	21900 S Sonoita Highway Vail, Arizona 85641 Approximately 30 miles southeast of Tucson
Mailing Address:	P.O. Box 35130 Tucson, Arizona 85740-5130

B. Attainment Classification

The Sonoita area is attainment for all criteria pollutants.

C. Learning Sites Evaluation

In accordance with ADEQ's Environmental Permits and Approvals Near Learning Sites Policy, the Department conducted an evaluation to determine if any nearby learning sites would be adversely impacted by the facility. Learning sites consist of all existing public schools, charter schools and private schools the K-12 level, and all planned sites for schools approved by the Arizona School Facilities Board. The learning sites policy was established to ensure that the protection of children at learning sites is considered before a permit approval is issued by ADEQ.

Upon review of ADEQ's database, it was determined that there are no learning sites within two miles of the facility.

D. Synthetic Minor

RCC has taken voluntary PM_{10} emission limits at the outlet of the 8 cartridge filters, the wet scrubber and the Electrostatic Precipitator to reduce the facility-wide emissions of PM_{10} to below major source thresholds. Compliance with the limits is established by weekly monitoring of opacity and annual testing. In addition, the emergency internal combustion engines are assumed to operate no more than 500 hours. Compliance is established by requiring installation of a non-resettable hours-meter to record all hours of operation.

II. PROCESS DESCRIPTION

The Rosemont Copper Project will primarily mine copper along with minor quantities of molybdenum, silver and other by-products. The copper mineralization in the area is a sulfide ore with a cap of oxide copper close to the surface. The sulfide and oxide ore will be mined through conventional open pit mining techniques. Concentrate ore (mostly comprised of sulfide ore) will be processed by crushing, grinding, and floatation to produce copper concentrate product, which contains copper, silver, and possibly small amount of gold, and molybdenum. Leach ore (mostly comprised of oxide ore) will be leached and the resulting leach solution processed through a solvent extraction and electrowinning facility to produce a copper cathode product for market.

Description of the various steps involved is outlined below:

A. Open-Pit Mining

Open pit mining activities will include drilling, blasting, loading and hauling of ore and development rock using large-scale equipment including rotary blast hole drills (diesel and electric powered), a hydraulic percussion track drill, electric mining shovels, front end loaders, off-highway haul trucks, crawler dozers, rubber-tired dozers, motor graders and off-highway water trucks. Ore will be transported to the leach pad or the primary crushing area.

B. Primary Crushing and Coarse Ore Stockpile

Ore trucks will either dump the ore into the crusher dump hopper or stockpiled near the primary crusher and loaded to the crusher using a front end loader. Primary crushed ore will be conveyed to the coarse ore stockpile to be located within the stockpile building.

C. Stockpile Reclaim

A reclaim tunnel will be installed beneath the stockpile that will draw ore via apron feeders and onto conveyor belts that discharge to the semi-autogenous (SAG) grinding mill.

D. Milling and Flotation

Ore will be ground in water to the final product size in a SAG mill primary grinding circuit and a ball mill secondary grinding circuit. The primary grinding SAG mill will operate in closed circuit with a trammel screen, pebble wash screen, and a pebble crusher. Undersize from the trommel screen will be conveyed to the SAG mill grinding circuit. Oversize will be sent to the pebble crusher for further processing and then returned to the SAG mill. Material from the SAG mill undergoes a floatation process to produce copper and molybdenum mineral concentrate slurries which will then be transported to the dewatering circuits.

D. Copper Concentrate and Molybdenum Concentrate Dewatering and Preparation for Shipment

Copper concentrate slurry will be dewatered and thickened in a copper concentrate thickener. Thickener underflow will be pumped to copper concentrate filters. Filter cake will be stockpiled in the copper concentrate load out building that will be trucked for shipment. Molybdenum concentrate slurry from the filter feed tank will be pumped to a plate and frame filter press. The filter cake will be discharged to a electric hot-oil dryer. Dried concentrate is stored in storage bins which are then trucked for shipment.

E. Tailings Dewatering and Placement

Tailings slurry will be dewatered and thickened in tailings thickeners. Thickener underflow will be pumped to tailings plate and frame filters. Filtered tailings cake will be discharged to the tailings placement system via conveyor belts. The tailings placement system will be used to deposit the filtered tailings behind large pre-formed containment buttresses constructed from waste rock in the two tailings storage areas. A dozer will be used to spread the filtered tailings in close proximity to the containment buttresses and as needed to provide sufficient compaction for the conveyor and stackers.

F. Heap Leaching

Leach ore will be transported from the open pit to the lined leach pad by mine haul trucks via a haul road running along the south and east edges of the pad area. The ore will be stacked on the lined leach pad area and irrigated with an acidified leach solution (raffinate). Crawler dozers will be used to spread the leach ore and cross rip the material to promote leach solution infiltration. Drip emitters located close to the ground will distribute the leach solution to the surface of the ore to minimize evaporation losses. Copper ions are leached into the leach solution from the ore. The pregnant leach solution (PLS) gravity flow into a double-lined collection pond.

G. Solvent Extraction and Electrowinning (SX/EW)

Copper contained in the aqueous phase will be extracted using reagents carried in an organic phase solution in the SX circuit. The resulting copper-depleted aqueous solution, or raffinate, will be transferred to a storage pond before being reused in the heap leaching process. Copper transferred to the organic phase will be stripped by an acidic aqueous solution, or lean electrolyte, thereby enriching the solution to produce a rich electrolyte. The rich electrolyte will be heated using diesel-fired hot water heater and two electrolyte heat exchangers and then returned to the electrowinning cells for copper plating onto stainless steel blanks. The copper will be stripped using a cathode stripping machine, weighed and bundled for shipment.

III. POLLUTION CONTROL EQUIPMENT

RCC will operate high efficiency cartridge filter dust collectors, one electrostatic precipitator, one wet scrubber, water sprays, and dust suppressants on haul roads to reduce PM_{10} emissions from the facility. Two wet scrubbers will be used to control sulfuric acid mist and cobalt compound emissions from the electrowinning process.

IV. EMISSIONS

Emissions from this facility occur during processing of ore and waste rock (crushing, screening, conveying), operating the diesel-fired boiler, the solvent extraction/electrowinning (SX/EW) process, emergency generators and fire pumps, and miscellaneous sources. The Permittee will install high efficiency cartridge filters, an electrostatic precipitator and use water sprays to reduce particulate matter emissions. The emission factors used to calculate the potential emissions are based on voluntarily accepted emission limits and from the Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition (AP-42). Table 1 below provides the facility's Potential to Emit (PTE) in tons per year. The maximum emissions from the facility can vary between the 1st and 5th year due to the nature of the mining operations conducted. The potential emissions listed in Table 1 reflect the worst case irrespective of the year they occur in.

Table 1: Potential Non-Fugitive and Fugitive Emissions

Pollutant	Non-Fugitive Emissions (tons per year)	Fugitive Emissions (tons per year)
PM	78.46	3490
PM_{10}	39.03	947
$PM_{2.5}$	10.23	106
NO_x	16.76	154
CO	9.00	606
SO_2	0.06	18
VOC	1.51	3.77
H_2SO_4	0.02	0.27
GHG	5792.62	5125
HAPs	0.0132	3.53

Since the facility is a non-categorical source under state law, fugitive emissions are not considered for major-source applicability determinations. The fugitive emissions, however, are accounted for in the modeling analysis to determine compliance with the National Ambient Air Quality Standards (NAAQS).

V. APPLICABLE REGULATIONS

The applicable regulations were identified by the company as part of the application packet. If necessary, the source is required to list any additional regulations that may become applicable. Table 2 displays the applicable requirements for each piece of equipment under this proposed permit.

Table 2: Verification of Applicable Regulations

Unit	**Control Device**	**Rule**	**Verification**
Metallic Mineral Processing Equipment	Cartridge Filters, Electrostatic Precipitator, Scrubber & Water sprays	40 CFR 60.382(a) 40 CFR 60.382(a)(2) 40 CFR 60.382(b) 40 CFR 60.386(a) 40 CFR 60.386(b)(1) 40 CFR 60.386(b)(2) P.C.C Section 17.16.490 AZ SIP R9-3-521 A.A.C. R18-2-702	The crushers, screens, conveyor belt transfer points, storage bins and truck unloading are affected facilities located in a metallic mineral processing plant as defined in NSPS Subpart LL The non-NSPS equipment are subject to the state regulations.
Boiler	N/A	A.A.C R18-2-724 40 CFR 63 Subpart JJJJJJ P.C.C Section 17.16.165	These standards apply to fossil fuel fired equipment rated at between 0.5 MMBTU/hr and 250 MMBTU/hr in which the products of combustion do not come into direct contact with process materials. Subpart JJJJJJ, NESHAP requirements for area source boilers apply to this boiler.

Unit	Control Device	Rule	Verification
Solution Extraction / Electrowinning Process	Scrubbers, use of covers, foam, dispersion balls, surfactants	A.A.C. R18-2-730 A.A.C. R18-2-702 P.C.C Section 17.16.430	These standards are applicable to unclassified sources. The opacity standards from Article 702 apply.
Tailings Dewatering and Placement Miscellaneous Sources – Silos, Lime Storage Bins, Sodium Metasciliate Storage Bins, Flocculant Storage Bins, Guar and Cobalt Sulfate Feeders	Water sprays Dust suppressants Dust Collector	A.A.C. R18-2-730 A.A.C. R18-2-702 P.C.C. Section 17.16.430	The opacity standards from A.A.C R18-2-702 apply to existing stationary point sources. The standards from A.A.C. R18-2-730 apply to unclassified sources.
Internal Combustion Engines	N/A	40 CFR 60, Subpart IIII	These standards apply to internal combustion engines manufactured after 2006. New engines subject to Subpart IIII meet the requirements of NESHAP Subpart ZZZZ by complying with the requirements of NSPS Subpart IIII.
Fugitive dust sources	Water Trucks Dust Suppressants	A.A.C. R18-2 Article 6 A.A.C. R18-2-702	These standards are applicable to all fugitive dust sources at the facility.
Petroleum Liquid Storage Tanks - Gasoline	Submerged filling device; Pump/ compressor seals	AAC R18-2-710 40 CFR 63 Subpart CCCCCC	This standard applies to the gasoline storage tanks. NESHAP Subpart CCCCCC applies to gasoline dispensing facilities.
Diesel Storage Tanks	N/A	A.A.C. R18-2-730	These standards apply to unclassified sources.
Laboratory Dust Collector	Dust Collector	A.A.C. R18-2-721, 702 AZ SIP Provision R9-3-521	The PM limits from A.A.C. R18-2-721 and AZ SIP apply
Abrasive Blasting	Wet blasting; Dust collecting equipment; Other approved methods	A.A.C. R-18-2-702 A.A.C. R-18-2-726	These standards are applicable to any abrasive blasting operation.
Spray Painting	Enclosures	A.A.C. R18-2-702 A.A.C. R-18-2-727	This standard is applicable to any spray painting operation.

Unit	Control Device	Rule	Verification
Demolition/renovation operations	N/A	A.A.C. R18-2-1101.A.8	This standard is applicable to any asbestos related demolition or renovation operations.
Mobile sources	None	A.A.C. R18-2-801	These are applicable to off-road mobile sources, which either move while emitting air pollutants or are frequently moved during the course of their utilization.

V. MONITORING AND RECORDKEEPING REQUIREMENTS

A. Facility Wide

1. The Permittee is required to maintain, on-site, records of the manufacturer's specifications or an operation and maintenance plan for all equipment listed in the permit.

2. The Permittee is required to keep records of dates and times when blasting is conducted along with the amount of ANFO used in the blast.

3. The Permittee is required to perform comprehensive annual preventative maintenance checks on all dust control equipment at the facility.

4. The Permittee is required to follow the procedures for reducing emissions as stated in the dust control plan included in the permit and the tailings management plan to be submitted prior to startup.

5. The Permittee is required to conduct daily visible emissions survey at places where facility fugitive dust generating activities are within 300 feet of the property boundary line in accordance with EPA Method 22. If any visible emissions are observed, it shall be reported as excess emissions.

B. Metallic Mineral Processing Subject To NSPS Subpart LL

1. The Permittee is required to show compliance with the opacity standards by having a Method 9 certified observer perform weekly surveys of visible emission from the dust collectors and process fugitive emission points. The observer is required to conduct a 6-minute Method 9 observation if the results of the initial survey appear on an instantaneous basis to exceed the applicable standard or baseline opacity level.

2. The Permittee is required to keep records of the name of the observer, the time, date, and location of the observation and the results of all surveys and observations.

3. The Permittee is required to keep records of any corrective action taken to lower the opacity of any emission point and any excess emission reports.

4. The Permittee is required to monitor the flow rate and pressure drop across the scrubber (PCL07).

5. The Permittee is required to monitor the voltage and current across the electrostatic precipitator according to the manufacturer's specifications.

C. Metallic Mineral Processing Subject To A.A.C. R18-2-721

1. The Permittee is required to show compliance with the opacity standards by having a Method 9 certified observer perform weekly surveys of visible emissions. The observer is required to conduct a 6-minute Method 9 observation if the results of the initial survey appear on an instantaneous basis to exceed the applicable standard.

2. The Permittee is required to keep records of the name of the observer, the time, date, and location of the observation and the results of all surveys and observations.

3. The Permittee is required to keep records of any corrective action taken to lower the opacity of any emission point and any excess emission reports.

D. Boiler

1. The Permittee is required to show compliance with the opacity standards by having a Method 9 certified observer perform a weekly survey of visible emissions from the stack of the electrolyte heater. The observer is required to conduct a 6-minute Method 9 observation if the results of the initial survey appear on an instantaneous basis to exceed the applicable standard.

2. The Permittee is required to keep records of the name of the observer, the time, date, and location of the observation and the results of all surveys and observations.

3. The Permittee is required to keep records of any corrective action taken to lower the opacity of any emission point and any excess emission reports.

4. The Permittee is required to keep records of the tune-ups, the procedures followed, manufacturer's specifications, concentrations of CO measured before and after tune-ups, taken, and any malfunction, duration and corrective actions taken.

E. Solution Extraction / Electrowinning (SX/EW) Process

The Permittee is required to maintain a record of all control measures used to limit emissions from the SX/EW process.

F. Internal Combustion Engines

1. The Permittee is required to record the hours of operation using a non-resettable hours meter and the reason of operation.

2. The Permittee is required to keep records of maintenance conducted on all engines.

G. Fugitive Dust

1. The Permittee is required to keep record of the dates and types of dust control measures employed.

2. The Permittee is required to show compliance with the opacity standards by having a

Method 9 certified observer perform weekly survey of visible emission from fugitive dust sources. The observer is required to conduct a 6-minute Method 9 observation if the results of the initial survey appear on an instantaneous basis to exceed the applicable standard.

3. The Permittee is required to keep records of the name of the observer, the time, date, and location of the observation and the results of all surveys and observations.

4. The Permittee is required to keep records of any corrective action taken to lower the opacity of any emission point and any excess emission reports.

5. The Permittee is required to monitor the forecast and wind speeds and conduct inspections of tailings as deemed necessary.

6. The Permittee is required to submit a Tailings Management Plan as part of a Significant Permit Revision at least 180 days prior to the start of dry tailings deposition.

H. Gasoline Storage and Dispensing

The Permittee is required to maintain monthly record of gasoline throughput, Reid vapor pressure and dates of storage and when the dates when the tank was empty. If the vapor pressure is greater than 470mm Hg, the Permittee is required to record the average monthly temperature and true vapor pressure of gasoline at such temperature. The Permittee is required to record and report any malfunction of operation and corrective actions taken.

I. Periodic Activities

1. The Permittee is required to record the date, duration and pollution control measures of any abrasive blasting project.

2. The Permittee is required to record the date, duration, quantity of paint used, any applicable MSDS, and pollution control measures of any spray painting project.

3. The Permittee is required to maintain records of all asbestos related demolition or renovation projects. The required records include the "NESHAP Notification for Renovation and Demolition Activities" form and all supporting documents.

J. Mobile Sources

The Permittee is required to keep records of all emission related maintenance performed on the mobile sources. The Permittee is required to purchase 6 haul trucks that meet US EPA Tier 4 requirements.

VI. Testing Requirements

A. The Permittee is required to perform an annual Method 5, 17 or 201A performance test for PM/PM_{10} on the control equipment.

B. The Permittee is required to conduct biennially boiler tune-ups with the first tune-up to be conducted no later than 25 months after initial start-up.

VII. Ambient Monitoring Requirements

In response to public comments, RCC is required to install and operate a continuous PM_{10} monitor and meteorological monitoring. The protocol is required to be submitted within 180 days of permit issuance and RCC will be required to operate the instruments at least 90 days prior to the startup of the mine operations. Quarterly and annual reports are required to be submitted electronically. The permit identifies specific requirements for the maintenance and calibration of the monitors. The ambient monitors will serve as Special Purpose Monitors (SPM) that would be maintained by RCC. These ambient monitors will be required for a temporary period to document ambient impacts over all potential meteorological conditions. The Department will work with RCC to determine the exact duration of the monitoring.

VIII. Insignificant Activities

Table 3 below, lists insignificant activities identified at the RCP facility:

Table 3: Insignificant Activities

Equipment Description	Maximum Size or Capacity	Verification of Insignificance
Diesel and Fuel Oil Storage Tank < 40,000 gallons	11,000 gal – EW Hot Water Heater 11,845 gal – Concentrate Ore Area 1,000 gal – Motivator 10,000 gal – Light Vehicles	A.A.C. R18-2-101.57.c
Miscellenous Storage Tanks <40,000 gallons	5000 gal Flocculant Mix Tank 5,000 gal Flocculant Distribution Tank 3,000 gal Promoter Storage Tank 500 gal Guar Mix Tank 500 gal Guar Day Tank 9,500 gal Diluent Storage Tank 165 gal Decant Tank 3,000 gal Automatic Transmission Fluid Storage Tank 5,876 gal Engine Oil Storage Tank 1,650 gal Organic Separation Tank 840 gal Recovered Organic Tank 10,000 gal Crud Decant Tank 5,000 gal Crud Filtrate Tank 3,000 gal Hydraulic Fluid Storage Tank 3,000 gal Gear Oil Storage Tank 5,876 gal Used Oil Storage Tank 275 gal Automatic Transmission Fluid Day Tank 275 gal Engine Oil Day Tank 275 gal Hydraulic Fluid Day Tank 275 gal Gear Oil Day Tank 275 gal Used Oil Day Tank	A.A.C. R18-2-101.57.j
Batch Mixers	<5 cu.ft	A.A.C. R18-2-101.57.d
Wet Sand & Gravel Operations excluding crushing/grinding operations	<200 tons per hour	A.A.C. R18-2-101.57.e
Hand-held or manually operated equipment	Buffing, polishing, carving, cutting, drilling, machining, routing, sanding, sawing, surface, grinding, or turning of ceramic art work, precision parts, Leather, metals, plastics, fiberboard, masonry, carbon, glass, or	A.A.C. R18-2-101.57.f

Equipment Description	Maximum Size or Capacity	Verification of Insignificance
	wood	
Lab Equipment used for chemical & physical analyses	Analytical laboratory equipment Small pilot scale R&D projects	A.A.C. R18-2-101.57.i

IX. Ambient Air Impact Analysis

An ambient air quality impacts analysis was conducted to determine if emissions of any criteria pollutant will cause or contribute to an exceedance of a National Ambient Air Quality Standard (NAAQS). The most recent version of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) was used in the modeling analysis. AERMOD is the EPA's preferred near-field dispersion modeling system for a wide range of regulatory applications.

For modeling demonstrations of compliance with the NAAQS, EPA requires the use of five years of National Weather Service (NWS) meteorological data or at least one year of site specific data. Three years of site specific meteorological data were collected in the Rosemont site, following the EPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications. The on-site surface data, in combination with the upper air data obtained from the NWS Tucson Airport Station, were processed with AERMET, the meteorological data processor for AERMOD.

Three years of site specific PM_{10} data were collected in the Rosemont site. The highest concentration for 24-hour PM_{10} over the three-year period was $71.3 \mu g/m^3$. While this monitored concentration is a statistical outlier, the reasons resulting in this extreme high concentration are unknown. Therefore, the background concentration for 24-hour PM_{10} was determined separately. For other criteria pollutants, background concentrations were determined on the basis of the data collected from representative monitoring sites, with the considerations of surrounding emission sources, terrain features as well as elevations.

A receptor network was developed to determine areas of maximum predicted concentrations. The grid spacing utilized for the receptors are as follows: process area boundary set at 25 m intervals; fine receptor grid of 100 m, extending from PAB to 1 km; medium receptor grid of 500 m, extending from 1 km to 5 km; coarse grid receptor grid of 500 m, extending from 5 km to 10 km. Receptor elevations and hill height scale factors were calculated with AERMAP, the terrain processor for AERMOD. Building downwash was evaluated using building and stack location and dimensions, and the EPA approved Building Profile Input Program Plume Rise Model Enhancements (BPIP-PRME).

A modeling analysis was performed for both Year 1 and Year 5, during which the maximum emission rates will most likely occur according to Mine Plan of Operations. All project emissions were modeled as either point sources or volume sources based on their release characteristics. The major particulate matter (PM) sources include haul road, open-pit, stockpiles, dust collectors, and conveyors. The major sources for gaseous pollutants include blasting, motor vehicles (tailpipe), emergency generators and hot water heaters. For modeling short-term impacts, the maximum daily process rates were used to estimate the short-term emissions. For modeling annual impacts, the average daily process rates were used to estimate the annual emissions.

<u>NO_2 modeling</u>

The compliance with 1-hour NO_2 was evaluated by using the Tier 3 - Ozone limiting Method (OLM) approach, following EPA's guidance memorandums entitled "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard". Since the vast majority of the NO_2 emissions at the Rosemont facility are from mobile sources with low-level plumes, OLM is likely to provide a better estimation of the NO_2 impacts than Plume Volume Molar Ratio Method (PVMRM), another widely used Tier 3 approach. There are two key model inputs for the Tier 3 approach, namely in-stack ratios of NO_2/NO_X emissions and background ozone concentrations. The in-stack ratios for mobile sources and internal combustion engines were determined based on testing data or data published in scientific literatures. Due to the absence of in-stack ratios for blasting sources, a default in-stack ratio of 0.5 was used, per the EPA's guidance memorandums. Hourly ozone background concentrations were obtained from the CASTNET ozone monitor at the Chiricahua National Monument. Since the hourly maximum ozone concentrations of the Chiricahua site are comparable or higher than that of the Green Valley site (the nearest monitoring site to Rosemont), the use of Chiricahua data is likely to provide a relatively conservative estimation for the 1-hour NO_2 impacts from the proposed sources. Results of the modeling are presented in the below table:

Table 4 – Results of Ambient Air Impact Analysis

Pollutant (Averaging Time)	NAAQS ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration Including Background ($\mu g/m^3$)
$PM_{2.5}$ (24-hour)	35	7.2	26.7
$PM_{2.5}$ (annual)	15	3.1	6.9
PM_{10} (24-hour)	150	47.7	147*
SO_2 (1-hour)	195	22.2	44.4
SO_2 (3-hour)	1,300	43.0	62.5
SO_2 (24-hour)	365	17.0	22.6
SO_2 (annual)	80	3.0	3.4
NO_x (annual)	100	4.0	26.3
NO_x (1-hour)	188.6	24.5	164.2
CO (1-hour)	40,000	582.0	2062.7
CO (8-hour)	10,000	582.0	1278.7

* The PM_{10} background concentration includes the outlier value of 71.3$\mu g/m^3$. If this outlier is replaced by the next highest reading of 40.3$\mu g/m^3$, the background concentration would reduce to 37.4$\mu g/m^3$ and the resulting modeled concentration would amount to 136.7$\mu g/m^3$.

X. LIST OF ABBREVIATIONS

A.A.C	Arizona Administrative Code
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
CO	Carbon Monoxide
HAPs	Hazardous Air Pollutants
H_2SO_4	Sulfuric Acid
GHG	Green House Gases
MSDS	Material Safety Data Sheets
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2/NO_x	Nitrogen Oxides
NSPS	New Source Performance Standards
P.C.C	Pima County Code
PLS	Pregnant Leach Solution

PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter of less than 2.5 microns
PM_{10}	Particulate Matter with an Aerodynamic Diameter of less than 10 microns
PTE	Potential to Emit
ROM	Run of Mine
RCP	Rosemont Copper Project
RCC	Rosemont Copper Company
SO_2	Sulfur Dioxide
SX/EW	Solution Extraction and Electrowinning
VOC	Volatile Organic Compounds
$\mu g/m^3$	Micro gram per cubic meter

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY CLASS II SYNTHETIC MINOR PERMIT

COMPANY: ***Rosemont Copper Company***
FACILITY: ***Rosemont Copper Project***
PERMIT #: ***55223***
DATE ISSUED: ***January 31, 2013***
EXPIRY DATE: ***January 31, 2018***

SUMMARY

This Class II synthetic minor permit is issued to Rosemont Copper Company for the construction and operation of an open pit copper mine, milling, leaching, and solvent extraction/electrowinning facility to be located at 21900 S Sonoita Highway, Vail, Arizona 85641, which is approximately 30 miles southeast of Tucson, west of State Highway 83, in Pima County, Arizona. The facility is accepting voluntary emissions limitations to stay below major source thresholds. Consequently, a Class II synthetic minor permit is being processed for this facility.

This permit is issued in accordance with an assertion of jurisdiction pursuant to Arizona Revised Statues (ARS) 49-402, 49-426 and applicable provision of the State Implementation Plan. It contains requirements from the Arizona Administrative Code, Title 18, Chapter 2, Pima County Code, Title 17, Code of Federal Regulations (CFR) and applicable State Implementation Plan requirements.

All definitions, terms, and conditions used in this permit conform to those in the Arizona Administrative Code R18-2-101 et. Seq. (A.A.C.) and 40 Code of Federal Regulations (CFR).

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ATTACHMENT "A": GENERAL PROVISIONS

Air Quality Control Permit No. 55223
For
Rosemont Copper Company- Rosemont Copper Project

I. PERMIT EXPIRATION AND RENEWAL

[ARS § 49-426.F; A.A.C. R18-2-304.C.2, & -306.A.1]

A. This permit is valid for a period of five years from the date of issuance.

B. The Permittee shall submit an application for renewal of this permit at least 6 months, but not more than 18 months, prior to the date of permit expiration.

II. COMPLIANCE WITH PERMIT CONDITIONS

[A.A.C. R18-2-306.A.8.a & b]

A. The Permittee shall comply with all conditions of this permit including all applicable requirements of the Arizona air quality statutes A.R.S Title 49, Chapter 3, Pima County and Arizona air quality rules. Any permit noncompliance constitutes a violation of the Arizona Revised Statutes and is grounds for enforcement action; for permit termination, revocation and reissuance, or revision; or for denial of a permit renewal application. In addition, noncompliance with any federally enforceable requirement constitutes a violation of the Clean Air Act.

B It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

III. PERMIT REVISION, REOPENING, REVOCATION AND REISSUANCE, OR TERMINATION FOR CAUSE

[A.A.C. R18-2-306.A.8.c, -321.A.1.c-d, & -321.A.2]

A. The permit may be revised, reopened, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for a permit revision, revocation and reissuance, termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.

B. The permit shall be reopened and revised under any of the following circumstances

1. The Director or the Administrator determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit.

2. The Director or the Administrator determines that the permit needs to be revised or revoked to assure compliance with the applicable requirements.

C. Proceedings to reopen and reissue a permit, including appeal of any final action relating to a permit reopening, shall follow the same procedures as apply to initial permit issuance and shall affect only those parts of the permit for which cause to reopen exists. Such reopenings shall be made as expeditiously as practicable. Permit reopenings shall not result in a resetting of the five-year permit term.

IV. POSTING OF PERMIT [A.A.C. R18-2-315]

A. The Permittee shall post this permit or a certificate of permit issuance where the facility is located in such a manner as to be clearly visible and accessible. All equipment covered by this permit shall be clearly marked with one of the following:

1. Current permit number; or

2. Serial number or other equipment ID number that is also listed in the permit to identify that piece of equipment.

B. A copy of the complete permit shall be kept on site.

V. FEE PAYMENT

[A.A.C. R18-2-306.A.9 & -326]

The Permittee shall pay fees to the Director pursuant to ARS § 49-426(E) and A.A.C. R18-2-326.

VI. ANNUAL EMISSION INVENTORY QUESTIONNAIRE

[A.A.C. R18-2-327.A & B]

A. The Permittee shall complete and submit to the Director an annual emissions inventory questionnaire. The questionnaire is due by March 31st or ninety days after the Director makes the inventory form available each year, whichever occurs later, and shall include emission information for the previous calendar year.

B. The questionnaire shall be on a form provided by the Director and shall include the information required by A.A.C. R18-2-327.

VII. COMPLIANCE CERTIFICATION

[A.A.C. R18-2-309.2.a, -309.2.c-d, and -309.5.d]

A. The Permittee shall submit a compliance certification to the Director semiannually which describes the compliance status of the source with respect to each permit condition. The first certification shall be submitted no later than May 15th, and shall report the compliance status of the source during the period between October 1st of the previous year and March 31st of the current year. The second certification shall be submitted no later than November 15th, and shall report the compliance status of the source during the period between April 1st and September 30th of the current year.

The compliance certifications shall include the following:

1. Identification of each term or condition of the permit that is the basis of the certification;

2. Identification of the methods or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period;

3. The status of compliance with the terms and conditions of the permit for the period covered by the certification, including whether compliance during the period was continuous or intermittent. The certification shall be based on the methods or means designated in Condition VII.A.2 above. The certifications shall identify each deviation and take it into account for consideration in the compliance certification;

4. All instances of deviations from permit requirements reported pursuant to Condition XII.B of this Attachment; and

5. Other facts the Director may require to determine the compliance status of the source.

B. A progress report on all outstanding compliance schedules shall be submitted every six months beginning with six months after permit issuance.

VIII. CERTIFICATION OF TRUTH, ACCURACY AND COMPLETENESS

[A.A.C. R18-2-304.H]

Any document required to be submitted by this permit, including reports, shall contain a certification by a responsible official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

IX. INSPECTION AND ENTRY

[A.A.C. R18-2-309.4]

Upon presentation of proper credentials, the Permittee shall allow the Director or the authorized representative of the Director to:

A. Enter upon the Permittee's premises where a source is located, emissions-related activity is conducted, or where records are required to be kept under the conditions of the permit;

B. Have access to and copy, at reasonable times, any records that are required to be kept under the conditions of the permit;

C. Inspect, at reasonable times, any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit;

D. Sample or monitor, at reasonable times, substances or parameters for the purpose of assuring compliance with the permit or other applicable requirements; and

E. Record any inspection by use of written, electronic, magnetic and photographic media.

X. PERMIT REVISION PURSUANT TO FEDERAL HAZARDOUS AIR POLLUTANT STANDARD

[A.A.C. R18-2-304.C]

If this source becomes subject to a standard promulgated by the Administrator pursuant to Section 112(d) of the Act, then the Permittee shall, within twelve months of the date on which the standard is promulgated, submit an application for a permit revision demonstrating how the source will comply with the standard.

XI. ACCIDENTAL RELEASE PROGRAM

[40 CFR Part 68]

If this source becomes subject to the provisions of 40 CFR Part 68, then the Permittee shall comply with these provisions according to the time line specified in 40 CFR Part 68.

XII. EXCESS EMISSIONS, PERMIT DEVIATIONS, AND EMERGENCY REPORTING

[A.A.C. R18-2-310.01.A & -310.01.B]

A. Excess Emissions Reporting

1. Excess emissions shall be reported as follows:

   a. The Permittee shall report to the Director any emissions in excess of the limits established by this permit. Such report shall be in two parts as specified below:

      (1) Notification by telephone or facsimile within 24 hours of the time when the Permittee first learned of the occurrence of excess emissions including all available information from Condition XII.A.1.b below.

      (2) Detailed written notification by submission of an excess emissions report within 72 hours of the notification pursuant to Condition XII.A.1.a.(1) above.

   b. The report shall contain the following information:

      (1) Identity of each stack or other emission point where the excess emissions occurred;

      (2) Magnitude of the excess emissions expressed in the units of the applicable emission limitation and the operating data and calculations used in determining the magnitude of the excess emissions;

      (3) Date, time and duration, or expected duration, of the excess emissions;

      (4) Identity of the equipment from which the excess emissions emanated;

      (5) Nature and cause of such emissions;

      (6) If the excess emissions were the result of a malfunction, steps taken to remedy the malfunction and the steps taken or planned to prevent the recurrence of such malfunctions; and

(7) Steps taken to limit the excess emissions. If the excess emissions resulted from start-up or malfunction, the report shall contain a list of the steps taken to comply with the permit procedures.

2. In the case of continuous or recurring excess emissions, the notification requirements of this Section shall be satisfied if the source provides the required notification after excess emissions are first detected and includes in such notification an estimate of the time the excess emissions will continue. Excess emissions occurring after the estimated time period, or changes in the nature of the emissions as originally reported, shall require additional notification pursuant to Condition XII.A.1 above.

[A.A.C. R18-2-310.01.C]

B. Permit Deviations Reporting

[A.A.C. R18-2-306.A.5.b]

The Permittee shall promptly report deviations from permit requirements, including those attributable to upset conditions as defined in the permit, the probable cause of such deviations, and any corrective actions or preventive measures taken. Prompt reporting shall mean that the report was submitted to the Director/Control Officer by certified mail, facsimile, or hand delivery within two working days of the time when the owner or operator first learned of the occurrence of a deviation from a permit requirement.

C. Emergency Provision

[A.A.C. R18-2-306.E]

1. An "emergency" means any situation arising from sudden and reasonable unforeseeable events beyond the control of the source, including acts of God, that require immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.

2. An emergency constitutes an affirmative defense to an action brought for noncompliance with such technology-based emission limitations if Condition XII.C.3 is met.
3. The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:

    a. An emergency occurred and that the Permittee can identify the cause(s) of the emergency;

    b. The permitted facility was being properly operated at the time;

    c. During the period of the emergency, the Permittee took all reasonable steps to minimize levels of emissions that exceeded the emissions standards or other requirements in the permit; and

d. The Permittee submitted notice of the emergency to the Director by certified mail, facsimile, or hand delivery within two working days of the time when emission limitations were exceeded due to the emergency. This notice shall contain a description of the emergency, any steps taken to mitigate emissions, and corrective action taken.

4. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an emergency has the burden of proof.

5. This provision is in addition to any emergency or upset provision contained in any applicable requirement.

D. Compliance Schedule

[ARS § 49-426.I.5]

For any excess emission or permit deviation that cannot be corrected within 72 hours, the Permittee is required to submit a compliance schedule to the Director within 21 days of such occurrence. The compliance schedule shall include a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance with the permit terms or conditions that have been violated.

E. Affirmative Defenses for Excess Emissions Due to Malfunctions, Startup, and Shutdown

[A.A.C. R18-2-310]

1. Applicability

This rule establishes affirmative defenses for certain emissions in excess of an emission standard or limitation and applies to all emission standards or limitations except for standards or limitations:

a. Promulgated pursuant to Sections 111 or 112 of the Act;

b. Promulgated pursuant to Titles IV or VI of the Clean Air Act;

c. Contained in any Prevention of Significant Deterioration (PSD) or New Source Review (NSR) permit issued by the U.S. EPA;

d. Contained in A.A.C. R18-2-715.F; or

e. Included in a permit to meet the requirements of A.A.C. R18-2-406.A.5.

2. Affirmative Defense for Malfunctions

Emissions in excess of an applicable emission limitation due to malfunction shall constitute a violation. When emissions in excess of an applicable emission limitation are due to a malfunction, the Permittee has an affirmative defense to a civil or administrative enforcement proceeding based on that violation, other than a judicial action seeking injunctive relief, if the Permittee has complied with the reporting requirements of A.A.C. R18-2-310.01 and has demonstrated all of the following:

a. The excess emissions resulted from a sudden and unavoidable breakdown of process equipment or air pollution control equipment beyond the reasonable control of the Permittee;

b. The air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good practice for minimizing emissions;

c. If repairs were required, the repairs were made in an expeditious fashion when the applicable emission limitations were being exceeded. Off-shift labor and overtime were utilized where practicable to ensure that the repairs were made as expeditiously as possible. If off-shift labor and overtime were not utilized, the Permittee satisfactorily demonstrated that the measures were impracticable;

d. The amount and duration of the excess emissions (including any bypass operation) were minimized to the maximum extent practicable during periods of such emissions;

e. All reasonable steps were taken to minimize the impact of the excess emissions on ambient air quality;

f. The excess emissions were not part of a recurring pattern indicative of inadequate design, operation, or maintenance;

g. During the period of excess emissions there were no exceedances of the relevant ambient air quality standards established in Title 18, Chapter 2, Article 2 of the Arizona Administrative Code that could be attributed to the emitting source;

h. The excess emissions did not stem from any activity or event that could have been foreseen and avoided, or planned, and could not have been avoided by better operations and maintenance practices;

i. All emissions monitoring systems were kept in operation if at all practicable; and

j. The Permittee's actions in response to the excess emissions were documented by contemporaneous records

3. Affirmative Defense for Startup and Shutdown

a. Except as provided in Condition XII.E.3.b below, and unless otherwise provided for in the applicable requirement, emissions in excess of an applicable emission limitation due to startup and shutdown shall constitute a violation. When emissions in excess of an applicable emission limitation are due to startup and shutdown, the Permittee has an affirmative defense to a civil or administrative enforcement proceeding based on that violation, other than a judicial action seeking injunctive relief, if the Permittee has complied with the reporting requirements of A.A.C. R18-2-310.01 and has demonstrated all of the following:

(1) The excess emissions could not have been prevented through careful and prudent planning and design;

(2) If the excess emissions were the result of a bypass of control equipment, the bypass was unavoidable to prevent loss of life, personal injury, or severe damage to air pollution control equipment, production equipment, or other property;

(3) The air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good practice for minimizing emissions;

(4) The amount and duration of the excess emissions (including any bypass operation) were minimized to the maximum extent practicable during periods of such emissions;

(5) All reasonable steps were taken to minimize the impact of the excess emissions on ambient air quality;

(6) During the period of excess emissions there were no exceedances of the relevant ambient air quality standards established in Title 18, Chapter 2, Article 2 of the Arizona Administrative Code that could be attributed to the emitting source;

(7) All emissions monitoring systems were kept in operation if at all practicable; and

(8) Contemporaneous records documented the Permittee’s actions in response to the excess emissions.

b. If excess emissions occur due to a malfunction during routine startup and shutdown, then those instances shall be treated as other malfunctions subject to Condition XII.E.2 above.

4. Affirmative Defense for Malfunctions During Scheduled Maintenance

If excess emissions occur due to a malfunction during scheduled maintenance, then those instances will be treated as other malfunctions subject to Condition XII.E.2 above.

5. Demonstration of Reasonable and Practicable Measures

For an affirmative defense under Condition XII.E.2 or XII.E.3 above, the Permittee shall demonstrate, through submission of the data and information required by Condition XII.E and A.A.C. R18-2-310.01, that all reasonable and practicable measures within the Permittee’s control were implemented to prevent the occurrence of the excess emissions.

XIII. RECORD KEEPING REQUIREMENTS

[A.A.C. R18-2-306.A.4]

A. The Permittee shall keep records of all required monitoring information including, but not limited to, the following:

1. The date, place as defined in the permit, and time of sampling or measurements;

2. The date(s) analyses were performed;

3. The name of the company or entity that performed the analyses;

4. A description of the analytical techniques or methods used;

5. The results of such analyses; and

6. The operating conditions as existing at the time of sampling or measurement.

B. The Permittee shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records and all original strip-chart recordings or other data recordings for continuous monitoring instrumentation, and copies of all reports required by the permit.

C. All required records shall be maintained either in an unchangeable electronic format or in a handwritten logbook utilizing indelible ink.

XIV. REPORTING REQUIREMENTS

[A.A.C. R18-2-306.A.5.a]

The Permittee shall submit the following reports:

A. Compliance certifications in accordance with Section VII of Attachment “A”.

B. Excess emission; permit deviation, and emergency reports in accordance with Section XII of Attachment “A”.

C. Other reports required by any condition of Attachment “B”.

XV. DUTY TO PROVIDE INFORMATION

[A.A.C. R18-2-304.G & -306.A.8.e]

A. The Permittee shall furnish to the Director, within a reasonable time, any information that the Director may request in writing to determine whether cause exists for revising, revoking and reissuing, or terminating the permit, or to determine compliance with the permit. Upon request, the Permittee shall also furnish to the Director copies of records required to be kept by the permit. For information claimed to be confidential, the Permittee shall furnish an additional copy of such records directly to the Administrator along with a claim of confidentiality.

B. If the Permittee has failed to submit any relevant facts or has submitted incorrect information in the permit application, the Permittee shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information.

XVI. PERMIT AMENDMENT OR REVISION

[A.A.C. R18-2-317.01, -318, -319, & -320]

The Permittee shall apply for a permit amendment or revision for changes to the facility which do not qualify for a facility change without revision under Section XVII, as follows:

A. Facility Changes that Require a Permit Revision - Class II (A.A.C. R18-2-317.01);

B. Administrative Permit Amendment (A.A.C. R18-2-318);

C. Minor Permit Revision (A.A.C. R18-2-319); and

D. Significant Permit Revision (A.A.C. R18-2-320)

The applicability and requirements for such action are defined in the above referenced regulations.

XVII. FACILITY CHANGE WITHOUT A PERMIT REVISION

[A.A.C. R18-2-306.A.4 & -317.02]

A. Except for a physical change or change in the method of operation at a Class II source requiring a permit revision under A.A.C. R18-2-317.01, or a change subject to logging or notice requirements in Conditions XVII.B and XVII.C below, a change at a Class II source shall not be subject to revision, notice, or logging requirements under this Section.

B. Except as otherwise provided in the conditions applicable to an emissions cap created under A.A.C. R18-2-306.02, the following changes may be made if the source keeps on site records of the changes according to Appendix 3 of the Arizona Administrative Code:

1. Implementing an alternative operating scenario, including raw materials changes;

2. Changing process equipment, operating procedures, or making any other physical change if the permit requires the change to be logged;

3. Engaging in any new insignificant activity listed in A.A.C. R18-2-101.57.a through A.A.C. R18-2-101.57.i but not listed in the permit;

4. Replacing an item of air pollution control equipment listed in the permit with an identical (same model, different serial number) item. The Director may require verification of efficiency of the new equipment by performance tests; and

5. A change that results in a decrease in actual emissions if the source wants to claim credit for the decrease in determining whether the source has a net emissions increase for any purpose. The logged information shall include a description of the change that will produce the decrease in actual emissions. A decrease that has not been logged is creditable only if the decrease is quantifiable, enforceable, and otherwise qualifies as a creditable decrease.

C. Except as provided in the conditions applicable to an emissions cap created under A.A.C. R18-2-306.02, the following changes may be made if the source provides written notice to the Department in advance of the change as provided below:

1. Replacing an item of air pollution control equipment listed in the permit with one that is not identical but that is substantially similar and has the same or better pollutant removal efficiency: 7 days. The Director may require verification of efficiency of the new equipment by performance tests;

2. A physical change or change in the method of operation that increases actual emissions more than 10% of the major source threshold for any conventional pollutant but does not require a permit revision: 7 days;

3. Replacing an item of air pollution control equipment listed in the permit with one that is not substantially similar but that has the same or better efficiency: 30 days. The Director may require verification of efficiency of the new equipment by performance tests;

4. A change that would trigger an applicable requirement that already exists in the permit: 30 days unless otherwise required by the applicable requirement;

5. A change that amounts to reconstruction of the source or an affected facility: 7 days. For the purposes of this subsection, reconstruction of a source or an affected facility shall be presumed if the fixed capital cost of the new components exceeds 50% of the fixed capital cost of a comparable entirely new source or affected facility and the changes to the components have occurred over the 12 consecutive months beginning with commencement of construction; and

6. A change that will result in the emissions of a new regulated air pollutant above an applicable regulatory threshold but that does not trigger a new applicable requirement for that source category: 30 days. For purposes of this requirement, an applicable regulatory threshold for a conventional air pollutant shall be 10% of the applicable major source threshold for that pollutant.

D. For each change under Condition XVII.C above, the written notice shall be by certified mail or hand delivery and shall be received by the Director the minimum amount of time in advance of the change. Notifications of changes associated with emergency conditions, such as malfunctions necessitating the replacement of equipment, may be provided with less than required notice, but must be provided as far in advance of the change, or if advance notification is not practicable, as soon after the change as possible. The written notice shall include:

1. When the proposed change will occur;

2. A description of the change;

3. Any change in emissions of regulated air pollutants; and

4. Any permit term or condition that is no longer applicable as a result of the change.

E. A source may implement any change in Condition XVII.C above without the required notice by applying for a minor permit revision under A.A.C. R18-2-319 and complying with subsection A.A.C. R18-2-319.D.2 and A.A.C. R18-2-319.G.

F. The permit shield described in A.A.C. R18-2-325 shall not apply to any change made under this Section, other than implementation of an alternate operating scenario under Condition XVII.B.1.

G. Notwithstanding any other part of this Section, the Director may require a permit to be revised for any change that, when considered together with any other changes submitted by the same source under this Section over the term of the permit, constitutes a change under subsection A.A.C. R18-2-317.01.A.

H. If a source change is described under both Conditions XVII.B and XVII.C above, the source shall comply with Condition XVII.C above. If a source change is described under both Condition XVII.C above and A.A.C. R18-2-317.01.B, the source shall comply with A.A.C. R18-2-317.01.B.

I. A copy of all logs required under Condition XVII.B shall be filed with the Director within 30 days after each anniversary of the permit issuance date. If no changes were made at the source requiring logging, a statement to that effect shall be filed instead.

J. Logging Requirements

[A.A.C. R18-2-306.A.4]

1. Each log entry required by a change under Condition XVII.B shall include at least the following information:

   a. A description of the change, including:

      (1) A description of any process change;

      (2) A description of any equipment change, including both old and new equipment descriptions, model numbers, and serial numbers, or any other unique equipment ID number; and

      (3) A description of any process material change.

   b. The date and time that the change occurred.

   c. The provision of A.A.C. R18-2-317.02.B that authorizes the change to be made with logging.

   d. The date the entry was made and the first and last name of the person making the entry.

2. Logs shall be kept for 5 years from the date created. Logging shall be performed in indelible ink in a bound log book with sequentially number pages, or in any other form, including electronic format, approved by the Director.

XVIII. TESTING REQUIREMENTS

[A.A.C. R18-2-312]

A. The Permittee shall conduct performance tests as specified in the permit and at such other times as may be required by the Director.

B. Operational Conditions During Testing

Tests shall be conducted during operation at the maximum possible capacity of each unit under representative operational conditions unless other conditions are required by the applicable test method or in this permit. With prior written approval from the Director, testing may be performed at a lower rate. Operations during periods of start-up, shutdown, and malfunction (as defined in A.A.C. R18-2-101) shall not constitute representative operational conditions unless otherwise specified in the applicable standard.

C. Tests shall be conducted and data reduced in accordance with the test methods and procedures contained in the Arizona Testing Manual unless modified by the Director pursuant to A.A.C. R18-2-312.B.

D. Test Plan

At least 14 calendar days prior to performing a test, the Permittee shall submit a test plan to the Director in accordance with A.A.C. R18-2-312.B and the Arizona Testing Manual. This test plan must include the following:

1. Test duration;
2. Test location(s);
3. Test method(s); and
4. Source operation and other parameters that may affect test results.

E. Stack Sampling Facilities

The Permittee shall provide, or cause to be provided, performance testing facilities as follows:

1. Sampling ports adequate for test methods applicable to the facility;
2. Safe sampling platform(s);
3. Safe access to sampling platform(s); and
4. Utilities for sampling and testing equipment.

F. Interpretation of Final Results

Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic mean of the results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs is required to be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the Permittee's control, compliance may, upon the Director's approval, be determined using the arithmetic mean of the results of the other two runs. If the Director or the Director's designee is present, tests may only be stopped with the Director's or such designee's approval. If the Director or the Director's designee is not present, tests may only be stopped for good cause. Good cause includes: forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the Permittee's control. Termination of any test without good cause after the first run is commenced shall constitute a failure of the test. Supporting documentation, which demonstrates good cause, must be submitted.

G. Report of Final Test Results

A written report of the results of all performance tests shall be submitted to the Director within 30 days after the test is performed. The report shall be submitted in accordance with the Arizona Testing Manual and A.A.C. R18-2-312.A.

XIX. PROPERTY RIGHTS

[A.A.C. R18-2-306.A.8.d]

This permit does not convey any property rights of any sort, or any exclusive privilege.

XX. SEVERABILITY CLAUSE

[A.A.C. R18-2-306.A.7]

The provisions of this permit are severable. In the event of a challenge to any portion of this permit, or if any portion of this permit is held invalid, the remaining permit conditions remain valid and in force.

XXI. PERMIT SHIELD

[A.A.C. R18-2-325]

Compliance with the conditions of this permit shall be deemed compliance with all applicable requirements identified in the portions of this permit subtitled "Permit Shield". The permit shield shall not apply to any minor revisions pursuant to Condition XVI.C of this Attachment and any facility changes without a permit revision pursuant to Section XVII of this Attachment.

XXII. APPLICABILITY OF NSPS/NESHAP GENERAL PROVISIONS

[40 CFR Part 60, Part 63]

For all equipment subject to a New Source Performance Standard, the Permittee shall comply with all applicable requirements contained in Subpart A of Title 40, Chapter 60 and Chapter 63 of the Code of Federal Regulations.

ATTACHMENT "B": SPECIFIC CONDITIONS

Air Quality Control Permit No. 55223
For
Rosemont Copper Company - Rosemont Copper Project

I. RELATIONSHIP OF PERMIT TO APPLICABLE STATE IMPLEMENTATION PLAN

This permit is issued pursuant to the provisions of the Arizona Revised Statutes (ARS) and constitutes an installation permit for the purpose of the applicable State Implementation Plan.

[ARS § 49-404.c and -426]

II. FACILITY WIDE REQUIREMENTS

A. Operating Limitations

1. Upon start-up of operations, the Permittee shall have a person on site certified in EPA Reference Method 9 for the observation and evaluation of visible emissions.

   [A.A.C. R18-2-306.A.3.c]

2. The Permittee shall operate and maintain all equipment identified in Attachment "C" in accordance with vendor-supplied operations and maintenance instructions. If vendor-supplied operations and maintenance instructions are not available or not applicable, the Permittee shall prepare an Operation and Maintenance Plan (O&M) at least 90 days prior to the start-up of operations, which provides adequate information to properly operate and maintain the equipment. The Permittee shall operate the equipment in accordance with the O&M plan. [A.A.C. R18-2-306.A.3.c]

3. The Permittee shall perform comprehensive preventative maintenance checks according to vendor-supplied O&M instructions or the facility's O&M plan on all dust control equipment used at the facility. These maintenance checks shall be conducted at least annually. [A.A.C. R18-2-306.A.2]

4. Nothing in this Attachment shall be so construed as to prevent the utilization of measurements from emissions monitoring devices or techniques not designated as performance tests as evidence of compliance with applicable good maintenance and operating requirements. [A.A.C. R18-2-312(I)]

5. The Permittee shall comply with the dust control plan included in Attachment "D" of this permit to control particulate matter emissions from activities identified in the dust control plan. The Permittee may implement proposed changes to the dust control plan upon submission to the Director if necessary to further minimize fugitive dust. Nothing in this permit prohibits the Permittee from implementing additional dust control measures not set forth in the dust control plan.

   [A.A.C. R18-2-306.A.2]

6. *<u>The Permittee shall limit the amount of rock mined (waste rock and ore combined) to no more than 359,500 tons per day as calculated on a calendar day basis</u>.*

   [A.A.C. R18-2-306.A.2 and -331.A.3.a]

   [Material Permit Conditions are indicated by underline and italics]

7. *<u>The Permittee shall limit the amount of Ammonium Nitrate and Fuel Oil (ANFO) used during blasting to no more than 52 tons per day.</u>*

   [A.A.C. R18-2-306.A.2 and -331.A.3.a]

8. The Permittee shall not cause or permit emissions from malodorous matter during processing, storing, use or transporting to cross a property line between the facility and a residential, recreational, institutional, education, retail sales, hotel, or business premise without minimizing the emissions by applying good modern practices. Malodorous matter shall include but not be limited to paints, acids, alkalis, pesticides, fertilizer, and manure. [Pima SIP Rule 344]

9. Visibility Limiting Standard [Pima County SIP Rule 343]

   a. The Permittee shall not cause or permit the airborne diffusion of visible emissions, including fugitive dust, beyond the property boundary line within which the emissions become airborne. Within actual practice, the airborne diffusion of visible emissions across property lines shall be prevented by appropriately controlling the emissions at the point of discharge, or ceasing entirely the activity or operation which is causing or contributing to the emissions.

   b. Condition II.A.9.a. above shall not apply when wind speeds exceed twenty-five (25) miles per hour as estimated by a certified visible emissions evaluator using the Beaufort Scale of Wind-Speed equivalents, or as recorded by a U.S. weather Bureau Stations or a U.S. government military installation. This exception does not apply to the demolition, destruction, transport, or pulverization of structures containing friable asbestos materials, and all dust-producing activities associated with such sources shall be halted when the wind is causing or contributing visible emissions to cross beyond the property lines within which the emissions discharge.

   c. Any disregard of, neglect of, or inattention to other controls required herein, during any time when this condition is in effect, shall automatically waive the exception and such relaxation of controls shall be a violation to the generation of airborne particulate matter from undisturbed land.

B. Visible Emissions Observation Methodology [A.A.C.R18-2-306.A.3.c]

The Permittee shall comply with the Visible Emissions Observation requirements referenced in the later sections of this permit using the methodology stated below:

1. At least 30 days prior to start of operations, the Permittee shall submit a visual observation plan to be approved by the Director. The observation plan shall identify a central lookout station or multiple observation points, as appropriate, from where the visible emission sources shall be monitored. When multiple observation points are used, all the visible emission sources associated with each observation point shall be specifically identified within the observation plan.

2. A certified Method 9 observer shall conduct a visual survey of visible emissions from the emission sources under normal representative operating conditions. The survey shall be conducted at the frequency specified in the permit conditions that refer to this procedure. The Permittee shall keep a record of the name of the observer, the date and time on which the observation was made, the location(s) of the observation, and the results of the observation.

3. If the observer sees a plume from a visible emission source that on an instantaneous basis appears to exceed the applicable opacity standard, then the observer shall, if practicable, take a six-minute Method 9 observation of the plume.

4. If the six-minute Method 9 observation of the plume is less than the applicable opacity standard, then the observer shall make a record of the following:

   a. Location, date, and time of the observation; and

   b. The results of the Method 9 observation.

5. If the six-minute Method 9 observation of the plume exceeds the applicable opacity standard, then the Permittee shall do the following:

   a. Adjust or repair the controls or equipment to reduce opacity to below the applicable opacity standard;

   b. Report as an excess emission in accordance with Section XII of Attachment “A” of this permit; and

   c. Conduct a six-minute Method 9 observation reading within 48 hours after taking corrective action. The results of this observation, date, time, and location shall be recorded.

C. Monitoring, Recordkeeping, and Reporting Requirements

1. The Permittee shall keep records of dates and times when blasting is conducted and the amount of ANFO in tons used during each blast. The records of each day’s blasting activity shall be available in a central log no later than 5:00pm the following business day. [A.A.C. R18-2-306.A.3.c]

2. The Permittee shall record the total tons of daily rock mined (ore and waste rock) as the sum of the following: concentrate ore loaded plus leach ore loaded plus waste rock loaded. The records of each day’s mined rock total shall be available in a central log no later than 5:00 pm the following business day.
[A.A.C. R18-2-306.A.3.c]

3. The Permittee shall maintain, on-site, records of the manufacturer's specifications or O&M plan for all equipment listed in Attachment “C” of this permit.
[A.A.C. R18-2-306.A.4]

4. All records, analyses, and reports required by this permit shall be retained for a minimum of five years from the date of generation. The most recent two years of data shall be kept on-site. All records shall be made available for inspection by authorized Department personnel during normal working hours.
[A.A.C. R18-2-306.A.4]

5. The Permittee shall conduct a daily visible emissions survey at places where the facility fugitive dust generating activities are within 300 feet of the property boundary line in accordance with EPA Reference Method 22. When such emissions are observed to cross the property boundary line, the Permittee shall follow the excess emissions reporting procedures in Section XII of Attachment “A” of this permit. [A.A.C R18-2-306.A.4, -306(A)(2)]

6. At the time the compliance certifications required by Section VII of Attachment "A" are submitted, the Permittee shall submit summary reports of all monitoring activities required by this Attachment performed in the same six month period as applied to the compliance certification period. The summary report shall identify each monitoring activity, state whether monitoring was conducted as required by the permit, list any deviations with dates, nature of the deviation and any explanation and/or corrective action, and identify any exceedances to excursions of relevant standards. [A.A.C.R18-2-306.A.5]

7. The Permittee shall notify the Director in writing within 30 days of purchase of the equipment listed in Attachment "C". Equipment purchases within a specified period may be grouped and reported together. This notification shall contain all the information required to complete Attachment "C". [A.A.C.R18-2-306.A.5]

III. METALLIC MINERAL PROCESSING SUBJECT TO NEW SOURCE PERFORMANCE STANDARDS (NSPS) SUBPART LL

A. Applicability

This Section is applicable to equipment identified in Attachment "C" as subject to New Source Performance Standards (NSPS), 40 CFR 60 Subpart LL ("Subpart LL").

B. Notification Requirements

The Permittee shall furnish to the Director written notification as follows:

1. A notification of the date of construction of an affected facility is commenced postmarked no later than 30 days after such date. This condition is satisfied by the notice given pursuant to Condition II.C.7 above. [40 CFR 60.7(a)(1)]

2. A notification of the actual date of initial startup of an affected facility postmarked within 15 days after such date. [40 CFR 60.7(a)(3)]

3. A notification of the anticipated date for conducting the opacity observations required by 40 CFR 60.11(e)(1) of this part. The notification shall also include, if appropriate, a request for the Director to provide a visible emissions reader during a performance test. The notification shall be postmarked not less than 30 days prior to such date. [40 CFR 60.7(a)(6)]

C. Operating Requirements

At all times, including periods of startup, shutdown, and malfunction, the Permittee shall, to the extent practicable, maintain and operate any affected facility in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. [40 CFR 60.11(d)]

D. Particulate Matter

1. Emission Limitations

a. On and after the date on which the performance test required to be conducted by 40 CFR 60.8 is completed, the Permittee shall not cause to be discharged into the atmosphere from equipment subject to this Section but not identified under Table 1, any stack emissions that contain particulate matter in excess of 0.05 grams per dry standard cubic meter.

[40 CFR 60.382(a)(1)]

b. *On and after the date on which the performance test required to be conducted by 40 CFR 60.8 is completed, the Permittee shall not cause to be discharged into the atmosphere from the control devices any emissions which contain particulate matter less than 10 microns (PM_{10}) in excess of the limits identified in the table below corresponding to each control device:*

[A.A.C. R18-2-306.01 and -331.A.3.a]
[Material Permit Conditions are indicated by underline and italics]

Table 1: Emissions Limits

Emission Unit ID	***Emission Points Controlled***	***PM_{10} Emissions Limit***
PCL01	*Process Equipment* • *Primary Crusher* *Material Handling Emission Points:* • *Crusher Discharge Hopper to Crusher Discharge Feeder* • *Crusher Discharge Feeder to Stockpile Feed Conveyor No.1*	*0.64 lbs/hour*
PCL02	*Material Handling Emission Points:* • *Stockpile Feed Conveyor No. 2 to Covered Coarse Ore Stockpile* • *Reclaim Feeders to Reclaim Conveyors* *General Ventilation of Stockpile building*	*1.47 lbs/hour*
PCL03	*Material Handling Emission Point:* • *Stockpile Feed Conveyor No. 1 to Stockpile Feed Conveyor No. 2*	*0.36 lbs/hour*
PCL04	*Process Equipment:* • *Pebble Crusher* *Material Handling Emission Points:* • *Reclaim Conveyor* • *Pebble Conveyor No.2 to SAG Oversize Surge Bin* • *SAG Oversize Surge Bin to Pebble Crusher Feeder* • *Pebble Crusher to Pebble Conveyor No. 3*	*0.32 lbs/hour*

Emission Unit ID	***Emission Points Controlled***	***PM_{10} Emissions Limit***
PCL05	*Material Handling Emission Points:* • *Copper Concentrate Conveyor to Copper Concentrate Loadout Stockpile* • *Copper Concentrate Loadout Stockpile to Shipment Truck via Front End Loader* *General Ventilation of Copper Concentrate Loadout Building*	*1.78 lbs/hour*
PCL06	*Material Handling Emission Points:* • *Copper Concentrate Conveyor to Copper Concentrate Loadout Stockpile* • *Copper Concentrate Loadout Stockpile to Shipment Truck via Front End Loader*	*1.78 lbs/hour*
PCL07	*Process Equipment:* • *Molybdenum Concentrate Dryer*	*0.014 lbs/hour*
PCL08	*Material Handling Emission Points:* • *Molybdenum Concentrate Dryer to Molybdenum Concentrate Bin* • *Copper Concentrate Conveyor to Molybdenum Packaging and Weigh System*	*0.053 lbs/hour*
PCL12	*Material Handling Emission Points:* • *Reclaim Conveyor to SAG Mill Feed Conveyor* • *Pebble Conveyor No. 3 to SAG Mill Feed Conveyor*	*0.46 lbs/hour*

2. Air Pollution Control Requirements

The Permittee shall install the following control equipment prior to start-up of the corresponding process unit(s) and shall operate it at all times any of the corresponding process unit(s) is in operation.

a. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL01) to control particulate matter emissions from the following sources*:

(1) *Primary Crusher;*

(2) *Material Transfer from Crusher Discharge Hopper to Crusher Discharge Feeder;*

(3) *Material Transfer from Crusher Discharge Feeder to Stockpile Feed Conveyor No.1.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

b. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL02) to control particulate matter emissions from the following sources*:

(1) *Stockpile Feed Conveyor No. 2 to Covered Coarse Ore Stockpile;*

(2) *Reclaim Feeders to Reclaim Conveyors; and*

(3) *General Ventilation of Stockpile Building*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

c. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL03) to control particulate matter emissions during material transfer from Stockpile Feed Conveyor No. 1 to Stockpile Feed Conveyor No. 2.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

d. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL04) to control particulate matter emissions from the following sources*:

(1) *Pebble Crusher;*

(2) *Material Transfer from Reclaim Conveyor and Pebble Conveyor No.2 to SAG Oversize Surge Bin;*

(3) *Material Transfer from SAG Oversize Surge Bin to Pebble Crusher Feeder; and*

(4) *Material Transfer from Pebble Crusher to Pebble Conveyor No. 3.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

e. *The Permittee shall install, operate* and maintain *cartridge filter dust collectors (PCL05 and PCL06) to control particulate matter emissions from the following sources*:

(1) *Copper Concentrate Conveyor to Copper Concentrate Loadout Stockpile;*

(2) *Copper Concentrate Loadout Stockpile to Shipment Truck via Front End Loader; and*

(3) General Ventilation of Copper Concentrate Loadout Building

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

f. *The Permittee shall install, operate* and maintain *a scrubber and an electrostatic precipitator in series (PCL07) to control particulate matter emissions from the Molybdenum Concentrate Dryer.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

g. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL08) to control particulate matter emissions during material* *transfer from:*

(1) *Molybdenum Concentrate Dryer to Molybdenum Concentrate Bin; and*

(2) *Copper Concentrate Conveyor to Copper Packaging and Weigh System.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

h. *The Permittee shall install, operate* and maintain *cartridge filter dust collector (PCL12) to control particulate matter emissions from the following sources:*

(1) *Reclaim Conveyor to SAG Mill Feed Conveyor; and*

(2) *Pebble Crusher No. 3 to SAG Mill Feed Conveyor.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

i. *The material that is fine enough to contribute to PM_{10} emissions that accumulates around process equipment shall be minimized. At points where such material does accumulate, it shall be collected and removed either manually or by using a vacuum equipped truck as expeditiously as practicable. Clean-up shall be performed on an as-needed basis*.

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

j. *The Permittee shall install, operate* and maintain *water sprays when unloading ore to the Primary Crusher Dump Hopper from Haul Trucks or the Run of Mine Stockpile to control particulate matter emissions*.

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

k. *The Permittee shall install chutes at the conveyor-to-conveyor transfer points to minimize particulate emissions*.

[A.A.C. R18-2-306.A.2 and -331.A.3.d]
[Material Permit Conditions are indicated by underline and italics]

l. *The Permittee shall install rubber sealing strips and rubber curtains on all material transfer associated with the affected facilities to minimize fugitive emissions.*

[A.A.C. R18-2-306.01 and -331.A.3.d]
[Material Permit Conditions are indicated by underline and italics]

3. Monitoring, Recordkeeping, and Reporting Requirements

a. *The Permittee shall install, calibrate,* maintain, *and operate a monitoring device for the continuous measurement of the change in pressure of the gas stream through the operating scrubber PCL07. The monitoring device must be certified by the manufacturer to be accurate within ±250 pascals (± 1 inch water) gauge pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions.*

[40 CFR 60.384(a) and A.A.C. R18-2-331.A.3.c]
[Material Permit Conditions are indicated by underline and italics]

b. *The Permittee shall install, calibrate*, maintain, *and operate a monitoring device for the continuous measurement of the scrubbing liquid flow rate to the operating scrubber PCL07. The monitoring device must be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid flow rate and must be calibrated on at least an annual basis in accordance with manufacturer's instructions.*

[40 CFR 60.384(b) and A.A.C. R18-2-331.A.3.c]
[Material Permit Conditions are indicated by underline and italics]

c. The Permittee shall record on a weekly basis the measurements of both the change in pressure of the gas stream across the operating scrubber and the scrubbing liquid flow rate. [40 CFR 60.385(b)]

d. The Permittee shall submit semi-annual reports of occurrences when the measurements of the scrubber pressure loss (or gain) or liquid flow rate differ by more than ±30 percent from the average obtained during the most recent performance test. These reports shall be postmarked within 30 days following the end of the second and fourth calendar quarters.

[40 CFR 60.385(c) and (d)]

e. The Permittee shall use the monitoring devices required by Conditions III.D.3.a and b to determine the pressure loss of the gas stream through the scrubber PCL07 and the scrubber (PCL07) liquid flow rate at any time during each particulate matter performance test run and the average of the three determinations shall be computed. [40 CFR 60.386(c)]

f. The Permittee shall continuously measure and record the electrostatic precipitator primary and secondary voltage and current and either alarm them or check once per shift. If an excursion from the manufacture's specifications is detected, the Permittee shall commence corrective action no later than the following shift to return the unit to proper operation. Proper operation shall be restored as expeditiously as practicable.

[A.A.C. R18-2-306.A.3.c]

4. Testing Requirements

a. Within 60 days of achieving the maximum production rate at the facility, but no later than 180 days after initial start-up, the Permittee shall conduct an initial performance tests for emissions of particulate matter from the stacks of the control equipment. Subsequent tests shall be performed annually. [40 CFR 60.8(a) and 60.386(a)]

b. EPA Reference Method 5, 17 or 201A shall be used to determine the concentration of particulate matter emissions from the control equipment stacks as specified in 40 CFR 51, Appendix M. Unless using Method 201A, all particulate matter measurements using Method 5 shall be considered to have an aerodynamic diameter less than 10 microns. The performance test shall be used to demonstrate compliance with the voluntarily accepted limits. The sampling volume for each run shall be at least 1.7dscm (60dscf). The sampling probe and filter holder of Method 5 may be operated without heaters if the gas stream being sampled is at ambient temperature. For gas streams above ambient temperature, the Method 5 sampling train shall be operated with a probe and filter temperature slightly above the effluent temperature (up to a maximum filter temperature of 121˚C (250˚F) in order to prevent water condensation on the filter. [40 CFR 60.386(b)(1)]

5. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.382(a)(1), 60.386(a), and 60.386(b)(1). [A.A.C. R18-2-325]

E. Opacity

1. Emission Limitations

a. On and after the date on which the performance test required to be conducted by 40 CFR 60.8 is completed, *the Permittee shall not cause to be discharged into the atmosphere from equipment subject to this Section, any stack emissions that exhibit greater than 7 percent opacity, unless the stack emissions are discharged from unit using a wet scrubbing emission control device (PCL07).*

[40 CFR 60.382(a)(2), A.A.C. R18-2-331A.3.f]
[Material Permit Conditions are indicated by underline and italics]

b. On or after the sixtieth day after achieving the maximum production rate at which the affected facility will be operated but not later than 180 days after initial startup, *the Permittee shall not cause to be discharged into the atmosphere from an affected facility subject to NSPS Subpart LL any process fugitive emissions that exhibit greater than 10 percent opacity.*

[40 CFR 60.382(b) and A.A.C. R18-2-331.A.3.f]
[Material Permit Conditions are indicated by underline and italics]

c. The opacity standards set forth in Conditions III.E.1.a & b shall apply at all times except during periods of startup, shutdown, and malfunction. [40 CFR 60.11(c)]

d. The Permittee shall not cause, allow or permit the effluent from affected wet scrubber (NSPS applicable) PCL07 stack to have an average optical density equal to or greater than 20 percent opacity. [PCC 17.16.040]

2. Monitoring, Reporting and Recordkeeping Requirements [A.A.C. R18-2-306.A.3.c and 306.A.4]

A certified Method 9 observer shall conduct a weekly visual survey of emissions from the dust collector stacks and from process fugitive emissions covered by this Section during normal operation mode. The survey shall be conducted in accordance with the Visible Emissions Observations Methodology identified in Condition II.B of this Attachment.

3. Testing Requirements

a. For the purpose of demonstrating initial compliance with Conditions III.E.1.a and b, opacity observations shall be conducted concurrently with the initial performance test required in Condition III.D.4.a above, except as allowed in 40 CFR 60.11(e)(1). The minimum total time of observations shall be 3 hours (thirty 6-minute averages).

[40 CFR 60.11(b) and 386(b)(2)]

b. EPA Reference Method 9 and the procedures in 40 CFR 60.11 shall be used to determine opacity from stack emissions and process fugitive emissions. The observer shall read opacity only when emissions are clearly identified as emanating solely from the affected facility being observed. [40 CFR 60.386(b)(2)]

4. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.382(a)(2), 60.382(b), 60.386(b)(2) and P.C.C 17.16.040.
[A.A.C. R18-2-325]

IV. METALLIC MINERAL PROCESSING NOT SUBJECT TO NSPS SUBPART LL

A. Applicability

This Section applies to the metallic mineral processing equipment identified in Attachment "C" as subject to A.A.C. R18-2-721.

B. Operational Requirements

1. The Permittee shall maintain records of the daily process rate and hours of operation of all material handling equipment. [A.A.C. R18-2-721.F]

2. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-721.F. [A.A.C. R18-2-325]

C. Particulate Matter

1. Emission Limitations

a. The Permittee shall not cause, allow or permit the discharge of particulate matter into the atmosphere in any one hour from any process source subject to the provisions of this Section in total quantities in excess of the amounts calculated by one of the following equations:

(1) For process sources having a process weight rate of 60,000 pounds per hour (30 tons per hour) or less, the maximum allowable emissions shall be determined by the following equation:

$E = 3.59P^{0.62}$

Where:

E = the maximum allowable particulate emissions rate in pounds-mass per hour.

P = the process weight rate in tons-mass per hour.
[AZ SIP R9-3-521.A.2.a]

(2) For process sources having a process weight rate greater than 60,000 pounds per hour (30 tons per hour), the maximum allowable emissions shall be determined by the following equation:

$$E = 17.31P^{0.16}$$

Where E and P are defined above.

[AZ SIP R9-3-521.A.2.b]

b. For purposes of this Section, the total process weight from all similar units employing a similar type process shall be used in determining the maximum allowable emissions of particulate matter.

[AZ SIP R9-3-521.A.4]

2. Air Pollution Control Equipment

a. *The material that is fine enough to contribute to PM_{10} emissions that accumulates around process equipment shall be minimized. At points where such material does accumulate, it shall be collected and removed either manually or by using a vacuum equipped truck as expeditiously as practicable. Clean-up shall be performed on an as-needed basis*.

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

b. *The Permittee shall install, operate* and maintain *water sprays to control particulate matter emissions from process sources*.

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

c. *The Permittee shall install chutes at the conveyor-to-conveyor transfer points to minimize particulate emissions*.

[A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

d. *The Permittee shall install, operate* and maintain *cartridge filter dust collectors (PCL09, PCL10 & PCL11) to control particulate matter emissions from the analytical laboratory building.*

[A.A.C. R18-2-306.01 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with AZ SIP R9-3-521.

[A.A.C. R18-2-325]

D. Opacity

1. Emission Limitations

a. The opacity of any plume or effluent from any process source shall not be greater than 20%. [A.A.C. R18-2-702.B.3]

b. If the presence of uncombined water is the only reason for an exceedance of the visible emissions requirements in Condition IV.D.1.a above, the exceedance shall not constitute a violation of the applicable opacity limit.

[A.A.C. R18-2-702.C]

2. Monitoring, Reporting and Recordkeeping Requirements

[A.A.C. R18-2-306.A.3.c and 306.A.4]

A certified Method 9 observer shall conduct a weekly visual survey of emissions from all sources covered by this Section while they are in operation and in accordance with the Visible Emissions Observations Methodology identified in Condition II.B of this Attachment.

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-702.B.3 and 702.C. [A.A.C. R18-2-325]

V. BOILER AT SOLVENT EXTRACTION/ ELECTROWINNING (SX/EW) PROCESS

A. Applicability

This Section applies to the SX/EW boiler as identified in the equipment list in Attachment "C" of this permit.

B. Fuel Limitations

1. The Permittee shall burn only diesel fuel with a sulfur content of 0.05% or less in the boiler. [A.A.C. R18-2-306.A.2]

2. Recordkeeping Requirements

The Permittee shall maintain fuel supplier documentation or certifications to demonstrate compliance with the fuel limitations above.

[A.A.C. R18-2-306.A.3.c]

C. Particulate Matter

1. Emission Limitation

The Permittee shall not cause, allow or permit the emission of particulate matter, caused by combustion of fuel, from the boiler in excess of the amounts calculated by the following equation:

$E = 1.02Q^{0.769}$

Where:

E = the maximum allowable particulate emissions rate in pounds-mass per hour

Q = the heat input in million Btu per hour.

[A.A.C.R18-2-724.C.1]

2. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-724.C.1. [A.A.C. R18-2-325]

D. **Opacity**

1. Emission Limitations

The Permittee shall not cause, allow or permit the opacity of any plume or effluent from the boiler to exceed 15 percent.

[A.A.C.R18-2-724.J]

2. Monitoring, Recordkeeping and Reporting Requirements

a. The Permittee shall report all six-minute periods in which the opacity of any plume or effluent exceeds 15 percent.

[A.A.C.R18-2–724.J]

b. A certified EPA Reference Method 9 observer shall conduct a weekly survey of visible emissions emanating from the stack of the boiler when in operation. If the opacity of the emissions observed appears on an instantaneous basis to exceed 15%, the observer shall conduct a certified EPA Reference Method 9 observation. The Permittee shall keep records of the initial survey and any EPA Reference Method 9 observations performed. These records shall include the emission point observed, location of observer, name of observer, date and time of observation, and the results of the observation. If the observation shows a Method 9 opacity reading in excess of 15%, the Permittee shall report this to ADEQ as an excess emission and initiate appropriate corrective action to reduce the opacity below 15%. The Permittee shall keep a record of the corrective action performed.

[A.A.C. R18-2-306.A.3.c, .306.A.4.a and 306.A.5]

3. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-724.J.

[A.A.C. R18-2-325]

E. **Sulfur Dioxide**

1. Emission Limitation

The Permittee shall not cause to be discharged into the atmosphere from the boiler any emissions that contain more than 1.0 pounds of sulfur dioxide per million Btu heat input.

[A.A.C.R18-2-724.E]

2. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-724.E.

[A.A.C. R18-2-325]

F. **Hazardous Air Pollutants**

1. Applicability

This Section applies to the diesel fuel fired boiler as identified in the equipment list in Attachment “C”.

[40 CFR 63.11194]

2. Operating Requirements

a. The Permittee shall operate and maintain the boiler, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Director or Administrator that may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source. [40 CFR 63.11205(a)]

b. Work-Practice Standard [40 CFR 63.11201(b)]

(1) Boiler Tune-up

(a) The Permittee shall conduct biennially tune-ups of the boiler to demonstrate continuous compliance according to the procedures stated in Condition V.F.2.c and 40 CFR 63.7(a)(2)(ix). Each biennial tune-up shall be conducted no more than 25 months after the previous tune-up. The first biennial tune-up shall be conducted no later than 25 months after the initial startup. [40 CFR 63.11210(f), 11223(b)]

(b) If the boiler is installed with an oxygen trim system that maintains an optimum air-to-fuel ratio, the Permittee shall conduct a tune-up of the boiler every 5 years according to the procedures stated in Condition V.F.2.c. Each 5-year tune-up shall be conducted no more than 61 months after the previous tune-up. The first 5-year tune-up shall be conducted no later than 61 months after the initial startup. The Permittee may delay the burner inspection specified in Condition V.F.2.c.(1) and inspection of the system controlling the air-to-fuel ratio specified in Condition V.F.2.C.(3) until the next scheduled unit shutdown, but shall inspect each burner and system controlling the air-to-fuel ration at least once every 72 months. [40 CFR 63.11223(c)]

c. Tune-up Procedures

The Permittee shall conduct a boiler tune-up according to the following procedures:

(1) As applicable, inspect the burner, and clean or replace any components of the burner as necessary (this may be delayed until the next scheduled unit shutdown, but the burner must be inspected at least once every 36 months from the previous inspection).

(2) Inspects the flame pattern, as applicable, and adjust the burner as necessary to optimize the flame pattern. The adjustment should be

consistent with the manufacturer's specifications, if available.

(3) Inspect the system controlling the air-to-fuel ratio, as applicable, and ensure that it is correctly calibrated and functioning properly (this may be delayed until the next scheduled unit shutdown, not to exceed 36 months from the previous inspection).

(4) Optimize total emissions of carbon monoxide. This optimization should be consistent with the manufacturer's specifications, if available, and with any nitrogen oxide requirement to which the unit is subject.

(5) Measure the concentrations in the effluent stream of carbon monoxide in parts per million, by volume, and oxygen in volume percent, before and after the adjustments are made (measurements may be either on a dry or wet basis, as long as it is the same basis before and after the adjustments are made). Measurements may be taken using a portable CO analyzer.

(6) Maintain onsite and submit, if requested by the Director or Administrator, a report containing the following information:

(a) The concentrations of CO in the effluent stream in parts per million, by volume, and oxygen in volume percent, measured at high fire or typical operating load, before and after the tune-up of the boiler.

(b) A description of any corrective actions taken as a part of the tune-up of the boiler.

[40 CFR 63.11223(b)]

(7) If the unit is not operating on the required date for a tune-up, the tune-up must be conducted within 30 days of startup.

[40 CFR 63.11223(b)]

4. Notification, Reporting and Recordkeeping Requirements

a. As required in 40 CFR 63.9(b)(2), the Permittee shall submit the initial notification no later than January 2014, or within 120 calendar days after commencing construction of the boiler. The notification shall be submitted to the Director and the Administrator.

[40 CFR 63.11225(a), 63.1125(a)(2)]

b. The Permittee shall submit a Notice of Compliance Status no later than 120 days of boiler startup and shall include certification(s) of compliance statement signed by a responsible official. The Notification of Compliance Status shall include information required in 40 CFR 63.9(h)(2), except for the information listed in 40 CFR 63.9(h)(2)(i)(B),(D),(E) and (F). The notification to the Administrator shall be submitted electronically using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). However, if the reporting form specific to this subpart is not available in CEDRI at the time that the report is due, the written Notification of Compliance Status shall be submitted to the Administrator at the appropriate address listed in 40 CFR 63.13.

[40 CFR 63.11225(a)(4), 63.112259(a)(4)(vi)]

c. The Permittee shall include a statement that the facility complies with the requirements of Condition V.F.2.b to conduct a biennial or five-year tune-up, as applicable, of the boiler in the semiannual compliance certifications required under Attachment "A" of this permit:

[40 CFR 63.11225(b)]

d. The Permittee shall keep the following records:

(1) Copy of each notification and report submitted under this section and all documentation supporting the Notification of Compliance Status.

(2) Documents showing conformance with work practices. Records shall identify the date of boiler tune-up, the procedures followed for the tune-up, and the manufacturer's specifications to which the boiler was tuned.

[40 CFR 63.11225(c)(1), (c)(2)]

d. The Permittee shall maintain onsite and submit, if requested by the Director or Administrator, a report containing the following information about the tune-ups.

(1) The concentrations of CO in the effluent stream in parts per million, by volume, and oxygen in volume percent, measured before and after the tune-up of the boiler.

(2) A description of any corrective actions taken as a part of the tune-up of the boiler.

(3) Records of occurrence, duration, and corrective action taken for each malfunction of the boiler.

[40 CFR 63.11223(b)(6), 11225(c)(4), and -(c)(5)]

5. Permit Shield

Compliance with this Section shall be deemed compliance 40 CFR 63.11205(a), -63.11201(b), 63.11214(d), 63.11223(a), -11223(b), -11223(b)(6), 63.11225(a)(2), -11225(a)(4), -11225(c)(2), (c)4, (c)5, and 63.11223(b)(6),.

[A.A.C. R18-2-325]

VI. SOLVENT EXTRACTION / ELECTORWINNING (SX/EW) PROCESS

A. Applicability

This Section applies to the equipment used in the SX/EW process, excluding the Hot Water Generator, as identified in the equipment list in Attachment "C" of this permit.

B. Emission Limitations

1. Opacity

   The Permittee shall not cause, allow or permit visible emissions from the SX/EW process in excess of 20% opacity, as measured by EPA Reference Method 9.

   [A.A.C. R18-2-702.B]

2. Volatile Organic Compounds

   a. Materials including solvents or other volatile compounds, acids and alkalis utilized shall be processed, stored, used and transported in such a manner and by such means that they will not evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices or other equipment shall be mandatory. [A.A.C. R18-2-730.F]

   b. Where a stack, vent or other outlet is at such a level that fumes, gas mist, odor, smoke, vapor or any combination thereof constituting air pollution is discharged to adjoining property, the Director may require the installation of abatement equipment or the alteration of such stack, vent or other outlet by the Permittee to a degree that will adequately dilute, reduce or eliminate the discharge of air pollution to adjoining property. [A.A.C. R18-2-730.G]

   c. The Permittee shall not cause or permit the emission of gaseous or odorous materials from equipment, operations, and premises under its control in such quantities or concentrations as to cause air pollution.

   [A.A.C. R18-2-730.D]

C. Air Pollution Control Requirements

1. *The Permittee shall install, operate* and maintain *two scrubbers at all times the electrowinning process is in operation to control emissions of sulfuric acid in the electrowinning process.*

   [A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
   [Material permit conditions are indicated by underline and italics]

2. The Permittee shall add dilute sulfuric acid to the leach pad either through low-pressure wobblers or a drip system to minimize acid mist emissions.

   [A.A.C. R18-2-306.A.2]

3. *The Permittee shall install*, maintain and *use covers in the designed fashion on the SX mixer settler tanks to control acid mist emissions from the Solution Extraction Plant*.

   [A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
   [Material permit conditions are indicated by underline and italics]

4. *The Permittee shall use one or more of the following methods to control emissions from the Electrowinning Tankhouse Cells*:

   a. *Foam;*

   b. *Dispersion Balls/Poly Balls;*

c. *Surfactants;*

d. *Other effective means of controlling sulfuric acid emissions approved by the Director*.

[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

D. Recordkeeping Requirements

The Permittee shall keep a record of the method that is used to control emissions from the electrowinning tankhouse cells. [A.A.C. R18-2-306.A.4.a]

E. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-730.D, F, G and -702.B. [A.A.C. R18-2-325]

VII. INTERNAL COMBUSTION ENGINES (ICE)

A. Applicability

This Section is applicable to the generators identified as subject to New Source Performance Standards (NSPS) Subpart IIII in the equipment list in Attachment "C".

B. General Requirements

1. The Permittee shall not install any new stationary compression ignition internal combustion engine (CI ICE) (excluding fire pump engines) that does not meet the applicable requirements for 2007 model year engines. [40 CFR 60.4208]

2. An emergency CI ICE shall be limited to emergency situations and required testing and maintenance only such as to produce power for critical networks or equipment (including power supplied to portions of a facility) when electric power from the local utility (or the normal power source, if the facility runs on its own power production) is interrupted, or used to pump water in the case of fire or flood, etc. Stationary CI ICE used to supply power to an electric grid or that supply power as part of a financial arrangement with another entity shall not be considered to be emergency engines. Notwithstanding the foregoing, emergency stationary ICE may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Maintenance checks and readiness testing of such units is limited to 100 hours per year. There is no time limit on the use of emergency stationary ICE in emergency situations. The owner or operator may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner or operator maintains records indicating that Federal, State, or local standards require maintenance and testing of emergency ICE beyond 100 hours per year. Emergency stationary ICE may operate up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing. The 50 hours per year for non-emergency situations cannot be used for peak shaving or to generate income for a facility to supply power to an electric grid or otherwise supply non-emergency power as part of a financial arrangement with another entity. For owners and operators of emergency engines, any operation other than

emergency operation, maintenance and testing, and operation in non-emergency situations for 50 hours per year, as permitted in this condition, is prohibited.

[40 CFR 60.4219, 60.4211(f)]

C. Operating Requirements

1. ***<u>The Permittee shall not operate any emergency CI ICE for any reason other than emergency operation, or maintenance and testing, and in non-emergency situations for no more than 50 hours per year.</u>*** [40 CF 60.4211(f), A.A.C.R18-2-331.A.3.a]

   [Material permit conditions are indicated by underline and italics]

2. ***<u>The Permittee shall install a non-resettable hour meter prior to startup of the engine.</u>***

   [A.A.C.R18-2-306.A.3.C, and -331.A.3.a]

   [Material Permit Conditions are indicated by underline and italics]

3. The Permittee shall operate and maintain the CI ICE and the control device according to the manufacturer's written instructions, over the entire life of the engine.

   [40 CFR 60.4211(a), 60.4206]

4. The Permittee shall only change those engine settings that are permitted by the manufacturer. [40 CFR 60.4211(a)]

5. The Permittee shall meet the applicable requirements of 40 CFR Part 89, 94 and/or 1068, as they may apply to the Permittee. [40 CFR 60.4211(a)]

6. The Permittee may operate the stationary ICE for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State, or local government, the manufacturer, the vendor, or the insurance company associated with the engine. [40 CFR 60.4211(f)]

7. Maintenance checks and readiness testing of such units is limited to 100 hours per year. The Permittee may petition the Administrator and the Director for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the Permittee maintains records indicating that Federal, State, or local standards require maintenance and testing of emergency ICE beyond 100 hours per year. The Permittee may operate the emergency stationary ICE for up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing.

   [40 CFR 60.4211(f)]

8. Permit Shield

   Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4206, and 60.4211(a) and (f). [A.A.C. R18-2-325]

D. Fuel Requirements

1. The Permittee shall use only diesel fuel that meets the requirements of nonroad diesel fuel listed in 40 CFR 80.510(b) and listed below:

   a. Sulfur content: 15 ppm maximum; and

   b A minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

   [40 CFR 60.4207(b)]

2. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4207(b). [A.A.C. R18-2-325]

E. Emission Limitations and Standards

1. The Permittee shall comply with the emission standards listed in the corresponding applicable regulations as stated in the Table below:

[40 CFR 60.4205(a), (b), (c), and (f)]

Table: Emission Standards for Emergency ICE

Engine Type	Displacement (Liters per cylinder)	Applicable regulations
Non-Fire Pump Engines	Less than 30	New Nonroad engines in 40 CFR 60.4202
Fire Pump	Less than 30	Table 4 of 40 CFR Part 60 Subpart IIII

2. Permit Shield [A.A.C. R18-2-325]

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4205(a), 40 CFR 60.4205(b), 40 CFR 60.4205(f), and 40 CFR 60.4205(c).

F. Compliance Requirements

1. The Permittee operating a 2007 model year and later stationary CI ICE or a CI fire pump engine that is manufactured during or after the model year that applies to the fire pump engine power rating in Table 3 of 40 CFR Part 60, Subpart IIII, shall comply by purchasing an engine certified to the emission standards in 40 CFR 60.4205(b) or (c), as applicable, for the same model year and maximum (or in the case of fire pumps, NFPA nameplate) engine power. The engine must be installed and configured according to the manufacturer's specifications. [40 CFR 60.4211 (c)]

2. If the Permittee does not install, configure, operate, and maintain the CI ICE and control device according to the manufacturer's emission-related written instructions, or change the emission-related setting in a way that is not permitted by the manufacturer, the Permittee shall demonstrate compliance as following:

   a. CI ICE less than 100 HP

   The Permittee shall keep a maintenance plan and records of conducted maintenance to demonstrate compliance and shall, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, if the Permittee does not install and configure the engine and control device according to the manufacturer's emission-related written instructions, or change the emission-related settings in a way that is not permitted by the manufacturer, the Permittee shall conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of such action.

b. CI ICE greater than or equal to 100 HP and less than or equal to 500 HP

The Permittee shall keep a maintenance plan and records of conducted maintenance and shall, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, the Permittee shall conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of such action or within 1 year after the engine and control device is no longer installed, configured, operated, and maintained in accordance with the manufacturer's emission-related written instructions, or within 1 year after you change emission-related settings in a way that is not permitted by the manufacturer.

c. CI ICE greater than 500 HP

The Permittee shall keep a maintenance plan and records of conducted maintenance to demonstrate compliance and shall, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, the Permittee shall conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of startup, or within 1 year after changing any non-permitted emission-related setting on the engine. Subsequent tests shall be conducted every 8760 hours of engine operation or 3 years, whichever comes first.

[40 CFR 60.4211(g)]

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4211(c), and 40 CFR 60.4211(g). [A.A.C.R18-2-325]

G. Recordkeeping Requirements [40 CFR 60.4214(b)]

1. Starting with model years in Table 5 of 40 CFR Subpart IIII, the Permittee operating an emergency ICE that does not meet the standards applicable to non-emergency engines in the applicable model year, shall keep records of the operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter.

2. The Permittee shall record the dates and start and stop times when the ICE is operated and the reason it was in operation during that time.

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with 40 CFR 60.4214(b). [A.A.C. R18-2-325]

VIII. FUGITIVE DUST REQUIREMENTS

A. Applicability

This Section applies to any source of fugitive dust at the facility.

B. Particulate Matter and Opacity

1. Open Areas, Roadways & Streets, Storage Piles, and Material Handling

a. Emission Limitations

(1) Opacity of emissions from any fugitive dust non-point source shall not be greater than 40% measured in accordance with the Arizona Testing Manual, Reference Method 9.
[A.A.C. R18-2-614]

(2) The Permittee shall not cause, allow or permit visible emissions from any fugitive dust point source, in excess of 20 percent opacity. [A.A.C-R18-2-702.B]

(4) The Permittee shall employ the following reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne:

(a) Keep dust and other types of air contaminants to a minimum in an open area where construction operations, repair operations, demolition activities, clearing operations, leveling operations, or any earth moving or excavating activities are taking place, by good modern practices such as using an approved dust suppressant or adhesive soil stabilizer, paving, covering, landscaping, continuous wetting, detouring, barring access, or other acceptable means; [A.A.C. R18-2-604.A]

(b) Keep dust to a minimum from driveways, parking areas, and vacant lots where motor vehicular activity occurs by using an approved dust suppressant, or adhesive soil stabilizer, or by paving, or by barring access to the property, or by other acceptable means;
[A.A.C. R18-2-604.B]

(c) Keep dust and other particulates to a minimum by employing dust suppressants, temporary paving, detouring, wetting down or by other reasonable means when a roadway is repaired, constructed, or reconstructed;
[A.A.C. R18-2-605.A]

(d) Take reasonable precautions, such as wetting, applying dust suppressants, or covering the load when transporting material likely to give rise to airborne dust;
[A.A.C. R18-2-605.B; PCC 17.16.050.A]

(e) Take reasonable precautions, such as the use of spray bars, wetting agents, dust suppressants, covering the load, and hoods when crushing, handling, or conveying material likely to give rise to airborne dust;
[A.A.C. R18-2-606; PCC 17.16.100.A]

(f) Take reasonable precautions such as chemical stabilization, wetting, or covering when organic or inorganic dust producing material is being stacked, piled, or otherwise stored; [A.A.C. R18-2-607.A]

(g) Operate stacking and reclaiming machinery utilized at storage piles at all times with a minimum fall of material, or with the use of spray bars and wetting agents; [A.A.C. R18-2-607.B]

(h) Any other method as proposed by the Permittee and approved by the Director. [A.A.C. R18-2-306.A.3.c]

(i) Operate mineral tailings piles by taking reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne. Reasonable precautions shall mean wetting, chemical stabilization, revegetation or such other measures as are approved by the Director. [A.A.C R18-2-608]

(5) The Permittee shall not construct new unpaved service roads or unpaved haul roads such that the total lengths of operational unpaved roads do not exceed the estimates in the permit application. [A.A.C R18-2-306.A.3]

b. Air Pollution Control Requirements

(1) <u>*The Permittee shall pave the entrance road leading to RCP from the State Route 83 and light duty roads as described in the map listed in Attachment "E".*</u>
[A.A.C. R18-2-306.01 and -331.A.3. d]
[Material Permit Conditions are indicated by underline and italics]

(2) <u>*Water, or an equivalent control, shall be used to control visible emissions from haul roads and storage piles*</u>.
[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

(3) <u>*The Permittee shall comply with the dust control measures identified in the Dust Control Plan specified in Attachment "D" of this permit.*</u>
[A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

(4) <u>*The Permittee shall use appropriate means, such as berms, signs or other effective procedures, to restrict traffic usage to the treated areas*</u>. Should there be a rock spill on a roadway such that traffic is blocked, the Permittee shall clean up the spill; under no circumstances is traffic to be diverted to untreated areas to avoid the spill. This condition does not prohibit cleanup equipment from using untreated areas in the course of cleanup activities.
[A.A.C. R18-2-306.A.2 and -331.A.3.d and e]
[Material Permit Conditions are indicated by underline and italics]

(5) Mineral Tailings

(a) *At least 180 days prior to start of dry tailings deposition in the mineral tailings area, the Permittee shall submit a dry tailings management plan (TMP) to minimize fugitive dust from the tailings. The plan shall be submitted as part of a significant permit revision application. Upon approval by the Director, the Permittee shall comply with the plan.* [A.A.C. R18-2-306.A.2 and -331.A.3.e]
[Material Permit Conditions are indicated by underline and italics]

(b) The TMP shall address the following operational requirements:

1) Tailings dust control during normal non-perimeter buttress construction operations;

2) Tailings dust control during perimeter buttress construction;

3) Tailings dust control at all other times.

4) Additional tailings dust control and monitoring methods during periods of high winds.

(6) The Permittee shall effectively control dust emissions from the transportation of materials by covering stock loads in open-bodied trucks, limiting vehicular speeds, or other equivalently effective controls. [P.C.C. 17.16.100.C]

c. Speed Limits on Haul Roads

(1) The Permittee shall post, provide training, and implement a speed limit of 35 mph for all vehicles travelling on the property. [A.A.C. R18-2-306.A.2]

(2) Notwithstanding (1) above, the speed for haul trucks shall not exceed 15 mph. [A.A.C. R18-2-306.A.2]

d. Monitoring Requirements

(1) The Permittee shall keep records to demonstrate compliance with the speed limit in Condition VIII.B.1.c.(2). [A.A.C. R18-2-306.A.2 and 306.A.3.c]

(2) The Permittee shall maintain records of the dates on which any of the activities listed in Conditions VIII.B.1.a.(4)(a) through VIII.B.1.a.(4)(i) above were performed and the control measures that were utilized. [A.A.C. R18-2-306.A.3.c]

(3) Opacity Monitoring Requirements

(a) A certified Method 9 observer shall conduct a weekly visual survey of visible emissions from the fugitive dust sources excluding the mineral tailings. The survey shall be conducted in accordance with the Visible Emissions Observations Methodology identified in Condition II.B of this Attachment.

(b) A certified Method 9 observer shall conduct at least twice daily, surveys of visible emissions from the mineral tailings starting from the day the buttress construction begins. The observations shall be conducted from strategic locations to be identified and submitted to the Director. The locations shall be identified as an attachment to the TMP titled Fugitive Lookout Points.

(4) Mineral Tailings

(a) The Permittee shall follow all the monitoring provisions identified in the approved TMP. [A.A.C. R18-2-306.A.3.c]

(b) When wind speeds are at or above 15 mph, or gusts at or above 20 mph, the Permittee shall physically inspect the tailings at least once daily for easily erodible areas. [A.A.C. R18-2-306.A.3.c]

(c) The Permittee shall review the TMP annually for its effectiveness in controlling fugitive emissions. The review shall be submitted to the Director by January 31st of each year (covering the period January 1st through December 31st of the previous year). If the review of the plan shows ineffectiveness in controlling emissions, the Permittee shall submit a revised plan for approval by April 1 following the annual review. The revised TMP shall show improved methods/techniques for reducing emissions in order to minimize or prevent further violations. The annual review shall take into account past compliance issues, resolved/unresolved including validated complaints reported the Department and propose how those issues can be avoided in the future. Recommendations or stricter requirements will be prescribed by the Department should the Permittee's annual review show that changes are required but not proposed by the Permittee. [A.A.C. R18-2-306.A.3.c]

e. Recordkeeping Requirements [A.A.C.R18-2-306.A.3.c]

(1) The Permittee shall record the results of the required monitoring as detailed in the approved TMP.

(2) When the wind speeds are at or above 15 mph, or gusts are at or above 20 mph, the Permittee shall maintain a record of all meteorological data, all tailings inspections, all control measures used and corrective action(s) taken to demonstrate compliance with the opacity limitations.

(3) The Permittee shall maintain a copy of watering schedules per shift basis.

f. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-604.A and B, 605.A and B, 606, 607.A and B, 614, 702.B and P.C.C17.16.040.A.1, 17.16.100.A&C., 17.16.050.A, and Pima County SIP Rule 343. [A.A.C. R18-2-325]

IX. GASOLINE STORAGE AND DISPENSING

A. Applicability

1. This Section applies to the following:

a. Gasoline Dispensing Facilities (GDFs), Storage tanks at the GDFs listed in Equipment List, Attachment “C”, associated equipment components in vapor or liquid gasoline service, pressure/vacuum vents on gasoline storage tanks, and equipment necessary to unload product from cargo tanks into storage tanks at GDFs. The equipment used for the refueling of motor vehicles is not covered. [40 CFR 63.11111 (a), (b), & (c), and 63. 11112(a)]

b. Each gasoline cargo tank during the delivery of product to a GDF. [40 CFR 63.11111(a)]

2. Definition of Monthly Throughput

Monthly throughput means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at each GDF during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the current day, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the previous 364 days, and then dividing that sum by 12. [40 CFR 63.11132]

B. Operating Requirements

1. The Permittee shall at all times, operate and maintain any affected source, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Director or Administrator which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source. [40 CFR 63.11115(a)]

2. The Permittee shall not allow gasoline to be handled in a manner that would result in vapor releases to the atmosphere for extended periods of time. Measures to be taken include, but are not limited to, the following:

a. Minimize gasoline spills;

b. Clean up spills as expeditiously as practicable;

c. Cover all open gasoline containers and all gasoline storage tank fill-pipes with a gasket seal when not in use;

d. Minimize gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices, such as oil/water separators.

[40 CFR 63.11116(b)]

3. Submerged Fill Pipes [40 CFR 63.11117(a)]

a. The Permittee shall only load gasoline into storage tanks by utilizing submerged fill pipes that are no more than 6 inches from the bottom of the storage tank.

b. If the submerged fill pipes do not meet the specifications specified above, the Permittee shall demonstrate that the liquid level in the tank is always above the entire opening of the fill pipe. Documentation providing such demonstration must be made available for inspection by the Director or Administrator's delegated representative during the course of a site visit.

4. If any GDF referenced above increases the monthly throughput over 100,000 gallons per month, the Permittee shall comply with new applicable provisions of Subpart CCCCCC within 3 years of the GDF unit becoming subject to the new requirements. [40 CFR 63.11113(c)]

5. All gasoline storage tanks shall be equipped with a submerged filling device, or acceptable equivalent, for the control of hydrocarbon emissions. [A.A.C. R18-2-710.B]

6. All pumps and compressors which handle volatile organic compounds (VOCs) shall be equipped with mechanical seals or other equipment of equal efficiency to prevent the release of organic contaminants into the atmosphere.

[A.A.C. R18-2-710.D]

C. Recordkeeping Requirements [A.A.C. R18-2-710.E.3]

1. The Permittee shall maintain monthly record of the gasoline throughput of each GDF as detailed in Condition IX.A.2. [A.A.C. R18-2-306.A.3.c]

2. The Permittee shall have records available within 24 hours of request by the Director or Administrator documenting the gasoline throughput. [40 CFR 63.11117(d)]

3. The Permittee shall, for the gasoline storage tanks, maintain a file of the typical Reid vapor pressure of gasoline stored and of dates of storage. Dates on which the storage vessel is empty shall be shown. [A.A.C. R18-2-710.E.1]

4. If the gasoline stored has a true vapor pressure greater than 470 mm Hg (9.1 psia), the Permittee shall record the average monthly temperature, and true vapor pressure of gasoline at such temperature. [A.A.C. R18-2-710.E.2.b]

5. The average monthly storage temperature shall be an arithmetic average calculated for each calendar month, or portion thereof, if storage is for less than a month, from bulk liquid storage temperature determined at least once every seven days.

6. The true vapor pressure shall be determined by the procedures in American Petroleum Institute Bulletin 2517, amended as of February 1980 (and no future editions), which is incorporated herein by reference and on file with the Office of the Secretary of State. This procedure is dependent upon determination of the storage temperature and the Reid vapor pressure, which requires sampling of the petroleum liquids in the storage vessels. Unless the Director requires in specific cases that the stored petroleum liquid be sampled, the true vapor pressure may be determined by using the average monthly storage temperature and the typical Reid vapor pressure. For those liquids for which certified specifications limiting the Reid vapor pressure exist, the Reid vapor pressure may be used. For other liquids, supporting analytical data must be made available upon request to the Director when typical Reid vapor pressure is used. [A.A.C. R18-2-710.E.4]

D. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-710.B, D, E.1, E.2.b, E.3 and E.4, 40 CFR 63.11111(a),(b),(c), 40 CFR 63.11112(a), 63.11113(c), 40 CFR 63.11115(a), 40 CFR 63.11116(b), and 40 CFR 63.11117(a), (d).
[A.A.C. R18-2-325]

X. STORAGE TANKS

A. Applicability

This Section is applicable to the storage tanks identified in the equipment list in Attachment “C” of this permit.

B. Operating Requirements

1. The Permittee shall not emit gaseous or odorous materials from the diesel storage tanks in such quantities or concentrations as to cause air pollution.
[A.A.C.R18-2-730.D]

2. Materials including solvents or other volatile compounds, paints, acids, and alkalies shall be processed, stored, used and transported in such a manner and by such means that they will not evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices, or equipment shall be mandatory.
[A.A.C. R18-2-730.F]

3. Where a stack, vent, or other outlet is at such a level that odor, smoke, vapor or any combination thereof constituting air pollution is discharged to adjoining property, the Director may require the installation of abatement equipment or the alteration of such stack, vent, or other outlet by the Permittee to a degree that will adequately dilute, reduce, or eliminate the discharge of air pollution into adjoining property. [A.A.C. R18-2-730.G]

C. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-730.D, -730.F, and -730.G. [A.A.C. R18-2-325]

XI. OTHER PERIODIC ACTIVITY REQUIREMENTS

A. Abrasive Blasting

Particulate Matter and Opacity

1. Emission Limitations

   a. The Permittee shall not cause or allow sandblasting or other abrasive blasting without minimizing dust emissions to the atmosphere through the use of good modern practices. Good modern practices include:

      (1) wet blasting;

      (2) effective enclosures with necessary dust collecting equipment; or

      (3) any other method approved by the Director.

      [A.A.C. R18-2-726]

   b. Opacity

      The Permittee shall not cause, allow or permit visible emissions from sandblasting or other abrasive blasting operations in excess of 20% opacity, as measured by EPA Reference Method 9.

      [A.A.C. R18-2-702.B]

2. Monitoring and Recordkeeping Requirement

   Each time an abrasive blasting project is conducted, the Permittee shall keep records of the following:

   a. The date the project was conducted;

   b. The duration of the project; and

   c. Type of control measures employed.

   [A.A.C. R18-2-306.A.3.c]

3. Permit Shield

   Compliance with this Section shall be deemed compliance with A.A.C. R18-2-726, A.A.C. R18-2-702.B. [A.A.C.R18-2-325]

B. Use of Paints

1. Volatile Organic Compounds

   a. Emission Limitations

      While performing spray painting operations, the Permittee shall comply with the following requirements:

      (1) The Permittee shall not conduct or cause to be conducted any spray painting operation without minimizing organic solvent emissions. Such operations, other than architectural coating and

spot painting, shall be conducted in an enclosed area equipped with controls containing no less than 96 percent of the overspray.

[A.A.C.R18-2-727.A]

(2) The Permittee or their designated contractor shall not either:

(a) Employ, apply, evaporate, or dry any architectural coating containing photochemically reactive solvents for industrial or commercial purposes; or

(b) Thin or dilute any architectural coating with a photochemically reactive solvent.

[A.A.C.R18-2-727.B]

(3) For the purposes of Condition XI.B.1.a.(2), a photochemically reactive solvent shall be any solvent with an aggregate of more than 20 percent of its total volume composed of the chemical compounds classified in Conditions XI.B.1.a.(3).(a) through XI.B.1.a.(3).(c) below, or which exceeds any of the following percentage composition limitations, referred to the total volume of solvent:

(a) A combination of the following types of compounds having an olefinic or cyclo-olefinic type of unsaturation-hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones: 5 percent.

(b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent.

(c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent.

[A.A.C.R18-2-727.C]

(4) Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the groups of organic compounds described in Conditions XI.B.1.a.(3)(a) through XI.B.1.a.(3)(c) above, it shall be considered to be a member of the group having the least allowable percent of the total volume of solvents.

[A.A.C.R18-2-727.D]

b. Monitoring and Recordkeeping Requirements

(1) Each time a spray painting project is conducted, the Permittee shall keep records of the following:

(a) The date the project was conducted;

(b) The duration of the project;

(c) Type of control measures employed;

(d) Material Safety Data Sheets for all paints and solvents used in the project; and

(e) The amount of paint consumed during the project.

(2) Architectural coating and spot painting projects shall be exempt from the recordkeeping requirements of Condition X.B.1.b.(1) above. [A.A.C. R18-2-306.A.3.c]

c. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C.R18-2-727.A, B, C, and D. [A.A.C.R18-2-325]

2. Opacity

a. Emission Limitations

The Permittee shall not cause, allow or permit visible emissions from painting operations in excess of 20% opacity, as measured by EPA Reference Method 9. [A.A.C. R18-2-702.B]

b. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C.R18-2-702.B. [A.A.C. R18-2-325]

C. Demolition/Renovation - Hazardous Air Pollutants

1. Emission Limitations

The Permittee shall comply with all of the requirements of 40 CFR 61 Subpart M (National Emissions Standards for Hazardous Air Pollutants - Asbestos). Notices shall be filed with the Pima County Department of Environmental Quality. [A.A.C. R18-2-1101.A.8]

2. Monitoring and Recordkeeping Requirement

The Permittee shall keep all required records in a file. The required records shall include the "NESHAP Notification for Renovation and Demolition Activities" form and all supporting documents. [A.A.C. R18-2-306.A.3.c]

3. Permit Shield

Compliance with the conditions of this Section shall be deemed compliance with A.A.C. R18-2-1101.A.8. [A.A.C. R18-2-325]

XII. MOBILE SOURCE REQUIREMENTS

A. Applicability

The requirements of this Section are applicable to mobile sources which either move while emitting air contaminants or are frequently moved during the course of their utilization but are not classified as motor vehicles, agricultural vehicles, or agricultural equipment used in normal farm operations. Mobile sources shall not include portable sources as defined in A.A.C. R18-2-101.90. [A.A.C.R18-2-801.A]

B. Particulate Matter and Opacity

1. Emission Limitations

a. Off-Road Machinery

The Permittee shall not cause, allow, or permit to be emitted into the atmosphere from any off-road machinery, smoke for any period greater than ten consecutive seconds, the opacity of which exceeds 40%. Visible emissions when starting cold equipment shall be exempt from this requirement for the first ten minutes. Off-road machinery shall include trucks, graders, scrapers, rollers, and other construction and mining machinery not normally driven on a completed public roadway. [A.A.C.R18-2-802.A and -802.B]

b. Roadway and Site Cleaning Machinery

(1) The Permittee shall not cause, allow or permit to be emitted into the atmosphere from any roadway and site cleaning machinery smoke or dust for any period greater than ten consecutive seconds, the opacity of which exceeds 40%. Visible emissions when starting cold equipment shall be exempt from this requirement for the first ten minutes. [A.A.C.R18-2-804.A]

(2) The Permittee shall take reasonable precautions, such as the use of dust suppressants, before the cleaning of a site, roadway, or alley. Earth or other material shall be removed from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water or by other means.

c. Unless otherwise specified, no mobile source shall emit smoke or dust the opacity of which exceeds 40%. [A.A.C.R18-2-801.B]

2. Recordkeeping Requirement

The Permittee shall keep a record of all emissions related maintenance activities performed on the Permittee's mobile sources stationed at the facility as per manufacturer's specifications. [A.A.C.R18-2-306.A.5.a]

3. Permit Shield [A.A.C.R18-2-325]

Compliance with this Section shall be deemed compliance with A.A.C. R18-2-801.A and B, A.A.C. R18-2-802.A and B, and A.A.C. R18-2-804.A and B.

XIII. PUBLIC ACCESS RESTRICTIONS

At least 90 days prior to beginning construction of the mine, the Permittee shall submit to the Director a Public Access Restriction Plan (Plan) that include measures such as fencing, natural topographic barriers, signage, security patrols, and access restrictions to adjacent private property to restrict public access to the RCC site. The Plan shall be implemented within 30 days after approval by the Director. [A.A.C.R18-2-306.A.2]

XIV. AMBIENT MONITORING REQUIREMENTS

[A.A.C.R18-2-306.A.3.d]

A. Meteorological Monitoring Requirements

1. Within 180 days of permit issuance, the Permittee shall develop and submit to the Director a monitoring and reporting protocol and a quality assurance project plan (QAPP) for the installation and operation of a meteorological monitoring station. The Permittee shall utilize appropriate EPA guidance for the collection of the meteorological data to be used in air quality dispersion models.

2. Within 90 days prior to the startup of the mine operations, the Permittee shall install, maintain and operate a meteorological monitoring station to record wind speed, vector wind direction, standard deviation of wind direction, Δt, and relative humidity. This monitoring shall be installed, maintained, and operated in accordance with applicable sections and appendices of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Measurements and consistent with the monitoring protocol approved by the Director, addressing all general requirements, meteorological station operations, and quality assurance initiatives.

3. The meteorological data measurements shall be collected continuously. One hour averages of all data including wind data and wind gust shall be collected. In the event of system malfunction, the unit shall be repaired or replaced as expeditiously as practicable to restore normal monitoring. If the repair of the unit is not feasible within 24 hours of the time when the Permittee first learned of the malfunction, the Permittee shall notify the Department of any such malfunction and expected duration.

4. The Permittee shall conduct annual audits of the meteorological monitoring stations consistent with applicable sections and appendices of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Measurements, utilizing a qualified auditor that is independent of the Permittee.

5. The Permittee shall provide before the 90th day of the following quarter, electronic files of the validated meteorological data in the Department's Data Collection System (DCS) format

   a. The validated data submitted for upload to the ADEQ database shall contain the following:

      (1) Date and hour of each measurement at each site; and

      (2) Hourly average meteorological parameters specified above, in the appropriate measurement units, per the monitoring protocol.

      (3) Qualifier and validation codes as necessary to support the data validation.

6. Meteorological Monitoring Reports

   a. An electronic report summarizing the meteorological data measurements collected pursuant to this section shall be submitted before the 90th day of the following quarter. An annual summary of quality assurance data shall be included in Meteorological Monitoring Report for the fourth quarter of the calendar year.

b. The quarterly reports shall contain the following information:

(1) Hourly meteorological data in DCS format quality assured and corrected by the Permittee, including appropriate DCS flags;

(2) Data recovery reports;

(3) Any field service activities; and

(4) Any other information required in the monitoring protocol.

(5) Description of any instrument problems affecting the data, any data validation concerns, and any comments on meteorological conditions occurring during the quarter.

c. Two electronic copies of the quarterly and annual reports shall be mailed to the Air Assessment Section and the report's cover letter without attachments shall be copied to the Air Compliance Section of the Air Quality Division of the Department.

B. PM_{10} Monitoring

1. General Requirements

a. Within 180 days of permit issuance, the Permittee shall develop and submit to the Director a monitoring and reporting protocol and a quality assurance plan for the PM_{10} monitor. The PM10 method shall be an Federal Reference Method (FRM) or a Federal Equivalent Method (FEM) as defined by U.S. EPA.

b. Within 90 days prior to the startup of mine operations, the Permittee shall install, operate and maintain a continuous particulate matter monitor at the Rosemont Copper Project site to monitor ambient concentrations of PM_{10}.

c. If the monitored daily average of PM_{10} is greater than 150 $\mu g/m^3$, the Permittee shall notify the Director of the event by a FAX communication within 24 hours of discovery. The cause of the exceedance shall be included in the notification, if known. It shall be the responsibility of the Permittee to demonstrate to the satisfaction of the Director whether the exceedance was or was not primarily caused by the Permittee's operations. If such concentrations are not shown to be primarily the result of emissions from a source or sources other than the Permittee, the Permittee shall implement immediate actions, including, but not limited to, a reduction in the level of operations, with the intention of avoiding a repeat of the exceedance. The immediate corrective actions shall be continued until the alternative control plan is implemented. The Permittee shall be required to develop an alternative control plan to eliminate the problem(s). The additional corrective actions to be taken shall be reported to the Director with a schedule for implementing those actions.

2. Sampling Frequency

   a. The Permittee shall operate the monitor continuously, collecting consecutive hourly readings except during periods of routine maintenance, instrument calibration or malfunction.

   b. In the event of system malfunction, the unit shall be repaired or replaced as soon as possible. Monitoring shall resume as soon as practicable after the correction of the malfunction problem. The Permittee shall report the malfunction to the Director within 24 hours of discovery. A malfunction shall mean equipment or operation issues other than routine maintenance or instrument calibration that result in invalidating a 24-hour sampling day. The report shall contain the probable reason for malfunction and a plan for repairing or replacing the affected equipment

3. PM_{10} Monitoring Quality Assurance/Quality Control

   a. The monitor shall be operated, calibrated, and maintained in accordance with applicable sections and appendices of 40 CFR Parts 50 and 58 and Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, U.S. Environmental Protection Agency and in accordance with the procedures set forth in the respective manufacturer's instruction manuals.

   b. The Permittee shall conduct monthly flow checks on the monitoring equipment during the 1st half of every calendar month.

   c. The Permittee shall conduct semi-annual (every six months) performance audits of the monitoring equipment in accordance with the requirements pertaining to sampler accuracy as specified in Appendix A of 40 CFR Part 58. The performance audits shall be conducted by a qualified auditor that is independent of the Permittee.

   d. The Permittee shall conduct technical systems audits of the PM_{10} ambient air monitoring program consistent with the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, U.S. Environmental Protection Agency. The technical systems audits shall be conducted by a qualified auditor that is independent of the Permittee at least once in every three (3) years.

   e. The Permittee and/or its monitoring contractor shall participate in technical systems audits or performance audits periodically conducted by the Department. The Department shall provide a minimum of 30 days notice of a technical systems audit and a minimum of 48 hours notice of a performance audit.

4. PM_{10} Monitoring Reporting Requirements

   a. The Permittee shall calculate the quarterly and annual summary statistics in accordance with the procedures of 40 CFR Part 50 and Appendices.

b. The Permittee shall calculate the precision and accuracy statistics in accordance with the procedures of 40 CFR Part 58 Appendix A.

c. Valid data recovery shall meet the EPA minimum data completeness requirement of 75 percent per quarter or the percentage specified in 40 CFR Part 50. Valid data shall refer to all observations collected for the specific monitoring purpose. Data collected during precision, audit, flow checks and during servicing shall not be considered valid for data completeness purposes.

d. Before the 90th day of the following quarter, the Permittee shall submit to the Director, a quarterly report pertaining to the PM_{10} measurements and the quality control and assurance (QA/QC) data collected pursuant to this section. An annual summary of PM_{10} measurements and the QA/QC data shall be included in the PM_{10} Monitoring Report for the fourth quarter of the calendar year The quarterly reporting schedule should follow the EPA reporting schedule as described in 40 CFR Part 58. Summary data and reporting frequencies shall be consistent with EPA reporting requirements; the frequency of reporting and the due date depends on type of data. Two electronic copies of the quarterly and annual reports shall be mailed to the Air Assessment Section and the report's cover letter without attachments shall be sent to the Air Compliance Section of the Air Quality Division of the Department.

e. The quarterly reports shall contain the following information, as appropriate. All concentration data shall be presented in micrograms per cubic meter.

(1) Sample date;

(2) Site name, place and time;

(3) Individual sample data that include every sample scheduled to be collected during the reporting period or the reason why the sample is missing;

(4) Data summaries based on EPA data rules,

(5) Data recovery statistics

(6) Analytical techniques or methods used for sampling

f. In addition, to confirm data validation by the Permittee, all data reports should include copies of all appropriate supporting documentation (field data sheets, flow checks, calibrations etc.), including, but not limited to, the following:

(1) Copies of all applicable quality control and field reports (e.g., precision checks, flow checks, and calibrations, audit reports); and

(2) Documentation of problems and corrective actions, and explanations for discrepancies.

g. All data and quarterly reports shall be submitted electronically as follows:

(1) Hourly data in DCS format, quality assured and corrected by the Permittee, including appropriate DCS flags;

(2) Data recovery reports;

(3) Any field service activities; and

(4) Any other information required in the monitoring protocol.

(5) Description of any instrument problems affecting the data, any data validation concerns, and any comments on meteorological conditions occurring during the quarter.

h. Notwithstanding the reporting and data submittal requirements of this section, units shall be consistent with EPA standards (NAAQS) and reporting requirements. If EPA standards or reporting requirements change, the data reporting format and units shall be changed accordingly.

i. All data submitted to the Director shall be reviewed, quality assured, and certified by the Permittee. All of the field documents, QC check documents, etc. need to be submitted with the quarterly report.

ATTACHMENT "C": EQUIPMENT LIST

Air Quality Control Permit No. 55223
For
Rosemont Copper Company – Rosemont Copper Project

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C
Primary Crushing, Conveying, Coarse Ore Storage, & Reclaim Conveying						
Crusher Dump Hopper	1	680 tons			H-CDp	NSPS Subpart LL
Primary Crusher	1	6950 tons per hour			PCr	NSPS Subpart LL
Crusher Discharge Hopper	1	725 tons			H-CDs	NSPS Subpart LL
Crusher Discharge Feeder	1	25' L x 96" W			F-CD	NSPS Subpart LL
Stockpile Feed Conveyor No. 1	1	2690' L x 60" W			CV-SF1	NSPS Subpart LL
Crushing Area Dust Collector	1	18,000 acfm	Cartridge Filter		PCL01/ PC-CADC	NSPS Subpart LL
Stockpile Feed Conveyor No. 2	1	2690' L x 60" W			CV-SF2	NSPS Subpart LL
Reclaim Feeders	4	20' L X 48" W			F-R1/R4	NSPS Subpart LL
Reclaim Conveyors	1	932' L X 60" W			CV-R	NSPS Subpart LL
Stockpile Feed Conveyor Transfer Point Dust Collector	1	10,000 acfm	Cartridge Filter		PCL03/ PC-SFCDC	NSPS Subpart LL
Stockpile Area and Reclaim Tunnel Dust Collector	1	41,500 acfm	Cartridge Filter		PCL02/ PC-SARTDC	NSPS Subpart LL
SAG Mill Feed Conveyor	1	660' L x 60" W			CV-SMF	NSPS Subpart LL
SAG Mill	1	36' D x 17.5' EGL			M-SAG	NSPS Subpart LL
Trommel Screen	1	16' L x 16' W	Polysius		Sn-T	NSPS Subpart LL
Pebble Conveyor No.1	1	135.5' L x 60" W			CV-Pb1	NSPS Subpart LL
Pebble Wash Screen	1	10' L x 20' W			Sn-PbW	NSPS Subpart LL
Pebble Conveyor No.2	1	675' L x 36" W			CV-Pb2	NSPS Subpart LL
SAG Oversize Surge Bin	1	500 Tons			B-SAGOS	NSPS Subpart LL
SAG Feed Conveyor Dust Collector	1	13,000 acfm	Cartridge Filter		PCL12 / PC-SFDC	NSPS Subpart LL
Pebble Crusher Feeder	1	31.5' x 48" W			F-PbC	NSPS Subpart LL
Pebble Crusher	1	1,771 tons per hour			PbC	NSPS Subpart LL

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C.
Pebble Conveyor No.3	1	170.5' x 36" W			CV-Pb3	NSPS Subpart LL
Pebble Crusher Area Dust Collector	1	9000 acfm	Cartridge Filter		PCL04 / PC-PCADC	NSPS Subpart LL
Ball Mills	2	26' D x 40' EGL			M-B1/B2	NSPS Subpart LL
Flotation, Regrind, and Concentration						
Copper/ Molybdenum/ Tailings Floatation and Concentrating Equipment (Flotation cells, column cells, thickeners, filters)	N/A	N/A			Various	A.A.C. 721
Copper Regrind Mills	2	11'-8" L x 13'-4" W			M-CR1/CR2	NSPS Subpart LL
Molybdenum Regrind Mill	1	4' L x 4'-4" W			M-MR	NSPS Subpart LL
Molybdenum Cleaner Regrind Mill	1	4 tons per hour			M-MCR	NSPS Subpart LL
Molybdenum Cleaner Area Scrubber	1	12,500 acfm			PC-MCAS	A.A.C. 730
Copper Concentrate Dewatering and Stacking						
Filter Feed Trash Screen	1	60" L x 48" W			Sn-FFT	NSPS Subpart LL
Copper Concentrate Loadout Building	1	175'L x 101'W x 60'H			BD-CCL	NSPS Subpart LL
Copper Concentrate Conveyor	1	330' L x 24" W			CV-CC	NSPS Subpart LL
Copper Concentrate Dust Collectors	2	50,000 acfm each	Cartridge Filter		PCL05 & PCL06 PC-CCDC1/ PC-CCDC2	NSPS Subpart LL
Molybdenum Dewatering and Packing						
Molybdenum Concentrate Dryer	1	N/A			D-MC	NSPS Subpart LL
Molybdenum Scrubber	1				PC-MS	NSPS Subpart LL
Electorstatic Precipitator	1	139 acfm			PC-EP	NSPS Subpart LL
Molybdenum Concentrate Bin	1	20 Tons			B-MC	NSPS Subpart LL
Molybdenum Dust Collector	1	1,500 acfm	Cartridge Filter		PCL08/ PC-MDC	NSPS Subpart LL
Molybdenum Concentrator Hopper	1	20 ft3			H-MC	NSPS Subpart LL
Molybdenum Concentrate Conveyor	1	90 tons per hour			CV-MC	NSPS Subpart LL
Molybdenum Packing & Weigh System	1	Variable			MPS	NSPS Subpart LL

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C.
Tailings Dewatering and Placement						
Tailings Belt Feeders	14				F-T1/T14	A.A.C 730
Fixed Tailings Conveyor No. 1	1				CV-F1	A.A.C 730
Fixed Tailings Conveyor No. 2	1				CV-F2	A.A.C 730
Fixed Tailings Conveyor No. 3	1				CV-F3	A.A.C 730
Relocatable Conveyors	2				CV-R1/R2	A.A.C 730
Shiftable Conveyors with Cross Conveyor Trippers	2				CV-S1/S2	A.A.C 730
Belt Wagon Conveyor on Crawlers (moveable)	1				CV-BW1	A.A.C 730
Spreader Crawler Mounted Conveyors (movable)	2				CV-SP1/SP2	A.A.C 730
Solvent Extraction and Electrowinning						
SX Primary Mix Tanks	4	7.75' D x 9.75' H			T-E1P, E1PP, E2P, S1P	A.A.C 730
SX Secondary Mix Tanks	4	9.5' D x 9.75'H			T-E1S, E1PS, E2S, S1S	A.A.C 730
SX Tertiary Mix Tanks	3	9.5' D x 9.75			T-E1T, E1PT, E2T	A.A.C 730
SX Settlers	4	64' L x 33' W x 3.33' H			ES-E1, E1P, E2, SS-S1	A.A.C 730
Electrowinning Commercial Cells	30	22' L x 4' W X 5' H			EWCC	A.A.C 730
Cell Ventilation Wet Scrubbers	3	5000 acfm each			PC-EWCVS1/ EWCVS3	A.A.C 730
Fuel Burning Equipment						
Diesel Electrowinning Hot Water Generator	1	6.0 MMBtu per hour			HWG	A.A.C 703
Thickener Area Emergency Generator	1	1000 kilowatt			TEG	NSPS Subpart IIII
PLS Pond Area Emergency Generator	1	1000 kilowatt			PEG	NSPS Subpart IIII
Main Substation Emergency Generator	1	750 kilowatt			MEG	NSPS Subpart IIII
Administration Building Emergency Generator	1	750 kilowatt			AEG	NSPS Subpart IIII
Electrowinning Building Emergency Generator	1	50 kilowatt			EWEG	NSPS Subpart IIII
Primary Crusher Fire Water Pump	1	400 horsepower			PCFWP	NSPS Subpart IIII
SX/EW Fire Water Pump	1	400 horsepower			SXFWP	NSPS Subpart IIII

Equipment	Qty	Max Capacity	Make / Model	Date of Manu-facture	Equipment ID / Serial Number	NSPS / A.A.C.
Miscellaneous Sources						
Lime Storage Bin	1				B-L	A.A.C 730
Lime Storage Bin Vent	1	750 / 1750 acfm			PC-LSBV	A.A.C 730
Lime Transfer Screw Conveyors	1				CV-LTS1/2	A.A.C 730
Lime Slakers	2				T-LS1/2	A.A.C 730
Lime Slaker Scrubber	1	500 acfm			PC-LSS	A.A.C 730
Sodium Metascilicate Storage Bin	1				B-SM	A.A.C 730
Sodium Metascilicate Storage Bin Vent	1				PC-SMSBV	A.A.C 730
Flocculant Storage Bin 1	1				B-F1	A.A.C 730
Flocculant Storage Bin 2	1				B-F2	A.A.C 730
Guar Feeder	1				F-Gu	A.A.C 730
Cobalt Sulfate Feeder	1				F-CoS	A.A.C 730
Tanks						
C7 Distribution Tank	1	11,845 gallons			T-C7D	A.A.C 730
MIBC Storage Tank	1	11,845 gallons			T-MIBCS	A.A.C 730
Diesel Fuel Storage Tanks – heavy Vehicles	2	100,000 gallons			T-DFS-HV1/HV2	A.A.C 730
Gasoline Storage Tank	1	10,000 gallons				A.A.C 710
Mix Tank	1	1,692 gallons				A.A.C 710
Other Pollution Control Equipment						
Laboratory Dust Collectors	3	10,000 acfm each			PC-L1/L3	A.A.C 721
Laboratory Wet Scrubber	1	9,000 acfm			PC-LWS	A.A.C.721

NOTE:
All missing equipment data will be updated upon purchase of equipment

ATTACHMENT “D”: DUST CONTROL PLAN

Air Quality Control Permit No. 55223
For
Rosemont Copper Company- Rosemont Copper Project

(See Attached)

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D.1 INTRODUCTION

As described in the Calculation Methodology presented in the Emission Inventory Information, Volume I, a 90% control efficiency is utilized during the calculation of fugitive dust emissions from regularly traveled unpaved haul roads servicing the open pit as well as from the general facility roads around the RCP. Additionally, the RCP plans to implement reasonable dust control measures to prevent excessive fugitive emissions from open areas and storage piles created by the mining operations. This document constitutes the RCP's dust control plan for achieving a 90% control of fugitive dust emissions from unpaved roads and preventing excessive fugitive emissions from open areas.

D.2 FUGITIVE DUST EMISSIONS FROM UNPAVED ROADS

D.2.1 Unpaved Road Network

The RCP has a network of unpaved haul roads for transporting concentrating ore, leaching ore, and waste rock from the open pit mine to the primary crushing area, leaching area, and waste rock areas, respectively. Additionally, the RCP has general roads around the facility used by support vehicles. Site diagrams of the RCP are presented in Appendix D. Primary roads include: (a) haul roads located in the pit, (b) haul roads for transporting concentrating ore from the pit to the primary crusher/run of mine stockpile, (c) haul roads for transporting leaching ore from the pit to the leach pad, (d) haul roads for transporting waste rock from the pit to the waste rock storage area, and (e) general facility roads around the RCP for support vehicles.

The RCP dust control plan for unpaved roads includes the use of chemical dust suppressants and/or road watering. The control efficiency achieved by chemical dust suppressants depends upon the strength of the ground inventory, whereas the control efficiency achieved by watering depends upon the amount of water that is used (gallons/yd^2) and the traffic volume. Since the chemical dust suppressant usage does not depend on traffic volumes, the ground inventory value determined for a 90% control efficiency can be applied on a periodic basis to any unpaved road at the facility, regardless of the rate of vehicles traveling on the road. However, because the control efficiency achieved by unpaved road watering depends upon traffic volume, in this dust control plan, the haul trucks traveling on haul roads during Year 5 operations at the RCP (the year when haul road travel rates are greatest) is used as an example in determining the application intensity of water used to control fugitive emissions. Additionally, the road network at the RCP is divided into four categories to account for each road network category having a different maximum traffic volume.

During actual operation, the RCP will evaluate the haul truck traffic rates at different time periods throughout the life of the mine to correctly identify the application intensity needed for road watering to achieve a 90% control efficiency on haul roads. Also, the RCP will evaluate the traffic rate of support vehicles to determine the water application intensity needed to control the general unpaved facility roads to a 90% control efficiency.

The calculation methodology used to estimate traffic volume is presented in Appendix D1. The road network categories and the average hourly haul truck traffic rates at the maximum production, assuming operations of 24 hours per day, are presented below:

a) Roadways that will be used to transport concentrating ore, leaching ore, and waste rock from the mining location inside the pit to the exit point of the pit. These roadways are expected to experience an average traffic rate of 120.0 vehicles per hour;

b) Roadways that will be used to transport concentrating ore from the exit of the pit to the primary crusher dump hopper / run of mine stockpile. These roadways are estimated to experience an average traffic rate of 30.0 vehicles per hour;

c) Roadways that will be used to transport leaching ore from the exit of the pit to the leaching area. These roadways are estimated to experience an average traffic rate of 2.0 vehicles per hour; and

d) Roadways that will be used to transport waste rock from the exit of the pit to the waste rock storage area. These roadways are estimated to experience an average traffic rate of 88.0 vehicles per hour.

D.2.2 Description of Dust Control Plans

Optimal dust control measures depend upon the characteristics of the road network and its use, and upon meteorological considerations. Additionally, dust control measures are continuously evolving with new products becoming available on a regular basis. In order to provide flexibility to change dust control measures while achieving the desired control efficiency, this document proposes three programs, each designed to achieve a 90% control of PM_{10} emissions. The RCP dust control plan includes the flexibility to alternate from one dust control program to another or to use a separate dust control program for an individual roadway system.

The RCP dust control plan ensures that at least a 90% control of PM_{10} emissions is achieved on the unpaved road network. The RCP is also required to maintain no greater than a 40% or 20% opacity for all non-point sources (see Table 4.1). A 90% control efficiency is considered sufficient to ensure that the 40% or 20% opacity limit will be met.

D.2.2.1 Dust Control Program A

Dust Control Program A consists of the application of sufficient chemical dust suppressant to achieve a ground inventory of 0.25 gallons/yard^2 with a reapplication frequency of 1-month (where reapplication frequency refers to the time interval between applications used to maintain a specific ground inventory). The term “ground inventory” represents the residual accumulation of a dust suppressant from previous applications. (For a detailed definition of “ground inventory” see page 3-20 of *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures*, EPA-450/2-92-004, in Appendix D2). Dust suppressants which could be used for this purpose include, among others, lignosulfonates, petroleum resins, asphalt emulsions, and acrylic cement.

D.2.2.2 Dust Control Program B

Dust Control Program B consists of periodic watering in sufficient amounts to achieve 90% control for PM_{10}. The program will be applied only during days with precipitation of less than 0.01 inches. The water application intensities necessary to achieve a 90% particulate control efficiency during daylight and nighttime hours are presented in Tables D.2.1 and D.2.2, respectively. The roadway network categories are presented in Section D.2.1 and a description on how the application intensities are calculated is presented in Section D.4.2.

Table D.2.1 Average Hourly Watering Requirements During Daylight Hours for Dust Control Program B

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter^2	gallons/yard^2
From Mining Location to Pit Boundary	120.0	4.87	1.08
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	1.22	0.27
From Pit Boundary to Leach Pad	2.0	0.08	0.02
From Pit Boundary to Waste Rock Storage Area	88.0	3.57	0.79

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.2.2 Average Hourly Watering Requirements During Nighttime Hours for Dust Control Program B

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter^2	gallons/yard^2
From Mining Location to Pit Boundary	120.0	2.43	0.54
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	0.61	0.13
From Pit Boundary to Leach Pad	2.0	0.04	0.009
From Pit Boundary to Waste Rock Storage Area	88.0	1.79	0.39

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

D.2.2.3 Dust Control Program C

Dust Control Program C consists of the application of sufficient chemical dust suppressant to achieve a ground inventory of 0.05 gallons/yard^2 with a 1-month reapplication frequency (the ground inventory of 0.05 gallons/yard^2 provides a base control efficiency of 62%.) plus periodic watering to increase the base control efficiency achieved by chemical dust suppressants alone to 90%. A summary of the roadway traffic volume and corresponding annual average watering requirements of Dust Control Program C is presented in Table D.2.3 (Daylight Hours) and Table D.2.4 (Nighttime Hours). If any type of water adhesion enhancing material, such as a surfactant, is used with Dust Control Program C, application intensities will be re-evaluated.

Table D.2.3 Average Hourly Watering Requirements During Daylight Hours for Dust Control Program C

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter^2	gallons/yard^2
From Mining Location to Pit Boundary	120.0	1.85	0.41
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	0.46	0.10
From Pit Boundary to Leach Pad	2.0	0.03	0.007
From Pit Boundary to Waste Rock Storage Area	88.0	1.36	0.30

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.2.4 Average Hourly Watering Requirements During Nighttime Hours for Dust Control Program C

Roadway System Category	Average Traffic Volume (vehicles/hour)	Average Hourly Application Intensity During Daylight Hours Required to Achieve a 90% Control Efficiency for Fugitive Dust Emissions [a]	
		liters/meter^2	gallons/yard^2
From Mining Location to Pit Boundary	120.0	0.93	0.20
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	30.0	0.23	0.05
From Pit Boundary to Leach Pad	2.0	0.02	0.003
From Pit Boundary to Waste Rock Storage Area	88.0	0.68	0.15

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

D.3 PLAN FOR THE CONTROL OF FUGITIVE DUST EMISSIONS FROM OPEN AREAS AND STORAGE PILES

D.3.1 Open Areas and Storage Piles

Open areas and storage piles include mined areas, overburden storage areas, as well as waste rock storage areas. Open areas and storage areas which are subject to generating fugitive emissions exclude ore, waste rock, and other similar areas because these areas are characterized by a low silt content and therefore, are not dust producing areas. Consequently, dust control measures are not necessary for such areas.

D.3.2 Description of Dust Control Plan

Open areas and storage piles which are in active use and subject to generating fugitive emissions will be controlled by the application of water as required by Title 18, Chapter 2, Article 6 of the A.A.C. and Chapter 17.16, Article III of the P.C.C.. Open areas and storage piles which are not actively used will be controlled by applying the methods required by A.A.C. R18-2-604 and R18-2-607 and P.C.C. Sections 17.16.080 and 17.16.110, respectively. This includes the application of sufficient chemical dust suppressant and/or water to develop and maintain a visible crust. Periodic inspections of the open areas will be performed to evaluate the condition of the visible crust and, if necessary, additional chemical dust suppressant and/or water will be applied. Other means which may be applied include use of an adhesive soil stabilizer, paving covering, landscaping, detouring, or other acceptable means. Access to such areas will also be minimized by the construction of berms or other barriers to prevent re-disturbance of the areas.

D.4 DEMONSTRATION THAT THE DUST CONTROL PLAN WILL PROVIDE A 90% CONTROL EFFICIENCY

D.4.1 Dust Control Program A

The control efficiency of a chemical dust suppressant is dependent upon the ground inventory of the dust suppressant and the frequency between applications. A model developed by EPA, and published in *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures* (see Appendix D2), provides the relationship between these parameters and PM_{10} control performance for dust suppressants in general. A graph representing this model is presented in Figure D.4.1.

The sufficiency of Dust Control Program A to achieve a control efficiency of 90% for PM_{10} is verified by considering this figure. Using a chemical dust suppressant, a ground inventory of 0.25 gallons/yd^2 with a 1-month reapplication frequency will provide a control efficiency for PM_{10} of 90%. It should be noted that the model for PM_{10} control efficiency of petroleum-based dust suppressants published in the AP-42, Section 13.2.2 (11/06), agrees with the EPA model used to determine the sufficiency of Dust Control Program A.

The control efficiencies in the above mentioned models are averages and not maximums. Therefore, it can be assumed that using a chemical dust suppressant with a ground inventory of 0.25 gallons/yd^2 could result in control efficiencies higher than 90%.

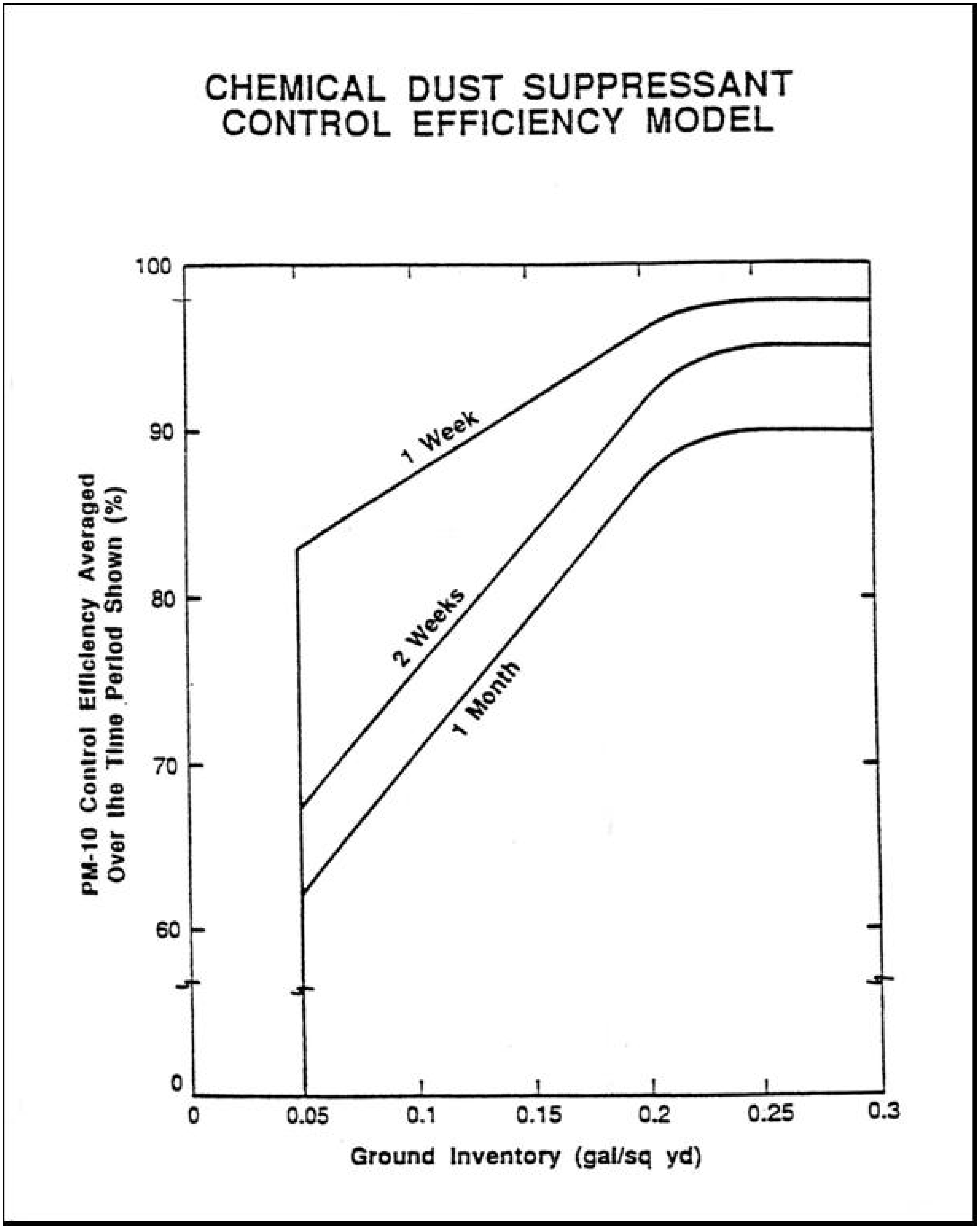

Figure D.4.1 Model for Control Efficiency of PM_{10} when Using Chemical Dust Suppressants.

D.4.2 Dust Control Program B

The application intensity of water during daylight and nighttime hours required to achieve a 90% control efficiency for each road category is calculated using an empirical model developed by EPA (*Control of Open Fugitive Sources*, EPA-U50/3-88-008, September, 1988, presented in Appendix D3). The following equations were derived from this model:

$$i = \frac{0.8 \times p \times d \times t}{(100 - W_c)} \qquad \text{Equation 1}$$

$$p = 0.0049 \times PER \qquad \text{Equation 2}$$

where:

- i = application intensity (liters/m^2);
- p = potential average hourly daytime evaporation rate (mm/hr, 0.507 for Tucson, AZ);
- d = average hourly daytime traffic (vehicles/hr; see Section D.2.1);
- t = time between applications (hours, 1 for hourly applications)
- W_c = average particulate control efficiency (%, 90 in this case); and
- PER = mean annual pan evaporation rate (inches/year, 103.51 for Tucson, AZ from Western Region Climate Center data from 1894-2005).

As shown by Equation 1, the application intensity is dependent upon the pan evaporation rate. Because the pan evaporation rate differs between daytime and nighttime conditions, as well as meteorological conditions, application intensities will also vary with daylight hours and nighttime hours and with meteorological conditions. Nighttime hour application intensities are calculated assuming the average hourly nighttime pan evaporation rate is equal to 50% of the average hourly daytime pan evaporation rate.

The application intensity required to achieve a 90% control efficiency is calculated using Equation 1. However, the application intensities are for illustration purposes due to the varying conditions of evaporation rates and traffic volumes. A summary of the input variables and resulting application intensities during daylight hours and nighttime hours derived from the above equation are presented in Tables D.4.1 and D.4.2, respectively.

The application intensities in Tables D.4.1 and D.4.2 are based upon an hourly frequency of application. The RCP may reduce the frequency of application by increasing the application intensity. A frequency of once every two hours, for example, would require that the application intensities in Tables D.4.1 and D.4.2 to be increased by a factor of 2.

Table D.4.1 Summary of Data Used to Verify Dust Control Program B During Daylight Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ $meter^2$	gallons/ $yard^2$
From Mining Location to Pit Boundary	90	0.507	120.0	1.0	4.87	1.08
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	90	0.507	30.0	1.0	1.22	0.27
From Pit Boundary to Leach Pad	90	0.507	2.0	1.0	0.08	0.02
From Pit Boundary to Waste Rock Storage Area	90	0.507	88.0	1.0	3.57	0.79

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.4.2 Summary of Data Used to Verify Dust Control Program B During Nighttime Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ $meter^2$	gallons/ $yard^2$
From Mining Location to Pit Boundary	90	0.254	120.0	1.0	2.43	0.54
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	90	0.254	30.0	1.0	0.61	0.13
From Pit Boundary to Leach Pad	90	0.254	2.0	1.0	0.04	0.009
From Pit Boundary to Waste Rock Storage Area	90	0.254	88.0	1.0	1.79	0.39

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

It should be noted that the pan evaporation rates used to calculate the application intensities in Tables D.4.1 and D.4.2 represent annual averages which, when used with Equation 1, will result in an application intensity that is too high for winter months and too low for summer months. Actual application intensities will be determined based on actual pan evaporation rates as determined for the different climatological periods of the year. Additionally, the calculated intensities are based on the maximum mine production rates. Lower production rates characterized by lower traffic rates will be characterized by lower application intensities. If any type of water adhesion enhancing material, such as a surfactant, is used with Dust Control Plan B, application intensities will be reevaluated.

D.4.3 Dust Control Program C

The sufficiency of Dust Control Program C to achieve a control efficiency of 90% for fugitive dust emissions is verified by considering Figure D.4.1. Using a chemical dust suppressant, a ground inventory of 0.05 gallons/yard^2 with a 1-month reapplication frequency provides a control efficiency of 62% for PM_{10}. The additional 28% control necessary to increase the control efficiency to 90% will be attained through periodic watering. The control efficiency of the watering program, W_c, necessary to increase the chemical dust suppressant control efficiency, CDS_c, of 62% to a combined dust suppressant/watering control efficiency of 90% is derived from the following equation:

$$W_c = \left(\frac{\text{Additional Control Necessary (\%)}}{(100\% - CDS_c)} \right) \times 100\% \qquad \text{Equation 3}$$

$$W_c = \left(\frac{28\%}{(100\% - 62\%)} \right) \times 100\%$$

$$W_c = 73.7\%$$

This value, 73.7%, is used in conjunction with the model described in Section D.4.2 to determine the average application intensity of watering that is necessary to achieve a 73.7% control efficiency. A summary of the input variables and resulting hourly application intensities during daylight and nighttime hours derived from the model is given in Tables D.4.3 and D.4.4, respectively.

Table D.4.3 Summary of Data Used to Verify Dust Control Program C During Daylight Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ meter^2	gallons/ yard^2
From Mining Location to Pit Boundary	73.7	0.507	120.0	1.0	1.85	0.41
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	73.7	0.507	30.0	1.0	0.46	0.10
From Pit Boundary to Leach Pad	73.7	0.507	2.0	1.0	0.03	0.007
From Pit Boundary to Waste Rock Storage Area	73.7	0.507	88.0	1.0	1.36	0.30

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

Table D.4.4 Summary of Data Used to Verify Dust Control Program C During Nighttime Hours

Roadway System Category	Variables				Average Hourly Water Application Intensity (i) [a]	
	Wc (%)	p (mm/h)	d (vehicles/ hour)	t (hours)	liters/ meter^2	gallons/ yard^2
From Mining Location to Pit Boundary	73.7	0.254	120.0	1.0	0.93	0.20
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	73.7	0.254	30.0	1.0	0.23	0.05
From Pit Boundary to Leach Pad	73.7	0.254	2.0	1.0	0.02	0.003
From Pit Boundary to Waste Rock Storage Area	73.7	0.254	88.0	1.0	0.68	0.15

[a] The model predicts a 90% control efficiency regardless whether the water application intensity is met with a single hourly application, multiple applications during the 1-hour period, or greater application intensities for less frequent applications.

D.5 DEMONSTRATION OF COMPLIANCE WITH THE REQUIREMENTS OF ARTICLE 6 OF THE A.A.C. AND CHAPTER 17.16, ARTICLE III OF THE P.C.C.

Section R18-2-604 of the A.A.C. and Section 17.16.080 of the P.C.C. require, in part, that fugitive dust from open areas be kept to a minimum by good modern practices such as using an approved dust suppressant.

Section D.3 of this document describes the control measures for wind-blown fugitive dust from open areas and storage piles at the RCP. By developing and maintaining a visible crust on the soil in all open areas and applicable storage piles, implementing best management practices (e.g., watering), and minimizing access to these areas, the RCP Dust Control Plan complies with the requirements of Article 6 of the A.A.C and Chapter 17.16, Article III of the P.C.C. for the control of fugitive dust emissions from open areas and storage piles.

D.6 PERIODIC REAPPLICATION

D.6.1 Chemical Dust Suppressants

Dust control programs that utilize chemical dust suppressants require periodic application of the chemical dust suppressant in order to replenish dust suppressants that are removed from the road due to the abrasion of the vehicles on the treated road surface. Each successive application will correspond to:

a) The manufacturer’s recommendation if available; or

b) If manufacturer’s recommendations are not available, the amount necessary to completely replenish the initial ground inventory every six months.

D.6.2 Road Watering

The frequency of reapplication of water used in Dust Control Programs B and C will depend upon the operational plans of the RCP. The frequency can be hourly, less frequent or more frequent, depending upon the traffic density, meteorological conditions, and operational considerations. The application intensities for water should be treated as annual averages as some days will require a greater water application whereas others will require a lesser water application due to seasonal climatic condition changes. The models introduced in Sections D.4.2 and D.4.3 predict the same control efficiency independent of whether the water is applied during one pass per hour of the water truck or during multiple passes during the 1-hour period. Additionally, watering will not be required for days when natural precipitation equals or exceeds 0.01 inches or when roads are moist due to recent rain, as the control efficiency during such days is assumed to be 100% by AP-42.

D.7 RECORD KEEPING REQUIREMENTS

D.7.1 Records of the Application of Chemical Dust Suppressants

Records will be maintained demonstrating the RCP's compliance with the initial chemical dust suppressant ground inventory required by Dust Control Programs A and C by recording the information necessary to demonstrate a 90% control efficiency.

D.7.2 Records of Reapplication of Chemical Dust Suppressants

Records will be maintained demonstrating the RCP's compliance with the periodic reapplication of dust suppressants to replace losses as identified in Section D.6.1. Records will be maintained concurrently with the records described in Section D.7.1.

D.7.3 Records of Application of Water

Records will be maintained demonstrating the RCP's compliance with the watering requirements of Dust Control Programs B and C by recording the information necessary to demonstrate a 90% control efficiency.

APPENDIX D1

ROADWAY NETWORK TRAFFIC VOLUME CALCULATION METHODOLOGY

D1. ROADWAY SYSTEM TRAFFIC VOLUME CALCULATION METHODOLOGY

Because the control efficiency of unpaved road watering is dependent upon traffic volume, the roadway system at the RCP was divided into four road network categories based on average hourly traffic rates. Traffic volume estimates for the road network categories are calculating by dividing the anticipated hourly amount of material transferred by the haul trucks on each road network category by the average haul truck load (250 tons) and multiplying this number by two to account for the haul trucks returning empty to the mining location. This methodology is shown in the following equation:

$$\text{Traffic Volume}\left(\frac{\text{vehicles}}{\text{hour}}\right)=\left(\text{Material Transferred by Haul Trucks}\left(\frac{\text{tons}}{\text{hour}}\right)\times\frac{1\,\text{trip}}{250\,\text{tons}}\times\frac{2\,\text{passes}}{\text{trip}}\right)$$

The process rates and resulting traffic volume estimates for each roadway system are listed in Table D1.1. The traffic volumes in this table are presented for Year 5 operations at the RCP. However, since process rates vary hourly, daily, and annually, traffic volumes will be monitored on an on-going basis so that accurate water application intensities are determined and a 90% control efficiency will be met.

Table D1.1 Summary of Data Used to Calculate Roadway System Traffic Volume (Year 5)

Roadway System Category	Maximum Process Rate (tons/hour)	Traffic Volume (vehicles/hour)
From Mining Location to Pit Boundary	15,000	120.0
From Pit Boundary to Primary Crusher Dump Hopper / Run of Mine Stockpile	3,750	30.0
From Pit Boundary to Leach Pad	250	2.0
From Pit Boundary to Waste Rock Storage Area	11,000	88.0

ATTACHMENT "E": MAP OF PAVED ROADS

Air Quality Control Permit No. 55223
For
Rosemont Copper Company- Rosemont Copper Project

(See Attached)

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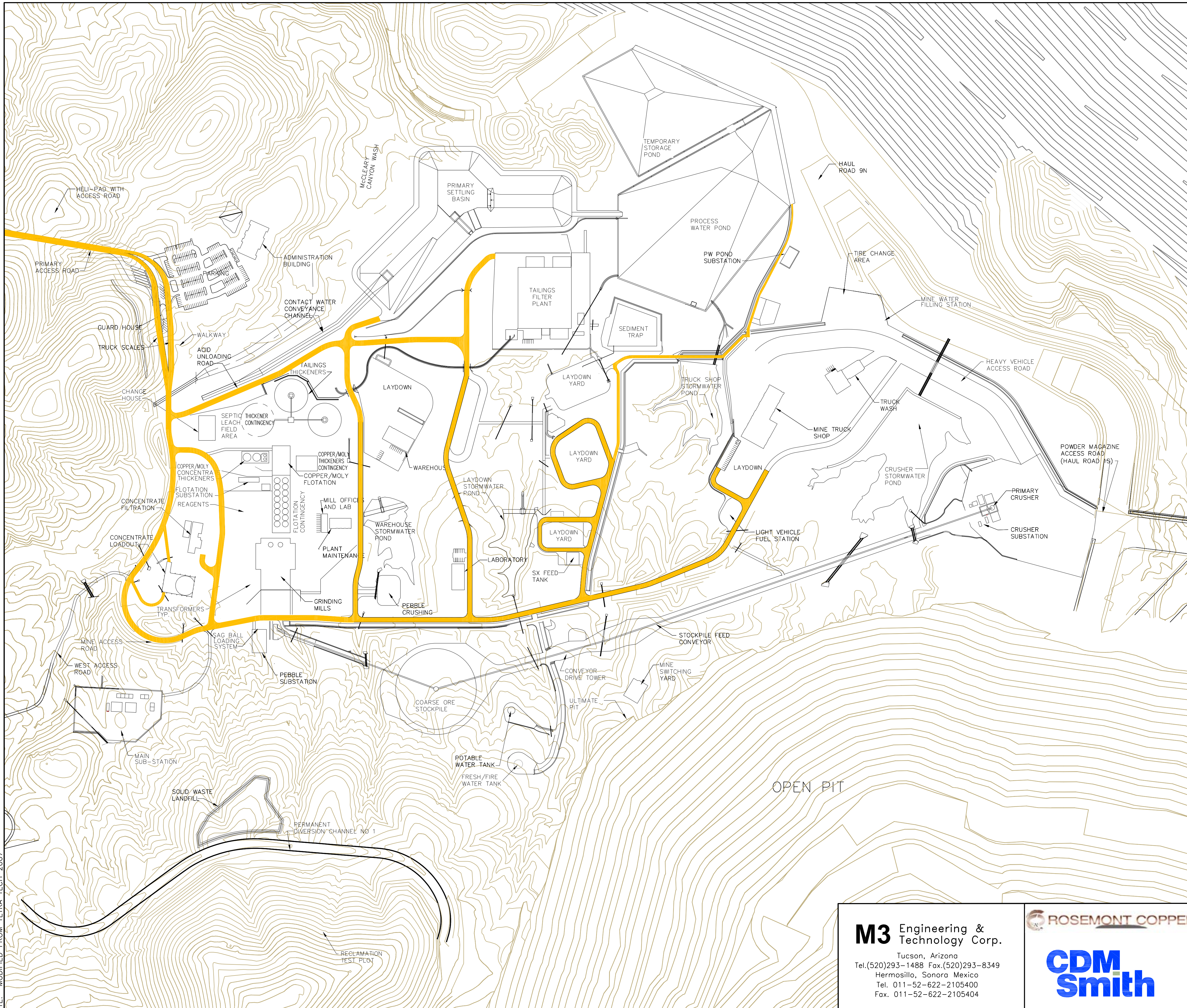

LEGEND:

EXISTING 10' CONTOUR

PERMANENT DIVERSION CHANNEL

PROPOSED PAVED ROADS

NOTES:

1. PLANT, CRUSHER, ACCESS ROADS, PIT LIMITS, AND WASTE ROCK STORAGE AREA DESIGNED BY OTHERS.
2. CONTOURS SHOWN FOR DRY PIT ARE IN 100' INTERVALS. CONTOURS SHOWN FOR EXISTING GROUND ARE IN 10' INTERVALS.
3. TEMPORARY ROM STOCKPILE LOCATION SHOWN FOR CLARITY ONLY.

M3 Engineering & Technology Corp.
Tucson, Arizona
Tel.(520)293-1488 Fax.(520)293-8349
Hermosillo, Sonora Mexico
Tel. 011-52-622-2105400
Fax. 011-52-622-2105404

ROSEMONT COPPER

CDM Smith

ROSEMONT COPPER PROJECT
AIR PERMIT

PROPOSED PAVED ROADS
ATTACHMENT E

LOCATION:	PIMA COUNTY, ARIZONA
DATE:	01.29.13
PROJECT NO.	91146
FILE NAME:	FIGURE 1
FIGURE NO.	1

j. Kennecott Utah Copper (KUC): Mine

i. Bingham Canyon Mine (BCM)

A. [~~Maximum total mileage per calendar day for ore and waste haul trucks~~] Emissions at the Bingham Canyon Mine shall not exceed 6,205 tons of NO_X, $PM_{2.5}$ and SO_2 combined per rolling 12-month period~~No later than January 1, 2019, combined site-wide emissions of NO_x, $PM_{2.5}$, and SO_2 shall not exceed[30,000 miles] 5,585 tons per year and 15.3 tons per day~~.

B. Maximum total NO_X emissions from ore and waste haul trucks shall not exceed 16.9 tons per day (calendar month average).
~~Haul truck emissions shall be calculated daily using the miles driven per haul truck. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System or equivalent. The system shall use real time tracking to determine daily mileage.~~

~~All other emission sources shall use their respective means of emission calculation through AP-42 emission factors or associated stack testing.~~

~~B~~C. To minimize fugitive dust on roads at the mine, the owner/operator shall perform the following measures:

I. Apply water to all active haul roads as weather and operational conditions warrant except during precipitation or freezing weather conditions, and shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.

II. Chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing weather conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.

III. Records of water and/or chemical dust control treatment shall be kept for all periods when the BCM is in operation.

IV. KUC is subject to the requirements in the most recent federally approved Fugitive Emissions and Fugitive Dust rules.

~~C~~D. [~~To minimize emissions at the mine, the owner/operator shall:~~]The In-pit crusher baghouse shall not exceed a $PM_{2.5}$ emission limit of 0.~~18~~78 lb/hr. $PM_{2.5}$ monitoring shall be performed by stack testing every three years.

[~~I. Control emissions from the in-pit crusher with a baghouse.~~]

~~D~~E. Implementation Schedule

When KUC replaces[~~shall purchase new~~] haul trucks, they shall be replaced with trucks that have the highest engine Tier level available which meet mining needs. KUC shall maintain records of haul trucks purchased and [~~retired~~]replaced.

~~E. Minimum design payload per ore and waste haul truck shall not be less than 240 tons. The minimum design payload for all trucks combined shall be an average of 300 tons.~~

Comment [CK1]: Calculation per J. Black on May 21st.

Haul Truck NOx = 5,134 tons per year
Divide by 365 = 14.1 tons per day
20% agreed variability = 16.9 tons per day

16.9*356 = 6,176 tons per year.
This is within the existing limit of 6,205 and not above any previous approvals. KUC will be required to make reductions and manage operations carefully in order to meet these proposed new daily NOx and combined site limits.

Comment [CK2]: Calendar month average is important because truck activity is reported for emissions calculations monthly and the only feasible way to demonstrate compliance with a daily limit.

Comment [CK3]: The in-pit crusher analysis indicates a reduction in limit will require system modifications at approx. ~$1.56M/ton.

A change in bags will not improve performance because of the amount of material we process and the rate we process (truck dump 320 tons at a time). The entire crusher baghouse system would need to be modified in order to determine if improved performance is achievable.

Crushed ore loading onto a conveyor belt at the rates we process, creates an up-flow air stream which increases the loading on the bags with heavy particles and impacts its overall performance. Airborne coarse dust from the operations as well as from the surrounding area also impact the performance of the baghouse and overall outlet grain loading.

We can reduce the grain loading rate from 0.016 (1.77lb/hr) to 0.007 (0.78 lb/hr) without a full system rework, otherwise the measure is not cost effective.

The 0.18 lb/hr proposed represents a grain loading of 0.001. Our vendors have indicated this is not feasible for guarantee at our facility.

Comment [CK4]: Since we are moving to a daily emissions limit, this requirement is a duplicate.

ii. Copperton Concentrator (CC)

A. Control emissions from the Product Molybdenite Dryers with a scrubber during operation of the dryers.

During operation of the dryers, the static pressure differential between the inlet and outlet of the scrubber shall be within the manufacturer's recommended range and shall be recorded weekly.

The manometer or the differential pressure gauge shall be calibrated according to the manufacturer's instructions at least once per year.

[~~The remaining heaters shall not operate more than 300 hours per rolling 12- month period unless upgraded so the NOx emission rate is no greater than 30 ppm.~~]

~~B. The eight (8) Tioga heaters shall not consume more than 70 MMCF of natural gas per rolling 12 month period.~~

Comment [CK5]: Two cost analyses have been submitted using 2014 and 2017 emissions. One indicated $200,000/ton emissions removed and the other $600,000/ton.

k. Kennecott Utah Copper (KUC): Power Plant

i. Utah Power Plant

A. [~~Boilers #1, #2, and #3 shall not be operated after January 1, 2018, or upon commencing operations of Unit #5 (combined-cycle, natural gas-fired combustion turbine), whichever is sooner.~~]When burning natural gas, Unit #4 shall not exceed the following emission rates to the atmosphere:

[~~B. Unit #5 (combined cycle, natural gas-fired combustion turbine) shall not exceed the following emission rates to the atmosphere:~~]

Pollutant	grains/dscf 68°F. 29.92 in Hg	ppmdv	lbs/hr 3% O_2	lbs/event
I. $PM_{2.5}$:				
Filterable	0.004			
Filterable + condensable	0.03			
II NO_x:		20	17.0	
Startup / Shutdown				395
[~~III. NH_4~~]		~~2.0*~~]		

B. When burning coal Unit #4 shall not exceed the following emission rates to the atmosphere:

Pollutant	grains/dscf 68°F. 29.92 in Hg	ppmdv	lbs/MMBTU 3% O_2	lbs/event
I. $PM_{2.5}$:				
Filterable	0.029			
Filterable + condensable	0.29			
II NO_x:		80	0.06	
Startup / Shutdown				395

* Except during startup and shutdown.

IV. Startup / Shutdown Limitations:

1. The total number of startups and shutdowns together shall not exceed 690 per calendar year.

2. The NO_x emissions shall not exceed 395 lbs from each startup/shutdown event, which shall be determined using manufacturer data.

3. Definitions:

(i) Startup cycle duration ends when the unit achieves half of the design electrical generation capacity.

(ii) Shutdown duration cycle begins with the initiation of boiler shutdown and ends when fuel flow to the boiler is discontinued.

B. Upon commencement of operation of Unit #4, stack testing to demonstrate

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compliance with [~~the~~]each emission limitation in IX.H.12.k.i.A and IX.H.12.k.i.B shall be performed as follows[~~ for the following air contaminants.~~]:

* Initial compliance testing for the [~~natural gas-fired~~]Unit 4 boiler is required. Initial testing shall be performed when burning natural gas and also when burning coal as fuel. The initial test date shall be performed within 60 days after achieving the maximum heat input capacity production rate at which the affected facility will be operated and in no case later than 180 days after the initial startup of a new emission source.

The limited use of natural gas during maintenance firings and break-in firings does not constitute operation and does not require stack testing.

Pollutant		Test Frequency
I.	$PM_{2.5}$	every year
II.	NO_x	every year
[~~III.~~	~~NH_4~~	~~every year~~]

C. [~~Prior to January 1, 2018, the following requirements are applicable to Units #1, #2, #3, and #4 during the period November 1 to February 28/29 inclusive:~~

~~I. Only natural gas shall only be used as a fuel, unless the supplier or transporter of natural gas imposes a curtailment. The power plant may then burn coal, only for the duration of the curtailment plus sufficient time to empty the coal bins following the curtailment. The Director shall be notified of the curtailment within 48 hours of when it begins and within 48 hours of when it ends.~~

~~II. When burning natural gas the emissions to the atmosphere from the indicated emission point shall not exceed the following rates and concentrations:~~]Unit #5 (combined cycle, natural gas-fired combustion turbine) shall not exceed the following emission rates to the atmosphere:

	Pollutant	lbs/hr	lbs/event	ppmdv (15% O_2 dry)
I.	$PM_{2.5}$ with duct firing: Filterable + condensable	18.8		
II.	VOC:			2.0*
III.	NO_x:			2.0*
	Startup / Shutdown	395		
~~IV.~~	~~NH_4~~			~~2.0*~~

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Comment [CK6]: Ammonia slip cannot be stack tested.

* Except during startup and shutdown.

V. Startup / Shutdown Limitations:

1. The total number of startups and shutdowns together shall not exceed 690 per calendar year.

2. The NOx emissions shall not exceed 395 lbs from each startup/shutdown event, which shall be determined using manufacturer data.

3. Definitions:

(i) Startup cycle duration ends when the unit achieves half of the design electrical generation capacity.

(ii) Shutdown duration cycle begins with the initiation of boiler shutdown and ends when fuel flow to the boiler is discontinued.

D: Upon commencement of operation of Unit #5*, stack testing to demonstrate compliance with the emission limitations in IX.H.12.m.i.B shall be performed as follows for the following air contaminants

* Initial compliance testing for the natural gas turbine and duct burner is required. The initial test date shall be performed within 60 days after achieving the maximum heat input capacity production rate at which the affected facility will be operated and in no case later than 180 days after the initial startup of a new emission source.

The limited use of natural gas during maintenance firings and break-in firings does not constitute operation and does not require stack testing.

Pollutant		Test Frequency
I.	$PM_{2.5}$	every year
II.	NO_x	every year
III.	VOC	every year
~~IV.~~	~~NH_4~~	~~every year~~

Comment [CK7]: Ammonia slip cannot be stack tested.

l. Kennecott Utah Copper: Smelter and Refinery

i. Smelter:

A. Emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

I. Main Stack (Stack No. 11)

1. $PM_{2.5}$
   a. 85 lbs/hr (filterable)
   b. 434 lbs/hr (filterable + condensable)

2. SO_2
   a. 552 lbs/hr (3 hr. rolling average)
   b. 422 lbs/hr (daily average)

3. NO_x 154 lbs/hr (daily average)

II. Holman Boiler

1. NO_x
   a. [~~14~~]9.0 lbs/hr, (calendar-day average)

B. Stack testing to show compliance with the emissions limitations of Condition (A) above shall be performed as specified below:

EMISSION POINT	POLLUTANT	TEST FREQUENCY
I. Main Stack (Stack No. 11)	$PM_{2.5}$	Every Year
	SO_2	CEM
	NO_x	CEM
II. Holman Boiler	NO_x	Every three years and alternate method according to applicable NSPS standards

The Holman boiler shall use an EPA approved test method every three years and in between years use an alternate method according to applicable NSPS standards.

C. During startup/shutdown operations, NO_x and SO_2 emissions are monitored by CEMS or alternate methods in accordance with applicable NSPS standards.

D. KUC must operate and maintain the air pollution control equipment and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction.

ii. Refinery:

A. Emissions to the atmosphere from the indicated emission point shall not exceed the following rate:

EMISSION POINT	POLLUTANT	MAXIMUM EMISSION RATE
The sum of two (Tankhouse) Boilers	NO_x	9.5 lbs/hr (before December ~~2019~~2020)
(Upgraded Tankhouse Boiler)	NO_x	1.5 lbs/hr (After December ~~2019~~2020)
Combined Heat Plant	NO_x	5.96 lbs/hr

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Comment [CK8]: Shut down scheduled in 2020.

B. Stack testing to show compliance with the above emission limitations shall be performed as follows:

EMISSION POINT	POLLUTANT	TESTING FREQUENCY
Upgraded Tankhouse Boiler~~s~~	NO_x	every three years*
Combined Heat Plant	NO_x	every year

* Stack testing shall be performed on boilers that have operated more than 300 hours during a three year period.

C. One 82 MMBTU/hr Tankhouse boiler shall be upgraded to meet a NO_x rating of 9 ppm no later than December 31, ~~2019~~2020. The remaining Tankhouse boiler shall not consume more than 100,000 MCF of natural gas per rolling 12- month period unless upgraded so the NO_x emission rate is no greater than 30 ppm

D. KUC must operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction. Records shall be kept on site which indicate the date, and time of startups and shutdowns.

j. Kennecott Utah Copper (KUC): Mine

i. Bingham Canyon Mine (BCM)

A. [~~Maximum total mileage per calendar day for ore and waste haul trucks~~] Emissions at the Bingham Canyon Mine shall not exceed 6,205 tons of NO_X, $PM_{2.5}$ and SO_2 combined per rolling 12-month period~~No later than January 1, 2019, combined site-wide emissions of NO_x, $PM_{2.5}$, and SO_2 shall not exceed[30,000 miles] 5,585 tons per year and 15.3 tons per day~~.

B. Maximum total NO_X emissions from ore and waste haul trucks shall not exceed 16.9 tons per day (calendar month average).
~~Haul truck emissions shall be calculated daily using the miles driven per haul truck. KUC shall keep records of daily total mileage for all periods when the mine is in operation. KUC shall track haul truck miles with a Global Positioning System or equivalent. The system shall use real time tracking to determine daily mileage.~~

~~All other emission sources shall use their respective means of emission calculation through AP-42 emission factors or associated stack testing.~~

~~B~~C. To minimize fugitive dust on roads at the mine, the owner/operator shall perform the following measures:

I. Apply water to all active haul roads as weather and operational conditions warrant except during precipitation or freezing weather conditions, and shall apply a chemical dust suppressant to active haul roads located outside of the pit influence boundary no less than twice per year.

II. Chemical dust suppressant shall be applied as weather and operational conditions warrant except during precipitation or freezing weather conditions on unpaved access roads that receive haul truck traffic and light vehicle traffic.

III. Records of water and/or chemical dust control treatment shall be kept for all periods when the BCM is in operation.

IV. KUC is subject to the requirements in the most recent federally approved Fugitive Emissions and Fugitive Dust rules.

~~C~~D. [~~To minimize emissions at the mine, the owner/operator shall:~~]The In-pit crusher baghouse shall not exceed a $PM_{2.5}$ emission limit of 0.~~18~~ 78 lb/hr. $PM_{2.5}$ monitoring shall be performed by stack testing every three years.

[~~I. Control emissions from the in-pit crusher with a baghouse.~~]

~~D~~E. Implementation Schedule

When KUC replaces[~~shall purchase new~~] haul trucks, they shall be replaced with trucks that have the highest engine Tier level available which meet mining needs. KUC shall maintain records of haul trucks purchased and [~~retired~~]replaced.

~~E. Minimum design payload per ore and waste haul truck shall not be less than 240 tons. The minimum design payload for all trucks combined shall be an average of 300 tons.~~

Comment [CK1]: Calculation per J. Black on May 21st.

Haul Truck NOx = 5,134 tons per year
Divide by 365 = 14.1 tons per day
20% agreed variability = 16.9 tons per day

16.9*356 = 6,176 tons per year.
This is within the existing limit of 6,205 and not above any previous approvals. KUC will be required to make reductions and manage operations carefully in order to meet these proposed new daily NOx and combined site limits.

Comment [CK2]: Calendar month average is important because truck activity is reported for emissions calculations monthly and the only feasible way to demonstrate compliance with a daily limit.

Comment [CK3]: The in-pit crusher analysis indicates a reduction in limit will require system modifications at approx. ~$1.56M/ton.

A change in bags will not improve performance because of the amount of material we process and the rate we process (truck dump 320 tons at a time). The entire crusher baghouse system would need to be modified in order to determine if improved performance is achievable.

Crushed ore loading onto a conveyor belt at the rates we process, creates an up-flow air stream which increases the loading on the bags with heavy particles and impacts its overall performance. Airborne coarse dust from the operations as well as from the surrounding area also impact the performance of the baghouse and overall outlet grain loading.

We can reduce the grain loading rate from 0.016 (1.77lb/hr) to 0.007 (0.78 lb/hr) without a full system rework, otherwise the measure is not cost effective.

The 0.18 lb/hr proposed represents a grain loading of 0.001. Our vendors have indicated this is not feasible for guarantee at our facility.

Comment [CK4]: Since we are moving to a daily emissions limit, this requirement is a duplicate.

ii. Copperton Concentrator (CC)

A. Control emissions from the Product Molybdenite Dryers with a scrubber during operation of the dryers.

During operation of the dryers, the static pressure differential between the inlet and outlet of the scrubber shall be within the manufacturer's recommended range and shall be recorded weekly.

The manometer or the differential pressure gauge shall be calibrated according to the manufacturer's instructions at least once per year.

[~~The remaining heaters shall not operate more than 300 hours per rolling 12- month period unless upgraded so the NOx emission rate is no greater than 30 ppm.~~]

~~B. The eight (8) Tioga heaters shall not consume more than 70 MMCF of natural gas per rolling 12 month period.~~

Comment [CK5]: Two cost analyses have been submitted using 2014 and 2017 emissions. One indicated $200,000/ton emissions removed and the other $600,000/ton.

k. Kennecott Utah Copper (KUC): Power Plant

i. Utah Power Plant

A. [~~Boilers #1, #2, and #3 shall not be operated after January 1, 2018, or upon commencing operations of Unit #5 (combined-cycle, natural gas-fired combustion turbine), whichever is sooner.~~]When burning natural gas, Unit #4 shall not exceed the following emission rates to the atmosphere:

[~~B. Unit #5 (combined cycle, natural gas-fired combustion turbine) shall not exceed the following emission rates to the atmosphere:~~]

	Pollutant	grains/dscf 68°F. 29.92 in Hg	ppmdv	lbs/hr 3% O_2	lbs/event
I.	$PM_{2.5}$:				
	Filterable	0.004			
	Filterable + condensable	0.03			
II	NO_x:		20	17.0	
	Startup / Shutdown				395
[~~III.~~	~~NH_4~~		~~2.0*~~]		

B. When burning coal Unit #4 shall not exceed the following emission rates to the atmosphere:

	Pollutant	grains/dscf 68°F. 29.92 in Hg	ppmdv	lbs/MMBTU 3% O_2	lbs/event
I.	$PM_{2.5}$:				
	Filterable	0.029			
	Filterable + condensable	0.29			
II	NO_x:		80	0.06	
	Startup / Shutdown				395

* Except during startup and shutdown.

IV. Startup / Shutdown Limitations:

1. The total number of startups and shutdowns together shall not exceed 690 per calendar year.

2. The NO_x emissions shall not exceed 395 lbs from each startup/shutdown event, which shall be determined using manufacturer data.

3. Definitions:

(i) Startup cycle duration ends when the unit achieves half of the design electrical generation capacity.

(ii) Shutdown duration cycle begins with the initiation of boiler shutdown and ends when fuel flow to the boiler is discontinued.

B. Upon commencement of operation of Unit #4, stack testing to demonstrate

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compliance with [~~the~~]each emission limitation in IX.H.12.k.i.A and IX.H.12.k.i.B shall be performed as follows[~~ for the following air contaminants.~~]:

* Initial compliance testing for the [~~natural gas-fired~~]Unit 4 boiler is required. Initial testing shall be performed when burning natural gas and also when burning coal as fuel. The initial test date shall be performed within 60 days after achieving the maximum heat input capacity production rate at which the affected facility will be operated and in no case later than 180 days after the initial startup of a new emission source.

The limited use of natural gas during maintenance firings and break-in firings does not constitute operation and does not require stack testing.

Pollutant		Test Frequency
I.	$PM_{2.5}$	every year
II.	NO_x	every year
[~~III.~~	~~NH_4~~	~~every year~~]

C. [~~Prior to January 1, 2018, the following requirements are applicable to Units #1, #2, #3, and #4 during the period November 1 to February 28/29 inclusive:~~

~~I. Only natural gas shall only be used as a fuel, unless the supplier or transporter of natural gas imposes a curtailment. The power plant may then burn coal, only for the duration of the curtailment plus sufficient time to empty the coal bins following the curtailment. The Director shall be notified of the curtailment within 48 hours of when it begins and within 48 hours of when it ends.~~

~~II. When burning natural gas the emissions to the atmosphere from the indicated emission point shall not exceed the following rates and concentrations:~~]Unit #5 (combined cycle, natural gas-fired combustion turbine) shall not exceed the following emission rates to the atmosphere:

	Pollutant	lbs/hr	lbs/event	ppmdv (15% O_2 dry)
I.	$PM_{2.5}$ with duct firing: Filterable + condensable	18.8		
II.	VOC:			2.0*
III.	NO_x: Startup / Shutdown	395		2.0*
~~IV.~~	~~NH_4~~			~~2.0*~~

* Except during startup and shutdown.

V. Startup / Shutdown Limitations:

1. The total number of startups and shutdowns together shall not exceed 690 per calendar year.

2. The NOx emissions shall not exceed 395 lbs from each startup/shutdown event, which shall be determined using manufacturer data.

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Comment [CK6]: Ammonia slip cannot be stack tested.

3. Definitions:

(i) Startup cycle duration ends when the unit achieves half of the design electrical generation capacity.

(ii) Shutdown duration cycle begins with the initiation of boiler shutdown and ends when fuel flow to the boiler is discontinued.

D: Upon commencement of operation of Unit #5*, stack testing to demonstrate compliance with the emission limitations in IX.H.12.m.i.B shall be performed as follows for the following air contaminants

* Initial compliance testing for the natural gas turbine and duct burner is required. The initial test date shall be performed within 60 days after achieving the maximum heat input capacity production rate at which the affected facility will be operated and in no case later than 180 days after the initial startup of a new emission source.

The limited use of natural gas during maintenance firings and break-in firings does not constitute operation and does not require stack testing.

Pollutant		Test Frequency
I.	$PM_{2.5}$	every year
II.	NO_x	every year
III.	VOC	every year
~~IV.~~	~~NH_4~~	~~every year~~

Comment [CK7]: Ammonia slip cannot be stack tested.

l. Kennecott Utah Copper: Smelter and Refinery

i. Smelter:

A. Emissions to the atmosphere from the indicated emission points shall not exceed the following rates and concentrations:

I. Main Stack (Stack No. 11)

1. $PM_{2.5}$
   a. 85 lbs/hr (filterable)
   b. 434 lbs/hr (filterable + condensable)

2. SO_2
   a. 552 lbs/hr (3 hr. rolling average)
   b. 422 lbs/hr (daily average)

3. NO_x 154 lbs/hr (daily average)

II. Holman Boiler

1. NO_x
   a. [~~14~~]9.0 lbs/hr, (calendar-day average)

B. Stack testing to show compliance with the emissions limitations of Condition (A) above shall be performed as specified below:

EMISSION POINT		POLLUTANT	TEST FREQUENCY
I.	Main Stack (Stack No. 11)	$PM_{2.5}$ SO_2 NO_x	Every Year CEM CEM
II.	Holman Boiler	NO_x	Every three years and alternate method according to applicable NSPS standards

The Holman boiler shall use an EPA approved test method every three years and in between years use an alternate method according to applicable NSPS standards.

C. During startup/shutdown operations, NO_x and SO_2 emissions are monitored by CEMS or alternate methods in accordance with applicable NSPS standards.

D. KUC must operate and maintain the air pollution control equipment and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction.

ii. Refinery:

A. Emissions to the atmosphere from the indicated emission point shall not exceed the following rate:

EMISSION POINT	POLLUTANT	MAXIMUM EMISSION RATE
The sum of two (Tankhouse) Boilers	NO_x	9.5 lbs/hr (before December ~~2019~~2020)
(Upgraded Tankhouse Boiler)	NO_x	1.5 lbs/hr (After December ~~2019~~2020)
Combined Heat Plant	NO_x	5.96 lbs/hr

B. Stack testing to show compliance with the above emission limitations shall be performed as follows:

EMISSION POINT	POLLUTANT	TESTING FREQUENCY
Upgraded Tankhouse Boiler~~s~~	NO_x	every three years*
Combined Heat Plant	NO_x	every year

* Stack testing shall be performed on boilers that have operated more than 300 hours during a three year period.

C. One 82 MMBTU/hr Tankhouse boiler shall be upgraded to meet a NO_x rating of 9 ppm no later than December 31, ~~2019~~2020. The remaining Tankhouse boiler shall not consume more than 100,000 MCF of natural gas per rolling 12- month period unless upgraded so the NO_x emission rate is no greater than 30 ppm

D. KUC must operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction. Records shall be kept on site which indicate the date, and time of startups and shutdowns.

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Comment [CK8]: Shut down scheduled in 2020.

Cost Effectiveness Calculations - Tioga Heaters **Updated** **5/18/2018**

Table 1. Capital Cost Estimate

		Cost	Reference
Purchased Equipment			
Total Purchased Equipment Cost	B	$696,486	Vendor
Direct Installation Cost			
Foundation and supports	.08B	$55,719	EPA
Erection and handling	.14B	$97,508	EPA
Electrical	.04B	Included in vendor costs	
Piping	.02B	Included in vendor costs	
Painting	.01B	Included in vendor costs	
Insulation	.01B	Included in vendor costs	
Building and site preparation not included			
Total Direct Installation Cost		$153,227	
Total Direct Cost		$849,713	
Indirect Cost			
Engineering	0.10B	$69,649	EPA
Construction and field expenses	0.05B	Included in vendor costs	
Construction fee	0.10B	Included in vendor costs	
Start-up	0.02B	Included in vendor costs	
Performance test	0.01B	Included in vendor costs	
Contingency	0.10B	$69,649	KUC
Total Indirect Cost		$139,297	
Total Capital Cost		**$989,010**	

Table 2. Annual Cost

			Annual Cost	Reference
Direct Costs				
Annual Operating Costs			$0	N/A - as it's a replacement
Total Direct Cost			$0	
Indirect Costs				
Other			Included in Annual Operating Costs	
Total Annual Costs Excluding Capital Recovery			**$0**	
Capital recovery			$116,169	
	Interest	10.0%		KUC
	Lifetime	20 years		UDAQ
Total Annual Cost			**$116,169**	

Table 3. Cost Effectiveness

Existing Burner NOX Emission Rate	100	lb/10^6 scf	AP-42 Emission Factor
Existing Burner NOX rating	0.10	lb/mmBtu	Calculated
Existing Burner NOX rating	83	ppm	http://www.faberburner.com/resource-center/conversion-charts/emissions-conversions-calculator/
New Burner NOX rating	9	ppm	
Reduction In NOX Emissions	89%		Calculated
2017 Actual Emissions	0.63		
Control Efficiency	89%		Estimate
Emission Reduction	0.56	tons/year	
Cost Effectiveness	$207,602	$/ton	

Puell Ortiz, *Cogent Engineering* (2017), 4: 1387955
https://doi.org/10.1080/23311916.2017.1387955

cogent engineering

CIVIL & ENVIRONMENTAL ENGINEERING | RESEARCH ARTICLE

Methodology for a dump design optimization in large-scale open pit mines

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Received: 10 May 2017
Accepted: 30 September 2017
First Published: 05 October 2017

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Abstract: Modern large-scale open pit mines move hundreds of thousands of tonnes of material daily, from the loading sources to the destination zones, whether these are massive mine dumps or, to a lesser extent, to the grinding mills. Mine dumps can be classified as leach or waste dumps, depending upon their economic viability to be processed in-place, a condition that has experienced great progress in the last decades and has reconfigured the open pit haulage network with an increase in the number of dumps. Therefore, new methods for dump design optimization are of the highest priority in mine planning management. This paper presents a methodology to model and optimize the design of a dump by minimizing the total haulage costs. The location and design of these dumps will be given mainly by the geological characteristics of the mineral, tonnage delivered, topographical conditions, infrastructure capital and transportation costs. Spatial and physical design possibilities, in addition, provide a set of parameters of mathematical and economic relationship that creates opportunities for modelling and thus facilitates the measurement and optimization of ultimate dump designs. The proposed methodology consists of: (1) Formulation of a dump model based on a system of equations relying on multiple relevant parameters; (2) Solves by minimizing the total cost using linear programming and determines a “preliminary” dump design; (3) Through a series of iterations, changes the “preliminary”

ABOUT THE AUTHOR

Jorge Puell Ortiz received MSc degree in Mining Engineering from Colorado School of Mines, USA. Mr Jorge Puell Ortiz is a PhD student at the University of Arizona, Tucson, USA. He worked principally in the field of open pit & underground mines, mine projects, mine planning, operations supervisor, consulting and project management for Freeport-McMoRan Copper & Gold, Xstrata plc, BHP Billiton and Newmont. His research interest emphasize on: Mine/Stockpile planning and design, simulation, mine water management, leaching technologies, GPS monitoring, sensors, radars and laser measuring techniques. He is a certified professional engineer (PE) for the State of Arizona and also a certified Project Management Professional (PMP).

PUBLIC INTEREST STATEMENT

Mine dumps can be classified as leach or waste dumps, depending upon their economic viability to be processed in-place, a condition that has experienced great progress in the last decades and has allowed large-scale surfaces mines to build larger and higher dumps, As a result, the entire mine configuration has changed, bringing with it concerns on safety and the environment, although at the same time it creates opportunities for optimization. Therefore, new methods for dump design optimization are of the highest priority in mine planning management. This paper presents a methodology to model and optimize the design of a mine dump by minimizing the total haulage costs. The proposed methodology consists of: (1) formulation of a dump model; (2) solves by using linear programming and determines a “preliminary” dump design; (3) through a series of iterations, changes the “preliminary” footprint and creates the ultimate dump design.

footprint by projecting it to the topography and creates the ultimate dump design. Finally, an application for a waste rock dump illustrates this methodology.

Subjects: Engineering Project Management; Mining Engineering; Planning & Design; Sustainable Mining

Keywords: mine planning; dump design; open pit; optimization

1. Introduction

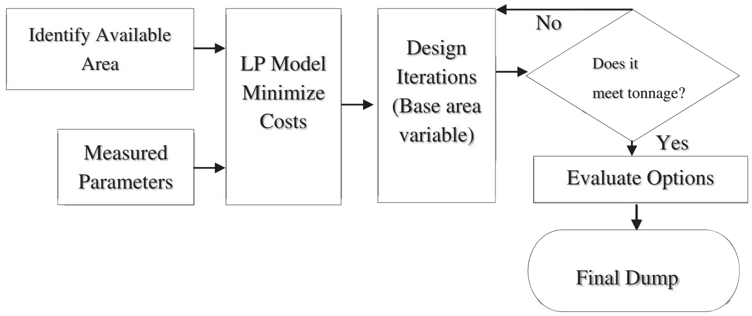
Three major destination groups, characterized by a cut-off grade criteria and ore type, represent the places in the mine where the material receives specific treatment after its delivery from the pit: leach dumps, waste dumps and mill (Hustrulid, Kuchta, & Martin, 2013). Dump leaching facilities are built to receive and treat low-grade ore by the use of solution agents, while waste rock dumps store uneconomic material. Dump leaching technologies have developed over the last decades, allowing the mining industry to build larger and higher dumps faster than ever (Smith, 2002), since they have proven to be an efficient method of treating oxide and sulfide ores, an attractive way to treat large low-grade deposits (Dorey, Van Zyl, & Kiel, 1988). As a result, an increase in the number of dumps, which are the most visual landforms left after mining (Hekmat, Osanloo, & Shirazi, 2008) has reconfigured the open pit mines network organization and landscape.

Contributions to this progress have come from the mineral and metallurgical processing field (hydrometallurgy), geo-synthetics, slope stability, and best construction practices of solution collection systems, notably prompted by environmental requirements. Researchers and slope stability practitioners have achieved extensive progress and expertise in the areas of geotechnical engineering (Ureel, 2014), establishing that a thorough knowledge of factors affecting the dump stability must be properly considered at the design stage (Upadhyay, Sharma, & Singh, 1990); especially the floor dip and foundation strength, from which the dump stability is highly sensitive (Rosengren, Simmons, Maconochie, & Sullivan, 2010). Along with the geotechnical, several other attributes, such as the topography, final pit limit, haul road distances, landform, among others, have been ranked, subjectively and objectively, by multi-criteria decision methods with the specific aim of selecting the dump location (Hekmat et al., 2008). However, few studies have attempted to integrate the safety and environmental factors with the haulage costs in order to elaborate a strategic plan for the location and ultimate dump design, whether it is leachable or for waste. The general practice for a dump design consists on the availability principle (Li, Topal, & Williams, 2013) driven by the short-term planning needs to make production by seeking the shortest haul to the dump, although this approach can be detrimental to the long-term scheduling and dump development.

In large-scale open pit mines, the mining process is rather complex and often involves different run-of-mine (ROM) ore and waste material treatment downstream. Appropriate areas to place these large amounts of material are limited and their selection and design must serve the environmental factors and economic goals of the long-term mine plans. Normally, construction of the leach or waste dumps results by creating a footprint base via deep dumping and subsequently, ramping up a determined lift height to accumulate the ex-pit material.

In designing the dump, there are many ways to assign values and combine the different geometric and size parameters while respecting the safety and environmental constraints. The total tonnage capacity required can have as many geometrical representations as its limitations allow. In this situation, building a mathematical optimization model is the best option to interrelate certain key variables and the first approach to calculating the values that seek to maximize the satisfaction of a linear programming objective. As most of the dumps are emplaced on irregular topographies, a second approach has to contrast the values got by the generalized model and correct them, if necessary, by a series of successive iterations and projections to the field.

Figure 1. Schematic flowchart of the dump design process.



This paper presents a methodology to optimize the ultimate dump design in a mining operation by minimizing the unit haulage cost using a linear algorithm and subsequent iterations on variables such as the footprint base, number of lifts and haulage distances from the toe of the ramp to the dynamic dumping point. Figure 1 briefly illustrates the process. This methodology applies to dumps receiving a single material target as it is usual in large-scale open pit mines; hence, there is no need for any special material blending or encapsulation, as the models proposed to handle waste rock dumping causing acid mine drainage (Li et al., 2013). In addition, an example illustrates the methodology.

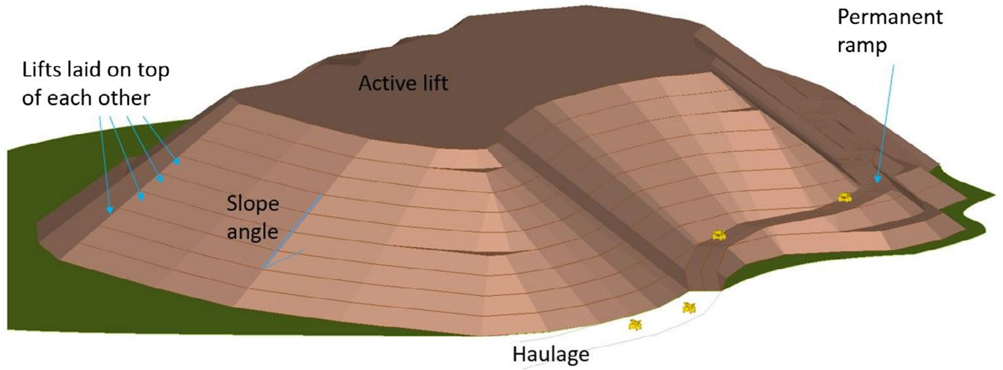
2. Dump design considerations

A mine dump can be defined as a massive structure formed by placing large amounts of material in lifts of a restricted vertical expansion that laid one on top of each other and form a stable slope at the angle of repose. A dump so formed, however, needs a horizontal base at first, which is built by push dumping material from a certain elevation and levelling off the required footprint area. Generally, this first phase of the dump construction takes the irregular shape of the topography where is placed. Subsequent lift height is constant, though is restricted to prevent shear stresses on the foundation and is a factor to control consolidations and permeability variations (Zanbak, 2012). The total height of the dump is also restricted by formation mechanism (Zhang et al., 2014) and carrying capacity limitations (Peng, Ji, Zhao, & Ren, 2013). As in most of the large open pit operations, haulage is performed by heavy trucks, the access to the successive dump lifts is achieved by establishing ramps of a suitable width, super elevation and gradient in order to minimize travel distance and therefore to reduce haulage costs (Figure 2).

In dump designing, costs may be governed by any or all of the following factors:

- Geometry: Usually designed to handle a total capacity throughout the life-of-mine. Over-dimensioning can cause underutilization of valuable areas. Under dimensioning can result in the increase of the total haulage distances.
- Operating costs: Costs resulting from fuel, energy, maintenance and labour of the haul trucks.
- Haulage distances: Minimizing the total haulage distance while meeting the required capacity by strategic placing of the ramps, exits, entrances and dumping sequence.
- Stability control: It will define the angle of repose and the nature of the underlying material. Maintaining the stability of the dump may require relocation of weathered rock or material blending, especially if water is present (Russell, 2008).
- If it is a dump leach, a leaching cycle time will define the mining delivery rate and dumping schedule. Ideally, deliveries rate from the mine should match the leaching cycle times of the dump. Otherwise, there is a risk of short cycling and losing on mineral recoveries. In addition, costs of building the leaching facilities are factored in (Kappes, 2002).
- Acquisition of the land permit for dumping purposes as specified by law.
- Environmental factors: costs of implementing and maintaining effective systems to reduce and eliminate loses and contamination. Design considerations for reclamation and closure to maintain long-term stability, erosion control (Piteau Associates Engineering Ltd, 1991) and to avoid re-handling costs (Sommerville & Heyes, 2009).

Figure 2. Typical configuration of a mine dump.



Although every dump is unique (Zástěrová et al., 2015) and some of its cost maybe be given by its own factors, the above description includes all the general concerns one would have to elaborate the most economical dump design.

3. Linear programming (LP) formulation of the dump model

Formulation of a model where the cost is to be minimized while meeting all the other constraints can be achieved by using Linear Programming (LP). The method optimizes an outcome, such as the lowest cost, in a mathematical model whose requirements are related by linear equations. Linear Programming, as one of the most widely used operations research tools (Wright, 1996), has been largely applied in the mining industry to solve production scheduling problems (Newman, Rubio, Caro, Weintraub, & Kelly, 2010). Then a solver software (AMPL) will produce optimization problems from models and data and will retrieve results for analysis (Figure 3).

The model is expressed as follows.

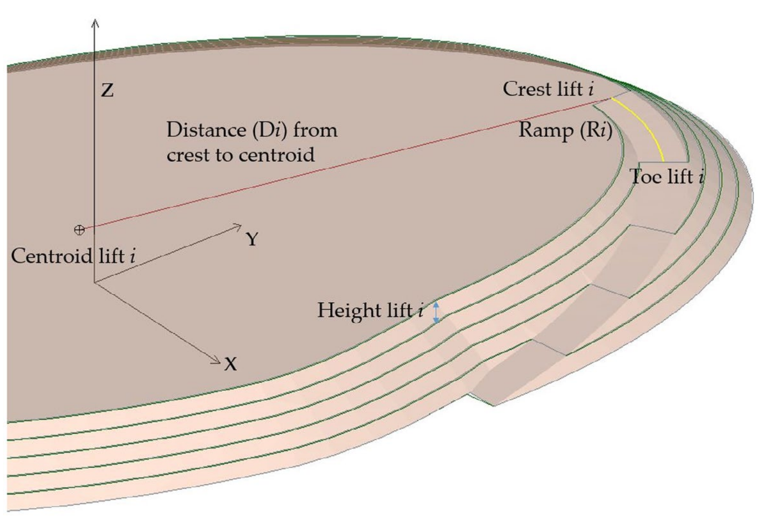
3.1. Sets

L_i^n = Set of the number of lifts of the dump from lift *i* to lift *n*.

3.2. Objective function

The objective is to minimize dumping costs of the open pit operation by finding the shortest haulage distances for the haul trucks in two round trips: (1) travel along the ramp and (2) travel the flat surface from the crest of the ramp to the lift centroid. Such distances are multiplied by the operating

Figure 3. Terminology for the LP dump model.



cost and tonnage dumped at that lift and then divided by the average speeds and haul truck capacity.

$$\text{Minimise} \sum_{i}^{n} \left(T_i \times R_i \times C_i \div S_i \div TC\right) + \sum_{i}^{n} \left(T_i \times D_i \times C_i \div SL_i \div TC\right) \tag{1}$$

where T_i = tonnage dumped at lift *i*; R_i is the distance of the ramp for lift *i* from toe to crest; D_i is the flat distance from the crest to the lift centroid; S_i and SL_i are the average speed up/down hill and at flat surface, respectively; C_i and *TC* are the operating cost and capacity of the standard haul truck.

3.3. Constraints

*3.3.1. The radius of the base of lift **i***

The generalized dump model is formulated within the context of making the most efficient theoretical dump and establishes a circular base which maximizes the use of the property surface and meets the slope angle along its boundaries.

$$r_i \geq 0 \tag{2}$$

*3.3.2. Ramp distance from toe to crest of lift **i***

$$R_i = h \times i \times \sqrt{\left(\frac{1}{g}\right)^2 + 1} \tag{3}$$

where *h* = height of lift *i* and *g* is the grade (%) of the ramp.

*3.3.3. Distance from crest to the centroid of lift **i***

$$D_i = r_i; \quad i = 1 \tag{4}$$

$$D_i = D_{i-1} - \frac{h}{\mathrm{Tan}(\alpha)}; \quad i = 2, \ldots, n \tag{5}$$

where α = angle of repose.

The centroid is the best approximation to the average distance travelled by haul trucks until the lift is fully filled as long as the material dumped has uniform density.

*3.3.4. Volume of lift **i***

$$V_i = \pi\left(r_i^2 + r_{i+1}^2\right)\frac{h}{2} \tag{6}$$

*3.3.5. Tonnage of lift **i***

$$T_i = V_i \div \mathrm{TF} \tag{7}$$

where TF = Tonnage factor m^3/tonne of the broken rock.

3.3.6. Total tonnage required or stockpile capacity

$$\sum_{i=0}^{n} T_i \leq \mathrm{TT} \tag{8}$$

where TT = Total tonnage capacity required.

3.3.7. Non-negativity

$$R_i, D_i, V_i, T_i \geq 0; \tag{9}$$

Table 1. Input parameters

Parameter	Details
Operating cost (of a truck)	280 $/h (operating, maintenance, labor and fuel)
Lift height	10 m
Speed uphill	17.7 km/h
Speed downhill	27.4 km/h
Speed level surface	45 km/h
Grade of ramp	10% gradient
Angle of repose	36.9°
Density – tonnage factor	0.467 m^3/tonne
Total tonnage – capacity	515 Million Tonne[a]

[a]Minimum.

4. Model implementation

4.1. Field input data

The proposed dump model concept has been applied to optimize the ultimate design of a waste dump in an open pit copper mine. Mine production plan shows that the East pit will deploy uneconomical waste material in an approximate amount of at least 515 million tonnes during its 15 years life-of-mine operation. Land properties extend its limits on the East side over 6 Km^2 of surface available. The results of the study will show the areas to conduct hydrological and hydraulic analyzes to estimate precipitation, runoffs and the presence of aquifers. As the waste material deployed will remain un-leached, its density and angle of repose will correspond to a broken and un-saturated (dry) material. Table 1 presents an overview of the input parameters used for the dump model optimization. Round-travel speeds are given by the technical specifications of the equivalent fleet truck in route; and operating costs include maintenance, fuel consumption, and labor. Ramp grade and lift height comply with the internal mine haul road design manual of the mine operation.

4.2. Linear programming coding and solving

Using AMPL (Fourer, Gay, & Kernighan, 2003) and CPLEX (2016) the model has been codified to solve the objective function, variables, sets of inequalities and constraints. The data-set is accessed from Microsoft Access. The program is executed on a computer of 2.80 GHz and 32 GB installed memory RAM, and the results are displayed for base radius, the number of lifts, tonnes, volume, and distances. The optimal solution is found for a six lifts dump to optimize the objective function to a minimum of $ 42,713,023.2. The result is presented for the total tonnage and costs-by lift, volume, and summary of the ramp and flat travel distances. Table 2 shows the optimization output. It should be noted that these results give us only a first idea of the total costs and values of the main variables. The design is still subject to adjustments to be made during the engineering and construction phases of the project. Likewise, be noted that the case studied does not include in its costs the use of geomembranes to isolate the dump due to state regulations regarding waste overburden that was not and will not be subject to leaching processes.

The value of the optimal base radius r (0) equal to 1,170 m. The ramp distance between the toe and crest of every lift is 100.5 m (a berm of 0.5 m is left at every lift perimeter). A particularity of dumps is that the haulage cost increases considerable from lift to lift (For instances, from lift 1 to lift 2, it increases 12%) while the number of tonnes is reduced by only 2% for the same movement from lift 1 to lift 2. The sum of the accumulated total tonnes gets the minimal required capacity, but leaves the dump open for further unplanned deliveries on top of the lift 6 level. Furthermore, the optimal radius r (0) equal to 1,170 m is then compared with different cases of base radius values in order investigate the effect of the number of lifts and base area on generated haulage costs as shown in Figure 4. The ∑Total cost curve indicates that a wide base dump area with less than four lifts yield more expensive

Table 2. Results for the optimal *r* (0) = 1,170 m

Lift number (*i*)	*R* (*i*) (m)	*D* (*i*) (m)	*V* (*i*) ($10^6 \times m^3$)	*T* (*i*) (10^6 × tonnes)	Total cost (*i*) (10^6 × US$)	∑Total cost (10^6 × US$)	∑*T* (10^6 × tonnes)
Lift 1	100.5	1,156.2	42.5	90.9	5.6	5.6	90.9
Lift 2	201.0	1,142.9	41.5	88.9	6.2	11.8	179.8
Lift 3	301.5	1,129.6	40.6	86.8	6.9	18.7	266.6
Lift 4	402.0	1,116.3	39.6	84.8	7.5	26.2	351.4
Lift 5	502.5	1,103.0	38.7	82.8	8.0	34.2	434.2
Lift 6	603.0	1,089.6	37.8	80.8	8.5	42.7	515.0

plan scenarios. However, cost decreases when the number of lifts varies between five and seven. After eight lifts and smaller base areas, the haulage cost increases gradually.

4.3. Iterative design process

Although linear programming optimizes the economic stockpile plan, it achieves this by assuming a regular inward dump shape, but does nothing regarding the irregular topography to be filled in. A process of iterative design overcomes this drawback through the use of calculated areas of interest, prioritizing the base area found by the linear programming and building successive dump structures until meeting the tonnage capacities. The first design 01 is framed inside a limited area—limit 01—given by the optimum radius π * r^2 (0) which equals 4,297,212 m^2. Table 3 summarizes the main characteristics of the three dump designs.

Figure 5 shows the three iterative limits. The innermost areas are reduced by eight percent while retaining the same west side and horizontal axis. This gradual area reduction of eight percent is done with the purpose of creating a design that best meets the required capacity. Here, the reduction has an equal percentage value, but it can also be variable, depending on whether the LP result was over or underestimating. For the three limit areas, the west side and the horizontal axis are the same to keep the shortest distance from the open pit exit. For operational convenience, property limits have been made squared, although the dump design maintains smoothed boundaries.

Figure 4. Minimum costs optimization results.

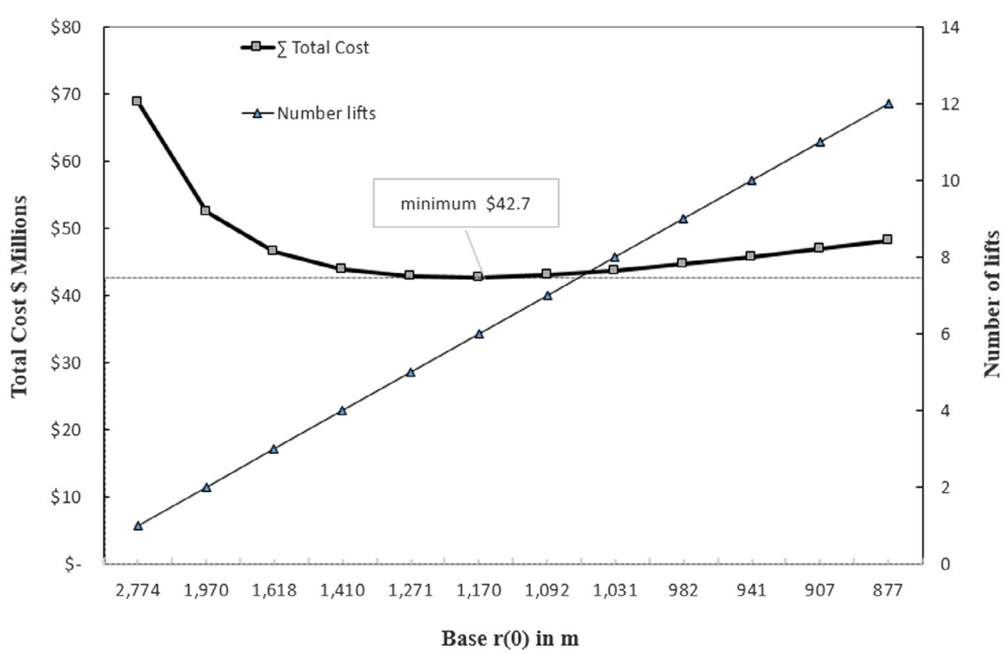
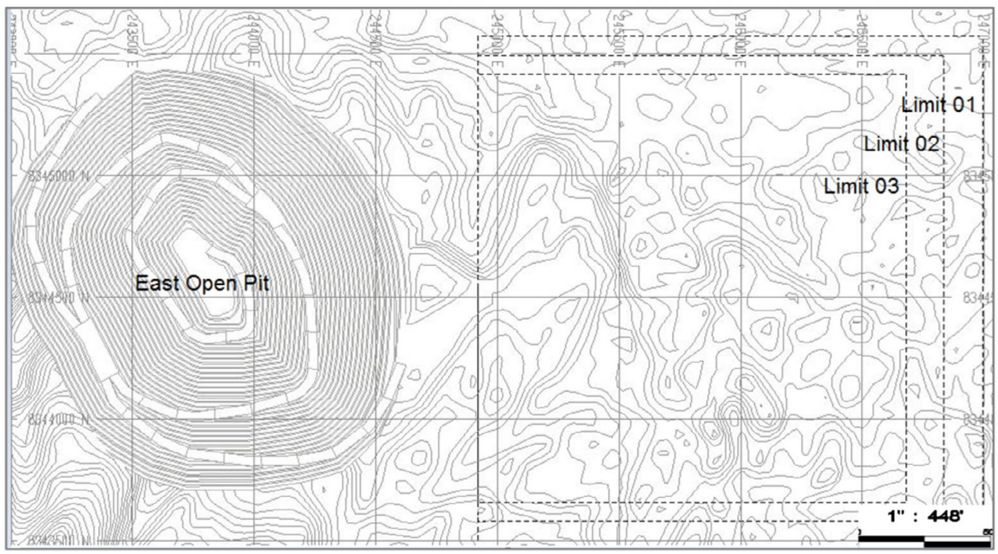


Table 3. A summary of the three dump designs

	Dump 1	Dump 2	Dump 3
Side (m)	2,073	1,911	1,762
Base area (m^2)	4,297,212	3,652,630	3,104,735
Side reduction (%)	–	0.92	0.92
Number lifts	6	6	7
Deep dump (10^6 × tonne)	272.9	267.7	238.4
Lift dump (10^6 × tonne)	265.5	247.9	262.2
Total dump (10^6 × tonne)	538.4	515.6	500.6

Figure 5. Three iteration limits for dump design.



The southern part of the dump is bounded by high elevated hill contours. The existing ground topography will require subgrade preparation and fine over liner fill. Also, perimeter berms will be constructed at each lift to prevent the runoff of stormwater. Figures 6–8 represent the iterated design of the dumps 01, 02 and 03 respectively.

Figure 6. Dump design 01–6 lifts.

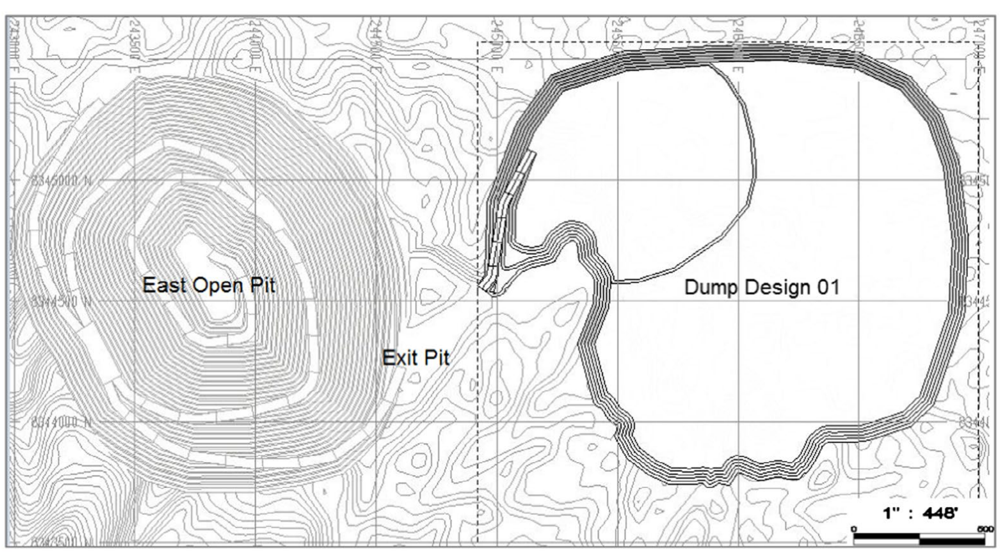


Figure 7. Dump design 02–6 lifts.

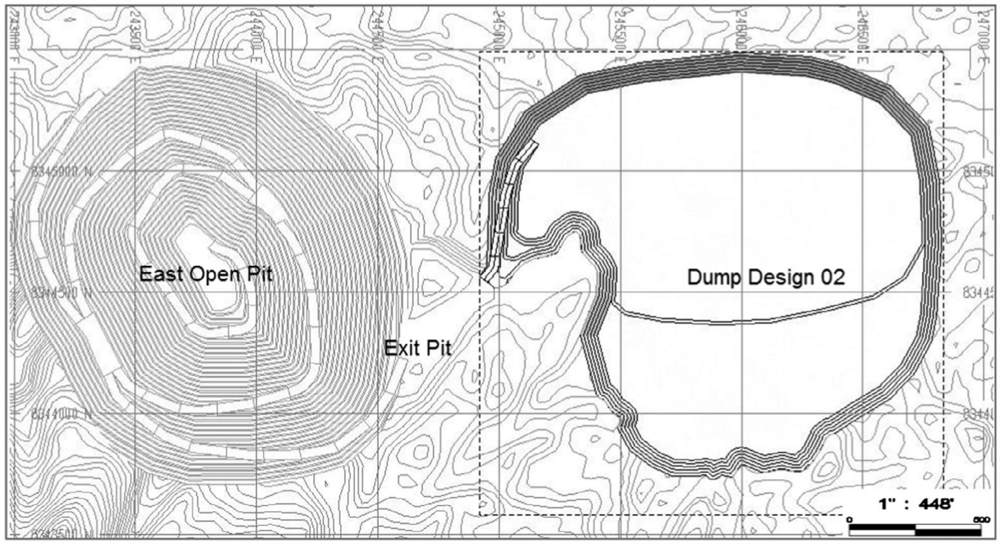
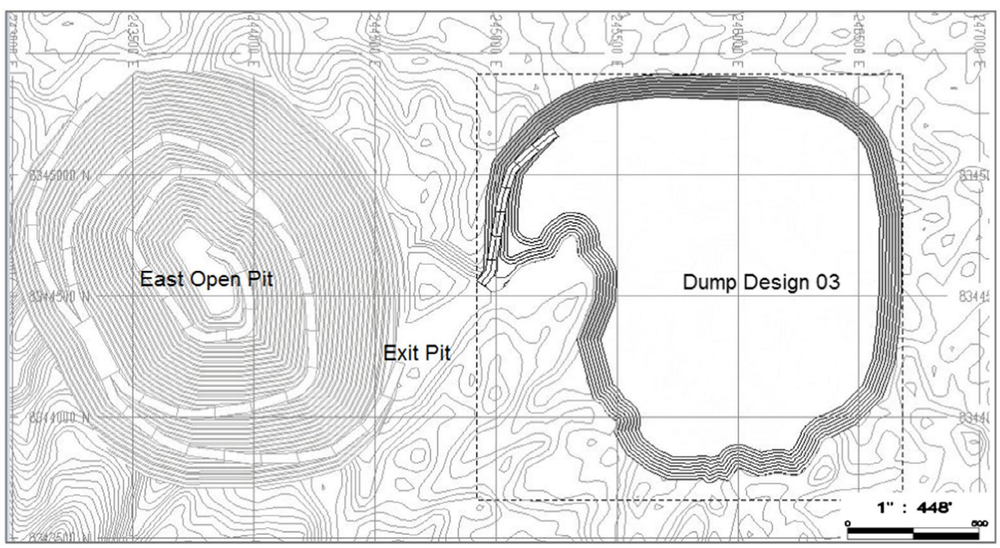


Figure 8. Dump design 03–7 lifts.



Upon iteration of the design process, the total tonnage for each dump is calculated (see Table 3), which determines that Dump 02 meets the required minimum capacity and is, therefore, the optimal design in the economic and operational aspect. Dump 01 and Dump 03 are over and under dimensioned and therefore are discarded as solutions. Notice that the base area calculated by the linear programming output corresponds to Dump 01, but when projected against the topography increases its tonnage capacity and makes it necessary to reduce the base area by eight percent to run the next design option (Dump 02). The methodology ends with the third iteration that provides insufficient tonnage capacity.

5. Conclusions

Waste and leach dumps must be subjected to in-depth study from the start of the mining project since they are among the most significant costs for the mine operation, and therefore their designs must be properly located and optimized. Traditionally, dumps have been intuitively sized and placed driven by short-term objectives, but this traditional approach, in the long term, results in under or overutilization of the mine surface and longer distances traveled by haul trucks. The present article outlines a method where a theoretical dump model is built based on geometrical and economic relationships of its main parameters, an LP algorithm is formulated as an optimization problem where the objective function minimizes the total haulage costs and the base dump radio and lifts number are defined as variables, solved and used to create alternative dump designs through successive iterations. Finally, the methodology compares and selects the ultimate dump design that best meets the requirements. The proposed methodology differs from the traditional approach in its orientation towards the economic value of the different combinations of the base area, lifts number and projection to the field that makes the optimal dump design.

This paper presented an application from an actual waste dump in an open pit copper mine. The LP model is prepared to minimize haulage cost while handling a required tonnage capacity and solved. Results showed that the larger the footprint base, the higher the haulage cost until the curve reaches an inflection point (lowest cost) where the curvature changes. Afterwards, haulage cost increases slightly if the footprint area is reduced. Proposed designs are built iteratively by reducing eight percent the previous area until getting the ultimate dump design.

Funding
The author received no direct funding for this research.

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Citation information
Cite this article as: Methodology for a dump design optimization in large-scale open pit mines, Jorge Puell Ortiz, *Cogent Engineering* (2017), 4: 1387955.

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EPA 0107

The Design and Operation of Waste Rock Piles at Noncoal Mines

July 1995

U.S. Environmental Protection Agency
Office of Solid Waste
401 M Street, SW
Washington, DC 20460

530R95083

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is developing technical summary reports on several issues related to the management of wastes produced by the non-coal mining and beneficiation industry. This document provides summary information on the design and operation of waste rock piles..-The intent of this and similar reports is to provide state and federal regulators with information on the newest technical designs and innovations used in the environmental management of mine waste.

Section 1.0 of this report introduces the subject of waste rock piles and provides information on research being conducted on waste rock piles by governmental agencies in the United States and internationally. Section 2.0 summarizes the current understandings of fundamental waste rock pile design and operation. Section 3.0 summarizes information on the prevention of acid rock drainage (ARD) through the design and operation of waste rock piles. Finally, section 4.0 presents a case study of a waste rock pile.

1.1 Waste Rock Generation

The act of mining involves the excavation of rock containing valuable minerals. This rock is known as ore. To access and excavate ore, miners must move and store or dispose of rock that does not contain economic mineral values. This rock is known as waste rock. This report summarizes recent and proposed future research efforts in the design and operation of waste rock piles, as they influence the potential for environmental impacts.

Waste rock consists of non-mineralized and low-grade mineralized rock removed from above or within the ore body during extraction activities. Waste rock includes granular, broken rock and soils ranging in size from fine sand to large boulders, with fines content largely dependent on the nature of the formation and the methods employed during mining.

Waste rock is produced at non-coal mines as a byproduct of excavating an identified economic mineral or metal deposit. Mines design their open pit and underground operations to provide the most cost-effective means for recovering the ore. Since removed waste rock is usually transported to some nearby location for disposal, mines generally attempt to limit the amount of waste rock removed as much as economically feasible. Modern mines use computer models to determine the most economical pit configurations, taking into account safety and reclamation requirements.

For open pit mines, the stripping ratio is the amount of overburden and waste rock that must be removed for each unit of crude ore mined and varies with the mine site and the ore being mined. Depending on the nature and depth to the ore deposit, mine waste rock may constitute the largest volume waste stream generated by a mining project and can amount to thousands of tons per day. The quantity of waste rock generated relative to ore extracted from a mine is typically larger for surface mines than underground mines, reflecting the greater costs of underground mining operation. The ratio of waste rock to ore (i.e., the stripping ratio) at surface mines may range as high as 10:1 for some areas, with typical values ranging from 1:1 to 3:1 for most mineral types.

Because ore grades in mined material are generally continuous, waste rock with mineral concentrations just below the "cut-off" grade (i.e., the grade at which the target mineral can be recovered economically) may be stockpiled separately from other waste rock; this material is often referred to as "subore" or "low-grade ore." In addition, the cut-off grade at a given mine may change with the price of the commodity, thus leading to more or less waste rock being disposed as the stripping ratio changes. The ratio of waste rock to ore is much lower at underground mines than at surface mines, reflecting the higher cost of underground mining. Because of the higher costs, underground mining is most suitable for relatively high-grade ores.

1.2 Environmental Impacts

Historic waste rock disposal practices provide evidence of the types of potential environmental impacts that may result from improper design, construction, or management of waste rock piles. For example, waste rock piles may experience slope or foundation failure. In addition, both abandoned and active non-coal mining sites have experienced problems that result in impacts to local surface and ground water quality. Both physical and chemical surface water impacts may result from increased sedimentation in the stream due to entrainment of waste material in runoff from the piles.

The generation of acid rock drainage (ARD) at waste rock piles is well documented in both U.S. and international scientific literature. Acid drainage is generated during all steps of the mining process via chemical oxidation of sulfide compounds, particularly iron sulfides, to sulfuric acid. Future uses for surface and ground waters that receive acid drainage from waste rock piles or other mining process wastes may be limited by the acidity of the waters.

Waste rock also is used in the construction of roads, tailings starter dams, buttresses for heap leach pads, and other on- and off-site construction. The formation of ARD from reactive rock used in these applications also has led to significant environmental problems caused by leaching of high concentrations of heavy metals to surface and ground waters.

1.3 Summary of Literature Review

Through the research conducted for the preparation of this paper, Canada, in particular, was found to be prominent in waste rock pile design research. In North America, most waste rock pile research is currently being performed by several different Canadian government and industry-sponsored groups. These groups include: the British Columbia Mine Waste Rock Pile Research Committee, the Mine Environment Neutral Drainage Program (MEND), and the Canada Centre for

Mineral and Energy Technology (CANMET).

Research conducted by the British Columbia Mine Waste Rock Pile Research Committee is focusing on the problems of stability experienced at mine waste piles constructed at coal mines in British Columbia. Although this research focuses on continual stability problems associated with coal mine waste piles, the results of the work sponsored to date by the committee can also be applied to non-coal mine waste piles. The British Columbia Mine Waste Rock Pile Research Committee has funded the development of five reports on design, operation, monitoring, failure characteristics, and review and analysis of failures of waste rock piles: Investigation and Design Manual (Piteau, 1991), Operating and Monitoring Manual (Klohn Leonoff, 1991), Methods of Monitoring (HBT AGRA Limited, 1992), Review and Evaluation of Failures (Broughton, 1992), and Failure Runout Characteristics (Golder, 1992).

The Mine Environment Neutral Drainage Program (MEND) has been very active in the research of acid rock drainage. This cooperative research program is sponsored and financed by the Canadian mining industry, the government of Canada and the governments of several Canadian provinces. Its purpose is to assist the mining industry and government agencies in developing and implementing techniques and technologies for minimizing and mitigating acid generation and its impacts at tailings and waste rock piles (as well as the associated environmental impacts).

The Canada Centre for Mineral and Energy Technology (CANMET) has provided funding to the MEND and British Columbia Mine Waste Pile Research Committee in their current research projects.

2.0 BASIC DESIGN AND OPERATION OF WASTE ROCK PILES

To design and operate stable waste rock piles, the operator must ensure proper foundation materials, allow for slope angles and construction processes that will ensure stability throughout the life of the mine, and provide for proper water drainage to minimize infiltration/seepage. The shear strength and durability characteristics of both the foundation and waste materials must be considered, as well as drainage patterns and predicted pore water pressures. This section addresses the major factors that affect the stability of waste rock piles and how they should be considered during the design and operation of the pile.

2.1 Preliminary Design Considerations

Generally, the first step in initiating the design of a waste rock pile is the assembly of all available information and data necessary to characterize the waste rock and proposed site. Much of the data is available from public or government organizations (e.g., topographic maps, climate information). This information is typically supplemented with field investigations that may include land surveying, sampling from test pits, trenches, or boreholes, groundwater monitoring, and piezometric and percolation testing. Further details on field testing requirements and techniques are provided in CANMET (1977), McCarter (1985), Piteau (1991), and Brodie et.al., (1992).

2.1.1 Waste Rock Characterization

Since mining sites vary in the types of materials encountered in the excavation of ore, a full characterization of the anticipated waste materials should be completed concurrent with mine design planning. However, Piteau Associates points out that the diversity of particle size and physical properties associated with waste rock leads to a difficult and complex sampling and analysis process relative to that required to characterize foundation soils and overburden materials. In addition, material properties may change over time due to stresses within the waste pile, weathering, chemical changes, and other types of degradation. Although abrasion and durability tests attempt to measure potential degradation, the effect of combined factors over time is difficult to predict.

The waste rock material to be disposed in the pile should be analyzed for both physical and chemical characteristics. The strength of the proposed pile may be assessed by such parameters as rock type (igneous, metamorphic or sedimentary), density, particle size distribution, and pore water pressures within the waste pile. The density and pore water pressures also are influenced by the pile construction method and subsequent amounts of consolidation and settlement. Pore water pressures decrease the stability of both the waste and foundation materials. With respect to shear strength, the most favorable pile materials are hard, durable rock with little or no fines present. Failure can occur when a pile containing material with excessive fines is constructed on a steep slope. In addition, waste fines may become saturated from water runon and snow melt and trigger a failure. Ideal waste rock would be of sufficient durability, hardness and coarseness to provide high shear strength and low pore water pressure. A description of the mineralogy of the pile material is necessary to identify, for example, the presence of sulfide materials such as pyrite, which indicate the potential for acid rock drainage. Likewise, the presence and amount of basic minerals (e.g., calcite) must be determined in order to evaluate the acid neutralization potential of the rock pile.

Once waste material characteristics are known, proper design and construction methods can be implemented. For example, as poor-quality waste materials are encountered during construction of a waste pile, specific sections of the pile can be prepared to receive the materials or additional protection can be installed. Overburden materials (e.g., soils), due to their fine nature, would contribute to instability in the waste rock pile and should, therefore, be placed in a separate location. Likewise, acid-generating rock may be segregated so that immediate measures may be taken to control acid generation. Lastly, since the physical and, particularly, the chemical properties of mined rock can change over time, there also should be a program of periodic or continuous characterization to ensure that changes can be made to design and operation as conditions warrant.

2.1.2 Site Characterization

A complete site characterization involves the collection and consideration of a diverse set of information that encompasses site activities, layout, terrain, hydrology, and climate. For example, physiographic data address the proximity of the location to the source of the waste, nearby mining activities such as blasting that could affect pile stability, the site capacity, and topographic features such as slopes and valleys that may determine placement of the waste rock pile and surface water flows. Hydrologic considerations address natural drainage and climate concerns include storm events, temperature, precipitation, and wind patterns. The MWRPRC data indicate that more failures have occurred during winter and spring seasons, which typically bring greater amounts of precipitation, than in summer and fall (Broughton, 1992). The hydrogeology of the site, including the position of the water table, groundwater flow systems, distribution of discharge and recharge areas, and groundwater usage, assists in identifying pathways for potential environmental and human health risks. In addition, ground and surface water quality, air quality, fish and wildlife habitat and productivity, vegetation, and existing and future land use must all be determined in order to assess potential environmental impact (Piteau, 1991).

2.2 Stability Factors

A close look at the factors that affect waste dump failures provides important information relative to the stability parameters that should be considered during the design and operation of waste rock piles. The Canadian Mine Waste Rock Pile Research Committee conducted an in-depth study of over 40 failures of waste rock dumps from coal mines aimed at improving the design and operation of future dumps (Broughton, 1992). The research committee identified numerous factors that potentially contribute to waste dump failures. For example, the data indicated that most waste dump failures occur on foundation slopes exceeding 20 degrees. Piteau and Associates (1991) identify seven major factors that affect pile stability: dump configuration, foundation conditions, waste material properties, method of construction, dumping rate, piezometric and climatic conditions, and seismic and blasting activities.

2.2.1 Foundation Stability

An important aspect of site characterization includes an accurate characterization of foundation stability. Soil tests for shear strength, permeability/hydraulic conductivity and consolidation, and depth determinations for any loose or incompetent soils, are important in assessing the strength and preparatory requirements of the foundation. Competent foundations refer to foundation material with higher shear strength than the waste materials; weak foundations have lower shear strength than the waste materials (CANMET, 1977). Level foundations are also more stable than sloping foundations. The strength and durability of the underlying bedrock should also be evaluated.

Foundation soil conditions, including the type of soil and the amount of pore pressure, have a large effect on overall waste pile stability. In addition, excess pore pressures may result from high loading rates and steep foundation slopes. Where sloped foundations are present (*i.e.*, greater than 10 degrees), a stability analysis is necessary to determine the maximum potential displacement due to base shearing.

Where a level foundation (i.e., less than 10 degrees) is provided, the pile will generally not be susceptible to mass sliding along the base unless it is constructed on very weak foundation materials (e.g., organic soils). In general, sloped foundations present greater risks associated with sliding than level foundations (foundations are less stable and material may move farther and more quickly). Therefore, CANMET recommends higher safety factors for waste rock piles on sloped foundations (CANMET, 1977). In addition, foundation stability also may be affected by temporal conditions that are not considered during a site characterization. For example, the Mine Waste Rock Pile Research Committee found that winter freezing of foundations, before loading, may also contribute to some failures (Broughton, 1992).

2.2.2 Waste Rock Pile Stability

The size and configuration of a waste pile directly affect its stability. The variables that need to be considered in the configuration of a waste pile are height, volume, and slope angles. The height of a pile is defined as the vertical distance from the ground at the toe of the pile to the pile crest. Piles may range from 20 m up to 400 m (Piteau, 1991). In the U.S., the size of waste rock in a pile is usually defined as tonnage or acres covered; however, the Canadian protocol describes the size of a waste rock pile as a volume unit. The slope angle of a pile is determined by the type of construction