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UTAH DEPARTMENT OF
ENVIRONMENTAL QUALITY

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DIVISION OF AIR QUALITY

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April 27, 2017

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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

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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

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4-2 BACT Summary for the Molybdenum Autoclave Process Facility

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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.