FINAL REPORT

Kennecott Utah Copper LLC

Notice of Intent for Expansion of the Tailings Impoundment Facility

Submitted to

Utah Division of Air Quality

Prepared for

Kennecott Utah Copper LLC

Prepared by:

CH2MHILL

DECEMBER 2011

Final Report

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December 2011

Contents

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Acronyms and Abbreviations

AO	Approval Order
ASL	Above Sea Level
BACT	best available control technology
CO	carbon monoxide
CO_2	carbon dioxide
EPA	United States Environmental Protection Agency
FDCP	Fugitive Dust Control Plan
HC	hydrocarbon
KUC	Kennecott Utah Copper LLC
lb/acre/day	pound per acre per day
NOI	Notice of Intent
NO_x	nitrogen oxides
OAQPS	Office of Air Quality Planning and Standards
PM	particulate matter
PM_{10}	particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in aerodynamic diameter
PTE	potential to emit
SO_2	sulfur dioxide
tpy	ton per year
UAC	Utah Administrative Code
UDAQ	Utah Division of Air Quality
VOC	volatile organic compound

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1.0 Introduction

Kennecott Utah Copper LLC (KUC) is submitting this Notice of Intent (NOI) for the Tailings Expansion Project. The Tailings Impoundment facility is being redesigned to handle an additional 1.2 billion tons of tailings storage. Current operations at the Tailings Impoundment facility are permitted under Approval Order (AO) DAQE-AN0572018-06.

This NOI document contains a process description for the proposed project, emissions information, regulatory review, and control technology analysis. For additional information or questions, please contact Cassady Kristensen at 801-204-2129.

1.1 Fugitive Dust Control Initiatives at the Tailings Impoundment Facility

Since 1999, KUC has initiated a number of business improvement projects to proactively reduce particulate matter (PM) emissions from the Tailings Impoundment facility. These improvement projects are summarized below:

Construction of Tailings Impoundment and Embankment. The tailings received from the Copperton Concentrator are routed through cyclones to separate out the coarse and fine tailings. The fine tailings (or cyclone overflow) are deposited in the interior of the tailings facility which is kept saturated by spigotting once every 4 days and does not result in any emissions. The coarse tailings (or cyclone underflow) are used to build the embankment which generates less dust due to its larger particle size. This current practice of building the embankments out of the coarse underflow fraction is less dust generating than the use of whole tailings as was used to build the south embankment.

Hydrometer testing of the tailings material has shown a very small portion of the fraction would result in fine particulate emissions. Emissions from the embankment are minimized by aggressive dust control practices discussed throughout this document.

During the winter time, operations at the tailings facility are ceased with snow covering the embankment and impoundment. The windblown emissions are therefore zero during this time.

Automated Sprinklers at Tailings Impoundment Facility. To control fugitive dust in areas where support equipment is actively building the embankments, KUC has historically used a large-scale manual sprinkler system to wet the surface. These sprinklers were operated manually during daytime hours. Due to concerns for personnel on the ground, night operation of the manual sprinkler system was deemed unsafe.

In 2010 and 2011, KUC converted the sprinklers to an automated system that wets the surface at regular intervals. This upgrade allows the surface to maintain its moisture and has greatly assisted in minimizing fugitive dust.

Fugitive Dust Control Plan. The reduction of dust is an ongoing part of operations at the Tailings Impoundment facility. This is accomplished through various means, including watering, application of polymer, revegetating, and vehicle speed limitations. KUC also uses chemical dust suppressants and water haul trucks to suppress dust on the haul roads at the Tailings Impoundment facility. KUC has an approved Fugitive Dust Control Plan (FDCP) that describes dust control measures implemented at the Tailings Impoundment facility. The FDCP is an effective mechanism to control emissions in a dynamic industrial environment such as the Tailings Impoundment facility.

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2.0 Process Description

As part of the expansion plan, the Tailings Impoundment facility is being redesigned in two Phases to handle an additional 1.2 billion tons of tailings storage. To achieve this required storage amount, modifications to the existing operation are proposed along with an increase to the overall impoundment footprint. Total plan view footprint of the current operations, including reclaimed areas, is approximately 8,900 acres consisting of the north and south sections. The proposed total plan view footprint of the Tailings Impoundment facility after expansion will be approximately 10,490 acres and will include the north, south, and new northeast sections of the impoundment.

KUC is proposing to permit both Phase I and Phase II operations with this NOI application.

2.1 Phase I: Construct Northeast Expansion, Relocate Infrastructure, and Raise the North Impoundment

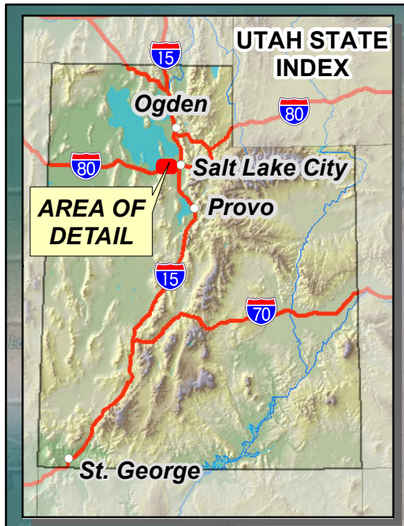
Infrastructure additions and relocations associated with the northeast expansion will take place in the 2-year period beginning January 2013 and ending December 2014. Figure 2-1 shows the location of the Tailings Impoundment facility. Figure 2-2 shows the future proposed footprint of the facility. Initial tailings deposition in the northeast expansion is scheduled for March 2015. Simultaneously, the North Impoundment will be raised with embankments consisting of underflow tailings. A summary list of the major parts of the northeast expansion is below; the list has been provided for informational purposes only, to provide an overview of the activities associated with the proposed expansion. Section 3 of the NOI provides an estimate of emissions from the proposed expansion.

- Raise the existing North Impoundment area and expand onto an approximately 1,290-acre parcel adjacent to the northeast corner (the northeast expansion) of the existing impoundment for a combined active impoundment area of 4,490 acres. Final design elevation of the northeast expansion is 4,462 feet above sea level (ASL).
- Construct a drainage blanket underneath the proposed northeast embankment.
- Add a 25,000-linear-foot toe ditch around the expansion and backfill portions of the existing ditch.
- Upgrade and expand the tailings delivery system to accommodate the increased tailings volume.
- Add a new whole tailings and underflow delivery system including a decant pond and pump barge for the Northeast Expansion.
- Install a dust control system at the proposed northeast expansion using the same type of sprinklers as the existing system at the North Impoundment.
- Reroute existing electrical and fiber optic utilities located in the Northeast Expansion footprint.
- Realign 4 miles of Union Pacific Railroad and construct an overpass bridge for 7200 West where the new railroad alignment crosses 7200 West.

2.2 Phase II: Raise the North Impoundment and Combine with the South Impoundment

The Impoundment area on the north end of the facility will continue to be raised and the Impoundment area at the south end of the facility will also be modified. Tailings material will be placed on the Northeast part of the Impoundment to an elevation of 4,462 feet ASL. Final design height of the combined impoundment is approximately 4,500 feet ASL and maximum impoundment area, including the northeast expansion, will be 10,190 acres. A summary list of the major parts of the proposal follows. The list has been provided for informational purposes only to provide an overview of the activities associated with the proposed expansion. Section 3 of the NOI provides an estimate of emissions from the proposed expansion.

- Construct east, west, and south engineered structures using borrow area random fill.
- Install 3.2 million square feet of wick drains and other foundation improvements underneath the proposed new south containment dike and construct the south expansion embankment dike.
- Upgrade and expand the tailings delivery system at the north and south to accommodate the increased tailings volume and embankment requirements, including modifying or relocating the existing tailings pipeline bridge over Highway 201.
- Two additional pumps will be added to provide extra pump head for the existing North Impoundment dust control system. South Impoundment area dust control will use water from the decant pond pumped by additional barge pumps to new booster pumps at the base of the south embankment supplying water to the proposed automated dust control sprinkler system.



Kennecott Copper Corporation Pond

Topo Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, AND, USGS, NRCAN, and the GIS User Community

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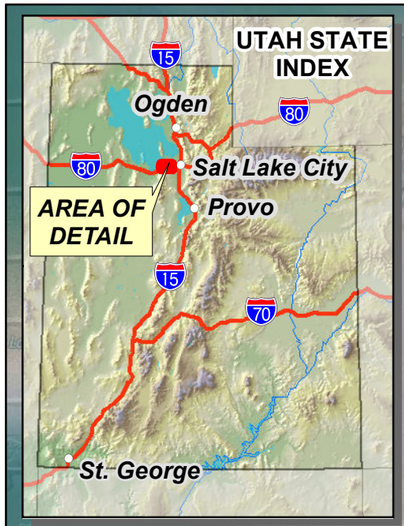
North and South Impoundment

1,500 0 1,500 3,000
Feet

Title: Base Map / Location Map	
Tailings Expansion Project	Figure: 1
RioTinto	Date: October 2011
	URS



Kennecott Copper Corporation Pond

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Topo Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, AND, USGS, NRCAN, and the GIS User Community

Tailings Expansion Impoundment

1,500 0 1,500 3,000
Feet

Title: Base Map / Location Map	
Tailings Expansion Project	**Figure:** 2
RioTinto	**Date:** October 2011
	URS

3.0 Emissions Information

This section provides a summary of emissions from the sources at the Tailings Impoundment facility, which include windblown dust, and a propane generator.

3.1 Windblown Dust from the Tailings Impoundment Facility

The current version of the United States Environmental Protection Agency's (EPA's) *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*, Fifth Edition (AP-42), Chapter 13.2.5 (EPA, 2006) provides a methodology to estimate emissions for Industrial Wind Erosion. These factors were developed for windblown dust from aggregate storage piles. The emission factors were developed for nonhomogenous surfaces impregnated with nonerodible elements. The tailings are uniform in size distribution and are not impregnated with nonerodible elements. Based on advice sought from the EPA Office of Air Quality Planning and Standards (OAQPS), the algorithms used in Chapter 13.2.5 (EPA, 2006) are not representative of the operations at the Tailings Impoundment facility. However, if KUC were to estimate emissions using this algorithm, windblown dust from the Tailings Impoundment facility would be zero.

The emissions from the Tailings Impoundment facility are clearly not zero and therefore KUC is proposing to use modified AP-42 emission factors approved by the Utah Division of Air Quality (UDAQ). These factors were developed specifically for the Tailings Impoundment facility when it was expanded in 1995 and are discussed in detail in the sections below.

3.1.1 Emission Factors

KUC is proposing to estimate emissions from windblown dust consistent with the modified emission factor approved by the UDAQ in January 1995.

Particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}) emission factor for storage piles from AP-42, Table 8.19.1-1 (EPA, 1985), is 1.7 pounds per acre per day (lb/acre/day).

The above emission factor was developed for a cone shaped storage pile. The following adjustment for the "wind face" of the storage pile is used regardless of the type of material stored.

Surface area of cone = $\pi \times \sqrt{\pi 2 + h2}$

Area of the cone base = $\pi \times r^2$

Assuming a 45˚ angle, $r = h$

Ratio of the area of the base to the area of the cone at 45° angle = $\frac{\pi \times r^2}{\pi \times r\sqrt{r^2+r^2}} = \frac{1}{\sqrt{2}} = 0.707$

Therefore, the PM_{10} emission factor for Tailings Impoundment facility at low wind speed is 1.7 lb/acre/day × 0.707 = 1.202 lb/acre/day for a "flat pile."

Particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) emissions will be estimated consistent with current AP-42, Chapter 13.2.4 (EPA, 2006).

$PM_{2.5}$ = 0.053/0.35 × PM_{10}

The emission factor above represents low wind speed conditions and a second emissions factor is necessary that takes into account high wind events (winds greater than 25 miles per hour, which is consistent with the Natural Events Action Plan) by increasing the above discussed emission factor.

Again, consistent with methodology approved by UDAQ, PM_{10} emission factor for the Tailings Impoundment facility at high wind conditions is increased by a factor of 10. Therefore, emissions from high wind events are calculated using the following emission factor: 1.202 lb/acre/day x 10 = 12.02 lb/acre/day for a "flat pile."

3.1.2 Estimation of Emissions

The Tailings Impoundment operations can be categorized into four 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 that the impoundment is saturated with water and in the unlikely event an area appears to be drying out, the area would be resaturated.

The underflow tailings are actively deposited in the embankment areas. In an active embankment cell, the tailings are deposited every fourth day. The tailings are placed in a slurry and are extremely wet when deposited. Those 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 spread 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 automated the sprinkler system that wets the surface at regular intervals. This upgrade allows the surface to maintain its moisture while minimizing interruptions to the watering system caused by manual movement of the sprinklers. Inactive embankment areas, as a result, are wet and do not result in windblown dust emissions.

The embankment slopes are sprayed with polymers to minimize windblown dust. Polymers are reapplied as necessary to maintain their effectiveness. Polymered embankment slopes do not result in windblown dust emissions. Visual inspections are performed to ensure that the integrity of the polymer is maintained. Again, the polymer is reapplied as necessary to maintain its effectiveness.

Once released for reclamation, KUC implements a revegetation plan to reclaim the areas. Polymers are applied to areas still waiting to be reclaimed. Areas that have been released for reclamation do not result in windblown dust emissions.

Projected peak year emissions have been estimated for the Tailings Impoundment facility. As previously discussed, the calculations assume that the active embankment areas have the potential for wind erosion on days 2, 3, and 4. The emission calculations do not account for additional control from inherent moisture content of the surface. These calculations therefore provide a conservative estimate of emissions from the Tailings Impoundment facility.

Two modified AP-42 emission factors, previously mentioned, are used to calculate windblown emissions. The first represents low wind speed conditions, while the second takes into account high wind events by increasing the first emission factor by a factor of 10. Emissions from both emission factors are added together to estimate emissions from the Tailings Impoundment facility. Windblown emissions from the Tailings Impoundment facility are summarized in Table 3-1. Detailed emissions calculations are included in Appendix A.

TABLE 3-1
Projected Peak Year Windblown Emissions from Tailings Impoundment Facility

Pollutant	Windblown Emissions (tpy)
Particulate Matter PM_{10} Low Wind Speed Conditions	33.0
Particulate Matter $PM_{2.5}$ Low Wind Speed Conditions	5.0
Particulate Matter PM_{10} High Wind Events	50.0
Particulate Matter $PM_{2.5}$ High Wind Events	7.6
Total Particulate Matter PM_{10} Emissions	**83.0**
Total Particulate Matter $PM_{2.5}$ Emissions	**12.6**

NOTE:
tpy = ton per year

3.2 Emergency Generator

KUC operates one liquid petroleum gas-fueled emergency generator at the Tailings Impoundment facility. The existing emergency generator is permitted to operate no more than 500 hours per year. Actual hours of operation are expected to be limited to maintenance and testing activities for the emergency generator. Carbon monoxide (CO), nitrogen oxide (NO_x), and total hydrocarbon (HC) emissions are based on manufacturer data. Emissions from the emergency generator are summarized in Table 3-2. The proposed expansion will not result any change in this emission source.

TABLE 3-2
Emissions from Emergency Generator

	Emissions (tpy)
NO_X Emissions	0.3
CO Emissions	1.2
Total HC Emissions	0.04

NOTES:
NO_x = nitrogen oxides
CO = carbon monoxide
HC = hydrocarbons

3.3 Emissions Summary

Using the emission factors described previously, KUC has estimated emissions for the Tailings Impoundment facility after the proposed expansion. Table 3-3 provides future emissions of criteria pollutants from the Tailings Impoundment facility. Detailed emissions calculations are provided in Appendix A.

TABLE 3-3
Projected Peak Year Emissions Summary for Tailings Impoundment Facility

	PM_{10}	$PM_{2.5}$	NO_x	SO_2	VOC	CO	$CO_2{}^e$
Windblown Emissions	83.0	12.6		-			-
Emergency Generator			0.3	-	0.04	1.2	-
Total	83.0	12.6	0.3	-	0.04	1.2	-

NOTES:
CO_2 = carbon dioxide
SO_2 = sulfur dioxide
VOC = volatile organic compound

Table 3-4 shows the pre-project and post-project emissions for the Tailings Impoundment facility.

TABLE 3-4
Emissions Change for Tailings Impoundment Facility

	Current PTEs – DAQE-AN0572018-06 (tpy)	Future Tailings Impoundment Facility PTEs (tpy)	Change in Emissions (tpy)
NO_x	0.3	0.3	-
CO	1.2	1.2	-
VOCs	0.04	0.04	-
Total PM_{10}	36.26	83.0	46.7
Total $PM_{2.5}$	5.49[a]	12.6	7.1

NOTES:
PTE = potential to emit
[a]PTEs for $PM_{2.5}$ are not listed in the Approval Order and are shown in Table 3-4 for comparison purposes only.

4.0 Regulatory Review

This section provides a regulatory review of the applicability of state and federal air quality permitting requirements for the Tailings Impoundment facility.

4.1 State of Utah Air Permitting Requirements

The State of Utah has been granted authority to implement and enforce the permitting requirements specified by the federal Clean Air Act. The general requirements for permits and permit revisions are codified under the state environmental protection regulations, Utah Administrative Code (UAC) R307-401.

4.1.1 Major Sources and Major Modifications (UAC R307-101-2)

Utah Administrative Code R307-101-2 defines a major stationary source, in pertinent part, as follows, with some parts underlined for emphasis:

To the extent provided by the federal Clean Air Act as applicable to R307:

(1) any stationary source of air pollutants which emits, or has the potential to emit, one hundred tons per year or more of any pollutant subject to regulation under the Clean Air Act

(2) any physical change that would occur at a source not qualifying under subpart 1 as a major source, if the change would constitute a major source by itself

(3) <u>the fugitive emissions and fugitive dust of a stationary source shall not be included in determining for any of the purposes of these R307 rules whether it is a major stationary source, unless the source belongs to one of the following categories of stationary sources</u>:

(a) Coal cleaning plants (with thermal dryers)
(b) Kraft pulp mills
(c) Portland cement plants
(d) Primary zinc smelters
(e) Iron and steel mill;
(f) Primary aluminum or reduction plants
(g) Primary copper smelters
(h) Municipal incinerators capable of charging more than 250 tons of refuse per day
(i) Hydrofluoric, sulfuric, or nitric acid plants
(j) Petroleum refineries
(k) Lime plants
(l) Phosphate rock processing plants
(m) Coke oven batteries
(n) Sulfur recovery plants
(o) Carbon black plants (furnace process)
(p) Primary lead smelters
(q) Fuel conversion plants
(r) Sintering plants
(s) Secondary metal production plants
(t) Chemical process plants

(u) Fossil-fuel boilers (or combination thereof) totaling more than 250 million British Thermal Units per hour heat input
(v) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels
(w) Taconite ore processing plants
(x) Glass fiber processing plants
(y) Charcoal production plants
(z) Fossil fuel-fired steam electric plants of more than 250 million British Thermal Units per hour heat input
(I) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the federal Clean Air Act.

The majority of emissions associated with this source are specifically exempt fugitive emissions (this source category is not among those listed under Subparagraph 3 of this definition).

Similarly, the emissions increases associated with the proposed modification are also fugitive emissions not included for major source determination. Therefore, the expansion will not constitute a major source under Subparagraph 2 of the definition.

4.1.2 Notice of Intent and Approval Order (UAC R307-401)

KUC is required by UAC R307-401-5 to submit this NOI application to UDAQ and obtain an AO issued by UDAQ before expanding the Tailings Impoundment facility (UDAQ, 2006). Utah Administrative Code R307-401-5 requires the NOI to include the following:

- A description of the project (provided in Section 1.0 of the NOI)
- A description and characteristics of emissions and control equipment (provided in Sections 2.0 and 3.0 of the NOI)
- An analysis of the best available control technology (BACT) for the proposed source (provided in Section 5.0 of the NOI)
- Location map (provided in Section 2.0 of the NOI)

4.1.3 Enforceable Offsets (UAC R307-403-5, UAC R307-420, and UAC R307-421)

Utah Administrative Code R307-403-5(1)(b) states that enforceable offsets of 1.2:1 are required for new sources or modifications that would produce an emission increase greater than or equal to 50 tpy of any combination of PM_{10}, SO_2, and NO_x.

Utah Administrative Code R307-403-5(1)(c) states that enforceable offsets of 1:1 are required for new sources or modifications that would produce an emissions increase greater than or equal to 25 tpy but less than 50 tpy of any combination of PM_{10}, SO_2, and NO_x.

Utah Administrative Code R307-403-5(2) specifically states that for offset determinations, PM_{10}, SO_2, and NO_x will be considered on an equal basis.

Consistent with the requirements of R307-403-5(1)(b), KUC will offset the emissions increase from the Tailings Expansion Project with 47 tons of banked credits included in the Emission Reduction Credits Registry.

4.1.4 Emissions Impact Analysis (UAC R307-410)

The Tailings Impoundment facility modification is not subject to UAC R307-410, which describes the emissions impact analysis requirements, since the emissions increases from the project do not trigger any modeling thresholds. Because the facility is located in a nonattainment area for PM_{10} and $PM_{2.5}$, modeling is not required for these pollutants; however, offsets are being provided consistent with UAC 307-403-5.

4.1.5 Monitoring and Reporting

After an AO is issued by UDAQ, KUC will be required to submit emission reports and conduct other activities as UDAQ requests. Some of these requirements include the following:

- Meet the reporting requirements specified in UAC R307-107-2 in the event of an unavoidable breakdown
- Submit and retain an air emission inventory as required in UAC R307-150-6, based on its applicability under UAC R307-150-3(3)

4.2 Federal Air Quality Permitting Requirements

The Tailings Impoundment facility is currently operating under the conditions of the 2006 AO and meets all applicable federal air quality permitting requirements. The Tailings Impoundment facility is not subject to any additional federal air quality permitting requirements as a result of the proposed modification.

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5.0 Best Available Control Technology

This section describes the BACT analysis for the emission sources at the Tailings Impoundment facility.

According to UAC R307-401-8, "The Executive Secretary will issue an approval order if the following conditions have been met: The degree of pollution control for emissions, to include fugitive emissions and fugitive dust, is at least best available control technology."

5.1.1 Tailings Impoundment Facility

Particulate emissions will be emitted from windblown dust at the Tailings Impoundment facility, and this section presents a BACT analysis for the emission source.

Step 1—Identify All Control Technologies. The following five control technologies have been identified 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—Rank Remaining Control Technologies by Control Effectiveness. The Tailings Impoundment facility 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 that the impoundment is saturated with water and in the unlikely event an area appears to be drying out, the area would be re-saturated.

The 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 spread 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. Inactive embankment areas are wet and do not result in windblown dust emissions.

The embankment slopes are sprayed with polymers to minimize windblown dust. Polymer is reapplied as necessary to maintain its effectiveness to minimize emissions. Polymered embankment slopes do not result in windblown dust emissions.

Once released for reclamation, KUC implements a revegetation plan to reclaim the areas. Polymers are applied to areas still waiting to be reclaimed. Areas that have been released for reclamation do not result in windblown dust emissions.

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

Step 4—Evaluate Most Effective Controls and Document Results. Since the remaining control technologies are proposed, no further evaluation is warranted.

Step 5—Select BACT. Based on this analysis and review of the EPA's Reasonably Available Control Technology/BACT/Lowest Achievable Emission Rate Clearinghouse database, water spray/wet suppression, polymer application, and revegetation are selected as BACT for the Tailings Impoundment facility.

6.0 Reference

United States Environmental Protection Agency (EPA). 1985 to 2006. *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*. Fifth Edition. Office of Air Quality Planning and Standards; Office of Air and Radiation. Accessed August 2011.

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APPENDIX A

Emissions Calculations

APPENDIX A INDEX

Tables	Titles
A-1	Windblown Dust Emissions
A-2	Communications Generator
A-3	Emissions Summary

Units	Definitions
g/hr	gallon per hour
kw	kilowatt
lb	pound
lb/yr	pound per year
tpy	ton per year

Acronyms	Definitions
CO	carbon monoxide
EPA	United States Environmental Protection Agency
NO_x	nitrogen oxide
$PM_{2.5}$	particulate matter less than 2.5 micrometers in aerodynamic diameter
PM_{10}	particulate matter less than 10 micrometers in aerodynamic diameter
PTE	potential to emit
SO_2	sulfur dioxide
VOC	volatile organic compound

TABLE A-1
Windblown Dust Emissions

End of Year	Active Impoundment Acres (North+South and North East)	Active Embankment Acres (North (slopes) + South(slopes) + North East(slopes) + Access Dike + East Engineered Structure)	Active Flat Embankment Acres (North+South+North East)	Dike Acres (Containment Dike)	Engineered Structures (West + South)	Reclaimed Acres	Total Acres	Active Embankment Areas	Active Embankment Areas not saturated and have potential for wind erosion	Annual PM_{10} Emissions (tpy)	Annual $PM_{2.5}$ Emissions (tpy)	Annual PM_{10} Emissions (tpy) for high wind days	Annual $PM_{2.5}$ Emissions (tpy) for high wind days	Total Annual PM_{10} Emissions (tpy)	Total Annual $PM_{2.5}$ Emissions (tpy)
Subject to Wind Erosion	No	No	Yes	No	No	No	-	-	Yes	317 days	317 days	48 days	48 days	365 days	365 days
2012	2781	210	567	0	0	134	3124	142	106	20.24	3.07	30.65	4.64	50.90	7.71
2013	2818	176	556	0	0	180	3173	139	104	19.86	3.01	30.08	4.55	49.94	7.56
2014	2860	188	525	0	0	225	3274	131	98	18.76	2.84	28.40	4.30	47.16	7.14
2015	3718	218	925	0	0	256	4192	231	173	33.03	5.00	50.02	7.57	83.05	12.58
2016	3772	241	895	0	0	277	4290	224	168	31.98	4.84	48.43	7.33	80.41	12.18
2017	3815	253	858	0	0	308	4376	214	161	30.63	4.64	46.39	7.02	77.02	11.66
2018	3854	251	806	0	0	356	4460	201	151	28.78	4.36	43.58	6.60	72.37	10.96
2019	3892	242	759	0	0	405	4538	190	142	27.11	4.11	41.05	6.22	68.16	10.32
2020	3931	228	719	0	0	459	4618	180	135	25.69	3.89	38.91	5.89	64.60	9.78
2021	3965	214	677	0	0	512	4691	169	127	24.19	3.66	36.62	5.55	60.81	9.21
2022	4002	200	639	0	0	563	4765	160	120	22.82	3.46	34.56	5.23	57.38	8.69
2023	4040	197	591	0	0	607	4843	148	111	21.10	3.20	31.95	4.84	53.06	8.03
2024	4079	239	541	0	0	652	4970	135	102	19.34	2.93	29.29	4.43	48.63	7.36
2025	4128	296	557	0	0	701	5125	139	104	19.90	3.01	30.13	4.56	50.03	7.58
2026	4171	339	548	0	0	751	5261	137	103	19.59	2.97	29.66	4.49	49.25	7.46
2027	4213	577	576	58	60	810	5718	144	108	20.58	3.12	31.16	4.72	51.74	7.84
2028	4256	546	536	39	89	906	5837	134	100	19.13	2.90	28.97	4.39	48.10	7.28
2029	4299	545	533	0	0	1088	5931	133	100	19.04	2.88	28.83	4.37	47.88	7.25
2030	4341	536	504	0	0	1162	6039	126	94	18.00	2.73	27.26	4.13	45.27	6.85
2031	5289	408	492	0	0	1314	7011	123	92	17.56	2.66	26.59	4.03	44.14	6.68
2032	6237	348	420	0	0	1448	8033	105	79	14.99	2.27	22.70	3.44	37.69	5.71
2033	6244	405	415	0	0	1474	8123	104	78	14.84	2.25	22.46	3.40	37.30	5.65
2034	5254	384	374	0	0	2761	8399	94	70	13.36	2.02	20.23	3.06	33.60	5.09
2035	5258	370	340	0	0	2795	8423	85	64	12.14	1.84	18.38	2.78	30.52	4.62
2036	5262	345	304	0	0	2834	8442	76	57	10.86	1.65	16.45	2.49	27.31	4.14
2037	5267	315	268	0	0	2878	8459	67	50	9.59	1.45	14.52	2.20	24.11	3.65
2038	5271	314	220	0	0	2932	8517	55	41	7.86	1.19	11.91	1.80	19.77	2.99
2039	5275	44	0	0	0	3391	8710	0	0	0.00	0.00	0.00	0.00	0.00	0.00
2040	5278	43	0	0	0	3391	8712	0	0	0.00	0.00	0.00	0.00	0.00	0.00

Assumptions:
Impoundment acres include the decant pond, areas assumed to be saturated.
Total Acres will be a sum of impoundment acres, embankment acres, dike acres, engineered structures and reclaimed acres.
Embankment slopes are polymered and therefore will not have a potential for wind erosion.
Dikes and Engineered structures will be polymered and will therefore not have a potential for wind erosion.

Maximum Annual PM_{10} Emissions (tpy):	83.05
Maximum Annual $PM_{2.5}$ Emissions (tpy):	12.58
Current PM_{10} PTEs for Windblown Dust (tpy):	36.26

At low wind speed conditions:
PM_{10} Emissions = 1.202 lb/acre/day x Active Embankment Acres (not saturated) x 317 days/yr x 1 ton/2000 lb
Based on AP-42, Chapter 13.2.4, $PM_{2.5}$ = 0.053/0.35 x PM_{10}.

At high wind conditions:
PM_{10} Emissions = 1.202 lb/acre/day x 10 x Active Embankment Acres (not saturated) x 48 days/yr x 1 ton/2000 lb
Based on AP-42, Chapter 13.2.4, $PM_{2.5}$ = 0.053/0.35 x PM_{10}.

TABLE A-2
Communications Generator

Name	BHP	KW	Kohler Model Number	CO Emission Factor (g/hr)	NOx Emission Factor (g/hr)	Total Hydrocarbon Emission Factor (g/hr)	Annual Hours of Operation	CO Emissions (lb/yr)	NOx Emissions (lb/yr)	Total Hydrocarbon Emissions (lb/yr)	CO Emissions (tpy)	NOx Emissions (tpy)	Total Hydrocarbon Emissions (tpy)
Emergency Generator	75	56	45RZG	2025.1	517.3	75.7	500	2230	570	83	1.12	0.28	0.04

Notes:
All emission factors per manufacturer data.

TABLE A-3
Emissions Summary

	Potential Emissions in Tons Per Year					
	PM_{10}	**$PM_{2.5}$**	**NOx**	**SO_2**	**VOC**	**CO**
Wind Blown Dust	83.05	12.58				
Emergency Generator			0.28		0.04	1.12
Total	**83.05**	**12.58**	**0.28**		**0.04**	**1.12**