Final Environmental Impact Statement

Thacker Pass Lithium Mine Project

Appendix K

Air Quality Information

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THACKER PASS AIR QUALITY SUMMARY

AIR QUALITY SUMMARY

THACKER PASS - LITHIUM NEVADA

REGULATORY FRAMEWORK

FEDERAL CLEAN AIR ACT

The Federal Clean Air Act (CAA) and subsequent Clean Air Act Amendments (CAAA) of 1990 authorized the regulation of air emissions from stationary and mobile sources. Specifically, the CAA and CAAA of 1990 requires the EPA to identify National Ambient Air Quality Standards (NAAQS) to protect public health and welfare, as well as to regulate emissions of hazardous air pollutants.

CRITERIA AIR POLLUTANTS

Based on the CAA and CAAA of 1990, the EPA has established NAAQS for pollutants known as "criteria" pollutants that are harmful to public health or the environment. NAAQS have been set for ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 and 2.5 microns in diameter (PM10 and PM2.5), and lead (Pb). Air pollutant concentrations that exceed the NAAQS constitute a risk to human health. State specific Ambient Air Quality Standards (AAQS) have also been developed by the Nevada Division of Environmental Protection (NDEP) and are defined in NAC 445B.22097. Table 1 summarizes the currently applicable National and Nevada AAQS standards.

TABLE 1

SUMMARY OF NATIONAL AND NEVADA AMBIENT AIR QUALITY STANDARDS FOR CRITERIA POLLUTANTS			
POLLUTANT	***AVERAGING PERIOD***	***NAAQS***	***NEVADA AAQS***
O_3 (PPB)	8-Hour	70	70
NO_2 (PPB)	1-Hour	100	100
	Annual	53	53
SO_2 (PPB)	1-Hour	75	75
	3-Hour	500	500
CO (PPM)	1-Hour	35	35
	8-Hour	9	9
PM10 (µG/M3)	24-Hour	150	150
PM2.5 (µG/M3)	24-Hour	35	35
	Annual	12	12
PB (µG/M3)	3-Month	0.15	0.15
Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m3). Source: USEPA, NAC 445B.22097			

[1] Nevada AAQs for 8-hour CO is 6 ppm for areas at or greater than 5000 feet.

HAZARDOUS AIR POLLUTANTS

In addition to the criteria pollutants listed above, the CAA requires the EPA to regulate toxic air pollutants, or hazardous air pollutants (HAPs), that are known to cause or are suspected to cause cancer or other serious health effects or adverse environmental impacts. The EPA has identified 187 specific chemical substances that are potentially hazardous to human health and set emission standards to regulate the amount of those substances that can be released by individual facilities or by specific industrial sources. The EPA has issued rules covering 80 categories of major industrial sources, as well as categories of smaller sources. Controls are usually required at the source to limit the release of these toxics into the atmosphere.

ATTAINMENT AND NON-ATTAINMENT AREAS

Classifications for geographic regions known as air quality management areas (AQMAs) have been developed by the EPA. Under these classifications, each criteria pollutant within a portion of an AQMA is classified as "in attainment" if the ambient concentrations of the pollutant are below the NAAQS or as "non-attainment" if the levels of ambient air pollution exceed the NAAQS. Each criteria pollutant is monitored separately. For nonattainment areas, state and local governments must develop comprehensive plans to reduce pollutant concentrations below the NAAQS and maintain compliance. AQMAs that do not have enough ambient air monitoring data are designated as "unclassifiable" and are treated as in attainment for regulatory purposes. The region in vicinity of and including the Thacker Pass Project is classified as unclassifiable for all criteria air pollutants.

PREVENTION OF SIGNIFICANT DETERIORATION

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Prevention of Significant Deterioration (PSD) applies to any new stationary source or major modification to an existing stationary source that emits or has the potential to emit any pollutant regulated under the CAA above the PSD threshold emission rate, typically 250 tons per year (ton/yr), where the source is located in an AQMA classified as in attainment or unclassifiable. PSD requires installation of the best available control technology (BACT), an air quality analysis, an additional impacts analysis, and public involvement.

Because sulfuric acid plants are a listed source category under 40 CFR Part 52.21, PSD would apply to the sulfuric acid plant at the proposed Thacker Pass Project if the emissions of any regulated air pollutant (e.g., SO_2, NOX, CO, VOC, PM10, PM2.5, H_2SO_4 mist, H_2S) from the sulfuric acid plant exceed 100 ton/yr (as opposed to the typical 250 ton/yr).

NEW SOURCE PERFORMANCE STANDARDS

New Source Performance Standards (NSPS) are standards established by the EPA under authority from the CAA for categories of new or modified stationary sources of air pollution. NSPS include emission standards, equipment specifications, and/or measurement requirements.

NSPS Subpart H includes standards for sulfuric acid plants. The Subpart H emission standards are as follows:

» *Sulfur dioxide: 2 kg sulfur dioxide per metric ton of acid produced (4 lb per ton), the production being expressed as 100 percent H_2SO_4*

» *Acid mist: 0.075 kg acid mist, expressed as H_2SO_4, per metric ton of acid produced (0.15 lb per ton), the production being expressed as 100 percent H_2SO_4*

» *Opacity: 10 percent opacity*

FEDERAL OPERATING PERMIT

The CAAA of 1990 introduced an operating permit program to ensure compliance with the CAA and enhance the EPA's ability to enforce the Act. The Federal Operating Permit Program, known as the Title V program, requires that major sources of air pollutants obtain a Title V permit. To be classified as a major source, a stationary facility must emit more than 100 tons per year of any pollutant regulated under the CAA, 10 tons per year of any single HAP, or 25 tons per year of any combination of HAPs.

FEDERAL OPERATING PERMIT

The CAA delegates primary responsibility for air pollution control to state governments. State governments, in turn, may delegate this responsibility to local governments or regional organizations. The NDEP has the following thresholds for various air quality permit types:

» ***Class I*** *– For facilities that emit more than 100 tons per year of any regulated air pollutant, emit more than 25 tons per year total HAPs, emit more than 10 tons per year of any one HAP, are a PSD source, are a major maximum achievable control technology (MACT) source, or are otherwise subject to Title V*

» ***Class II*** *– For facilities that emit less than 100 tons per year of any regulated air pollutant, emit less than 25 tons per year total HAPs, and emit less than 10 tons per year of any one HAP*

» ***SAD*** *– For surface area disturbance greater than five acres*

The proposed Thacker Pass Project is anticipated to require a Class II Permit.

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THACKER PASS - LITHIUM NEVADA

AFFECTED ENVIRONMENT

LOCAL CLIMATE AND METEOROLOGY

The Thacker Pass Project area is situated in the north central region of the Basin and Range physiographic province in an area known as Thacker Pass, in terrain roughly 5,000 feet amsl with lower-lying agricultural valleys to the east and west. The Double H Mountains are located directly to the south and the Montana Mountains are located directly to the north. The Thacker Pass Project area straddles the topographic divide separating the Kings River Valley hydrographic area and the Quinn River Valley hydrographic area.

An onsite meteorological station (Thacker Pass station) was installed in August 2011 and has continuously collected data through to the present day. Climatic conditions are arid, high desert with mild-cool winters and hot-dry summers. Average winter temperature is near freezing (32.5°F), with daily temperatures ranging from highs of about 50°F to lows of about 10°F. Summer temperatures range from highs of about 95°F to lows of about 50°F. Air moisture is generally arid, with relative humidity ranging from about 25% during summer to about 65% during winter.

Table 2 summarizes average wind speed, average temperature at ground level, and average temperature at 32.8 feet from January 2012 through December 2018.

Long-term data has been assessed to characterize overall climate conditions. The nearest long-term meteorological measurement station is in Winnemucca, Nevada, located about 60 miles south-southeast of the Project location. Long-term climate data is summarized in Table 3.

TABLE 2

METEOROLOGICAL DATA JAN. 2012 - DEC. 2018
THACKER PASS METEOROLOGICAL STATION

MONTH	AVERAGE WIND SPEED (MPH)	AVERAGE TEMP. (°F)	AVERAGE TEMP. (°F) 32.8 FT
JANUARY	6.84	32.13	32.80
FEBRUARY	8.18	35.81	36.29
MARCH	8.98	41.98	42.26
APRIL	9.46	47.04	47.15
MAY	7.99	55.68	55.79
JUNE	8.66	67.00	66.87
JULY	9.01	76.82	76.72
AUGUST	8.47	74.43	74.58
SEPTEMBER	8.24	64.81	65.15
OCTOBER	7.51	51.80	52.47
NOVEMBER	7.45	40.15	40.85
DECEMBER	7.48	29.58	30.17

TABLE 3

WINNEMUCCA WSO AIRPORT CLIMATE SUMMARY
1/1/1897 TO 12/31/2005

METEOROLOGICAL PARAMETER	MEASURED VALUE
ANNUAL AVERAGE MAX. TEMPERATURE (°F)	64.8
ANNUAL AVERAGE MIN. TEMPERATURE (°F)	33.1
ANNUAL AVERAGE TOTAL PRECIPITATION (IN.)	8.29
ANNUAL AVERAGE TOTAL SNOWFALL (IN.)	16.5
ANNUAL AVERAGE TOTAL SNOW DEPTH (IN.)	0
Source: Western Regional Climate Center	

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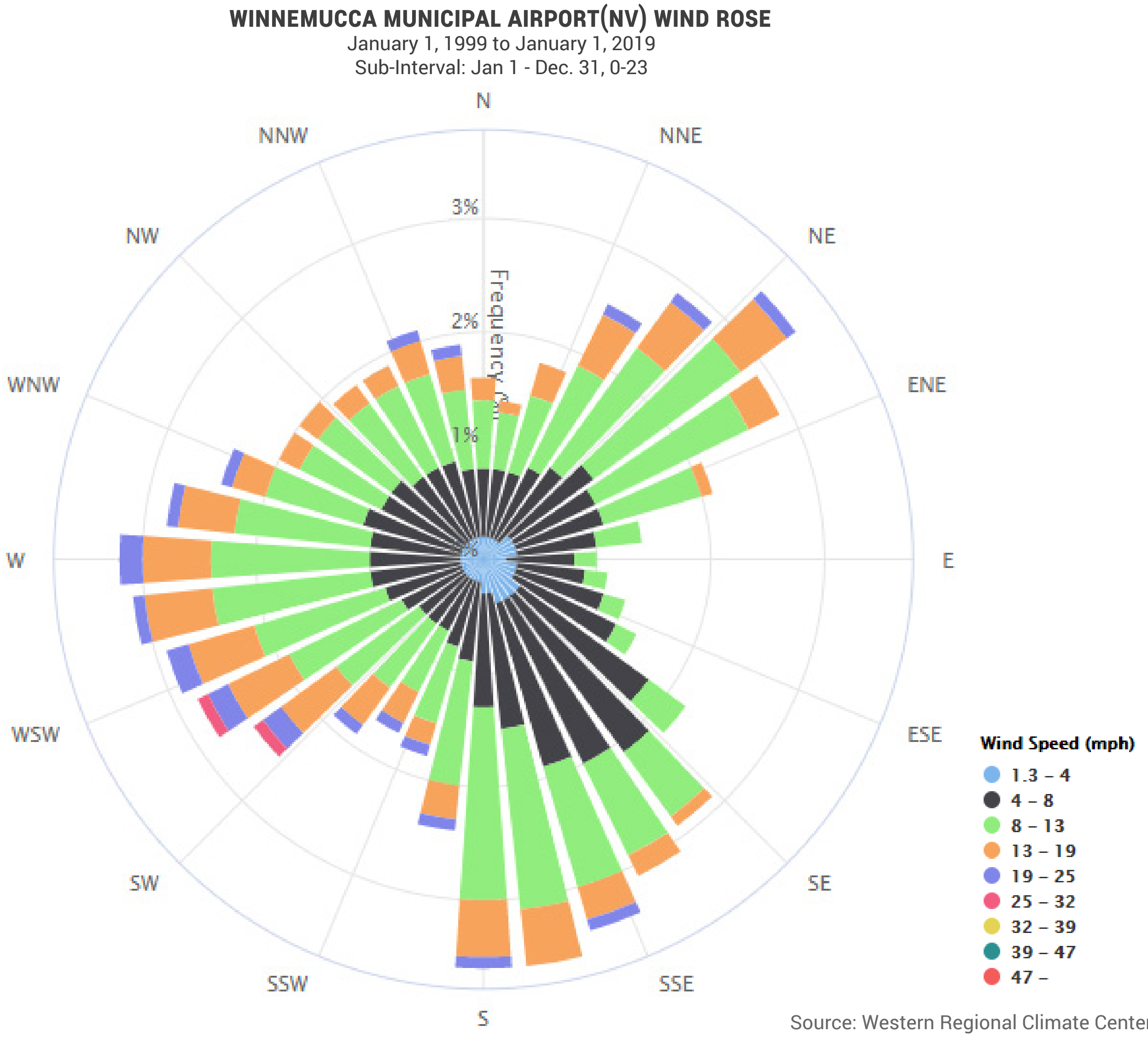
Figure 1 shows wind speed and direction at the Winnemucca Municipal Airport over a 20-year period, from 1999 to 2019. Wind speed and direction is shown in a wind rose diagram, which defines the wind direction as the direction which the wind is blowing. The length of each bar indicates the frequency of occurrence in each wind direction, and the shading indicates a differentiating wind speed

FIGURE 1



Source: Western Regional Climate Center

REFERENCES

Summary of the Clean Air Act https://www.epa.gov/laws-regulations/summary-clean-air-act

Criteria Air Pollutants https://www.epa.gov/criteria-air-pollutants

NAAQS Table https://www.epa.gov/criteria-air-pollutants/naaqs-table

Hazardous Air Pollutants https://www.epa.gov/haps

NAAQS Designation Process https://www.epa.gov/criteria-air-pollutants/naaqs-designations-process

Prevention of Significant Deterioration https://www.epa.gov/nsr/prevention-significant-deterioration-basic-information

New Source Performance Standards https://www.law.cornell.edu/cfr/text/40/part-60

Nevada Air Quality Operating Permit https://ndep.nv.gov/air/permitting

Winnemucca WSO Airport Climate Data https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nvwinn

Winnemucca Municipal Airport Wind Rose https://www.wcc.nrcs.usda.gov/climate/windrose.html

THACKER PASS AIR QUALITY IMPACT REPORT

(DECEMBER 2019, REVISION 6)

AIR SCIENCES INC.

DENVER • PORTLAND • LOS ANGELES

Lithium Nevada – Thacker Pass Project NEPA Air Quality Impact Analysis Report

PREPARED FOR:
LITHIUM NEVADA CORP.

PROJECT NO. 270-3-3
DECEMBER 2019

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1.0 INTRODUCTION

Lithium Nevada Corp. (LNC) is proposing to develop the Thacker Pass Project (Project), an open-pit lithium mining and lithium processing operation located on public lands in northern Humboldt County, Nevada. In order to support the environmental analysis required by the National Environmental Policy Act (NEPA), LNC has conducted an air quality analysis to quantify and evaluate the impacts on ambient air quality resulting from the Project.

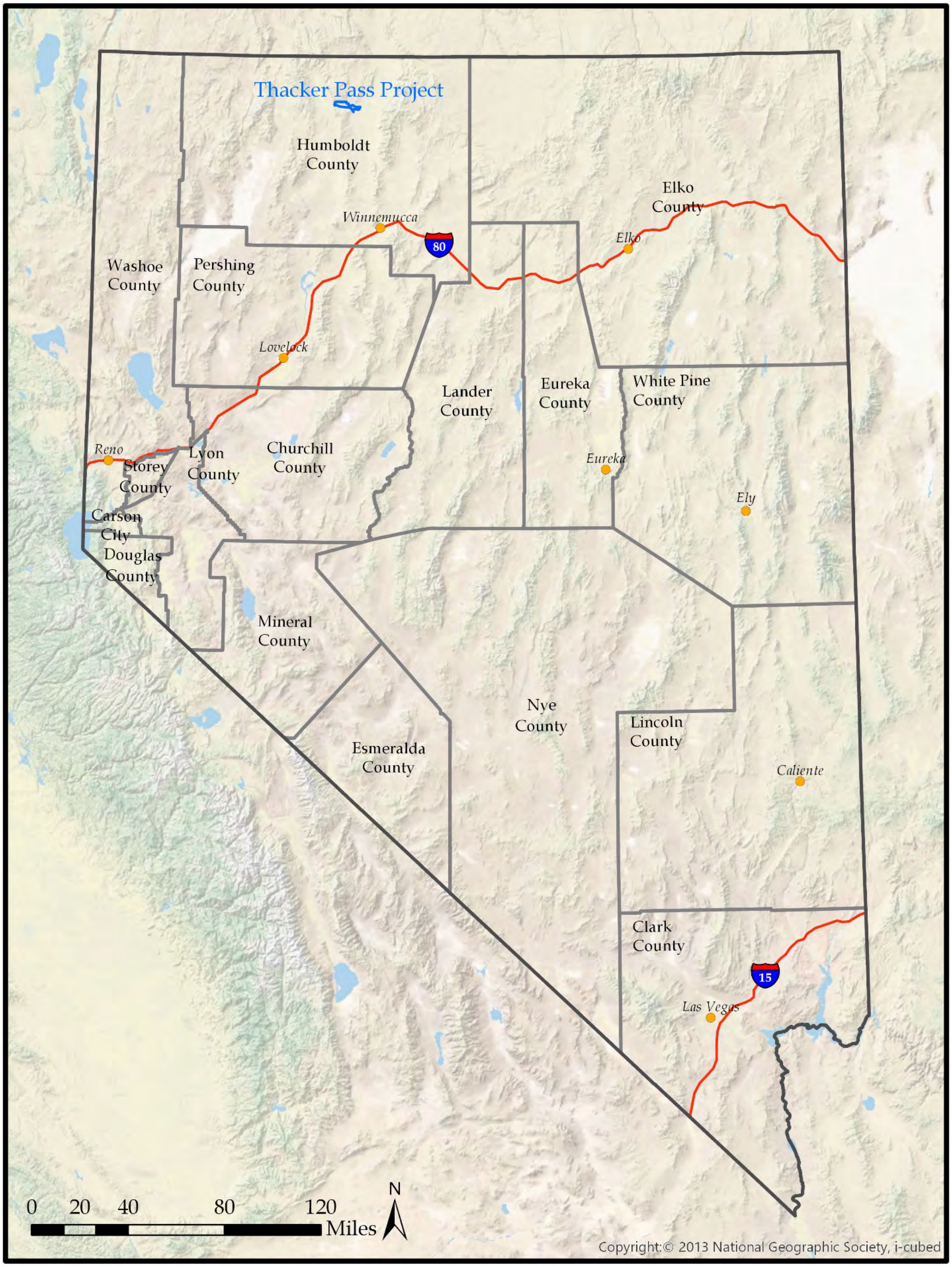
The Project is located in Humboldt County in northern Nevada, 62 miles north-northwest of Winnemucca and about 20 miles west-northwest of Orovada, Nevada. The Project is situated at the southern end of the McDermitt Caldera at an approximate elevation between 4,200 and 5,650 feet above sea level. The area is sparsely populated and used primarily for ranching and farming. The Project location is shown in Figure 1. The Project is located in the Quinn River Valley and Kings River Valley Hydrographic Areas (HA 33A and 30A, respectively). These planning areas have not been triggered for prevention of significant deterioration (PSD) baseline for any pollutant.

The Project will consist of open-pit lithium mining and lithium processing operations designed to produce lithium carbonate, lithium hydroxide monohydrate, lithium sulfide, lithium metal, and solid-state lithium batteries. These lithium carbonate equivalent (LCE) end products are recovered through ore crushing, acid leaching, and lithium processing. The on-site facilities will include a sulfuric acid plant to supply sulfuric acid for leaching. The sulfuric acid plant will also generate steam for energy that will provide power to support the Project.

This air quality impact analysis was performed consistent with the methodologies and data sets outlined in the modeling protocol submitted by LNC to the Bureau of Land Management on February 7, 2019, except for the following minor changes/updates:

- The newest version (19191) of the AERMOD model was used.
- Receptors at a 25-meter spacing were used along the modeling boundary.
- A comparison of modeled impacts with Nevada Ambient Air Quality Standards (NvAAQS), including 1-hour average hydrogen sulfide (H_2S) impacts, was included.

Figure 1. Thacker Pass Project Location Map



2.0 AIR EMISSIONS

The current life of mine schedule for the proposed Project consists of 41 years of commercial mining production, preceded by two years of facility construction and pre-production waste rock removal. The commercial mining operation will be developed in two phases (Phases 1 and 2). Concurrent with the commercial mining, LNC will conduct ongoing exploration activities. The potential air emissions from each operational phase of the Project are discussed in this section.

2.1 Construction Emissions

Prior to commercial production, the construction of the Project will occur over approximately two years, including pre-production waste rock removal. The site preparation and construction activities are not precisely defined at this time; however, they are expected to include a combination of scraping, dozing, grading, compacting, and material transfers. These activities will have the potential to create fugitive dust emissions, which contain trace amounts of hazardous air pollutant (HAP) metals. The pre-production waste rock removal operations will include drilling, blasting, waste hauling, and material transfers, which have the potential to create fugitive dust emissions, as well as combustion products from blasting. The drilling and blasting operations will only occur as needed, requiring an estimated 11 blasts per year. The mobile equipment that supports both the construction and waste rock removal activities will result in tailpipe emissions, including HAPs, from fuel combustion. The estimated annual emissions in tons per year from the facility construction and pre-production waste rock removal operations are presented in Table 1.

Table 1. Thacker Pass Construction Emissions (ton/yr)

Activity	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC	HAP	GHG
Facility Construction	34.5	7.5	-	-	-	-	0.10	-
Mobile Equipment Tailpipe	8.6	8.6	137.4	269.9	0.31	29.9	0.42	34,109
Waste Rock Removal	12.8	1.0	30.0	0.8	0.002	-	0.04	-
Total	55.9	17.2	167.4	270.7	0.31	29.9	0.57	34,109

2.2 Exploration Emissions

Concurrent with the commercial mining (Phase 1 and 2), LNC will conduct ongoing exploration operations. These operations have the potential to disturb approximately 150 acres, including up to 600 drill sites, over the life of the mine. The timing and location of these operations are not yet known; however, it is expected that exploration will occur only during the summer, approximately four months out of the year. Exploration operations have the potential to emit fugitive dust, which contains trace amounts of HAP metals, from drill pad and access road construction and exploration drilling, and tailpipe emissions, including HAPs, from the drill rigs and support equipment. The estimated annual emissions in tons per year from the exploration operations are presented in Table 2.

Table 2. Thacker Pass Exploration Emissions (ton/yr)

Activity	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC	HAP	GHG
Exploration Operations	1.5	0.2	-	-	-	-	4.7E-03	-
Mobile Equipment Tailpipe	0.3	0.3	15.2	9.3	0.03	2.4	6.1E-02	3,018
Total	1.8	0.5	15.2	9.3	0.03	2.4	0.07	3,018

2.3 Commercial Production Emissions

LNC will develop the commercial production portion of the Project in two phases (Phases 1 and 2). The Phase 1 average mining rate will be approximately 7.7 million tons per year, producing an average of approximately 3.1 million tons per year of ore and resulting in approximately 33,000 tons per year of LCE end products. Phase 2 will essentially double production from Phase 1, with an average mining rate of approximately 11.0 million tons per year, producing an average of approximately 6.2 million tons per year of ore and resulting in approximately 66,000 tons per year of LCE end products.

2.3.1 Mining Operations

During commercial mining production, ore and waste rock will be removed from the open pit using either excavators, truck loaders, or a surface miner. Some areas of the open pit may require occasional blasting with ammonium nitrate and fuel oil explosive (ANFO). LNC estimates the need for approximately six blasts per year. Once loaded into trucks, ore from the pit will be hauled to the ore stockpile and waste hauled to one of two waste rock storage facilities (WRSFs). As the pit is developed, waste rock may be directly placed in the pit as backfill material. Given the longer haul distances to the WRSFs, emission estimates for this analysis assume that all waste material is hauled to the WRSFs. Pollutants emitted from open pit mining include fugitive dust, which contains trace amounts of HAP metals, and combustion products from blasting and mobile equipment tailpipes, including HAPs. Fugitive dust emissions from haul roads will be controlled by a combination of watering and the application of chemical dust suppressants. When practical, fugitive dust emissions from the wind erosion of exposed areas will be controlled by watering or re-vegetation.

2.3.2 Mineral Processing

Ore from the ore stockpile will be fed by conveyor through a crusher and mineral sizer before discharging to the attrition scrubbing process. In the attrition scrubbers and classification circuit, high-grade fine lithium material will be separated from the low-grade course gangue using agitators and hydrocyclones. From the attrition scrubbers and classification circuit, lithium ore slurry will be pumped to the leaching process, while the course gangue material will be dewatered and conveyed to the gangue stockpile. Some course gangue material will be periodically hauled from the gangue stockpile to the pit to be used for backfill. Particulate emissions from the crushers and material transfers will be controlled by water sprays and material moisture content. Particulate emissions from the attrition scrubbers will be controlled by a baghouse.

2.3.3 Purified Lithium Solution

In the leach circuit, the lithium-bearing ore slurry will be leached with sulfuric acid in a series of tanks. Particulate and sulfuric acid mist (H_2SO_4) emissions from the leach tanks will be controlled by a wet scrubber. Following leaching, the lithium-bearing solution will be neutralized with alkaline reagents in a series of agitated tanks. Particulate emissions from the neutralization tanks will be controlled by a wet scrubber. Solids generated during leaching and neutralization will be thickened and filtered prior to being conveyed to the clay tailings filter stack (CTFS). Particulate emissions from the material transfers to the CTFS will be controlled by material moisture content. Over time, as the material dries out, fugitive dust emissions from wind erosion of the exposed areas of the CTFS will be controlled by watering or re-vegetation.

After neutralization, the lithium-bearing solution will be purified by crystallization and precipitation of magnesium sulfate (Epsom salt), followed by ion exchange to remove residual magnesium and other divalent cations. Particulate emissions from the magnesium precipitation process will be controlled by wet scrubbing. The purified lithium solution will be used for a variety of end products, including lithium carbonate, lithium hydroxide monohydrate, lithium sulfide, lithium metal, and solid-state lithium batteries. The quantity of each end product that will be produced will depend on market conditions.

2.3.4 Lithium End Products

A portion of the purified lithium solution will be sent to the lithium carbonate process in which lithium carbonate is precipitated out of the solution using soda ash, and then filtered and dried. The dried lithium carbonate is then packaged for shipment to customers. Particulate emissions from the lithium carbonate processing and packaging will be controlled by baghouses.

The remaining purified lithium solution will be diverted for lithium hydroxide monohydrate production. In the initial step, cations will be precipitated from the solution with caustic soda. The remaining lithium brine will be evaporated and crystallized to produce lithium hydroxide monohydrate crystals. The purified lithium hydroxide monohydrate will be dried and packaged for shipment to customers. Particulate emissions from the lithium hydroxide drying and packaging will be controlled by baghouses.

Lithium sulfide will be produced by reacting hydrogen gas, molten sulfur, and lithium carbonate or lithium hydroxide. Hydrogen sulfide emissions generated from the reaction process will be controlled by a caustic scrubber, and particulate emissions from lithium sulfide packaging will be controlled by a baghouse.

Lithium metal will be produced by passing an electrical current through a salt bath of potassium chloride and lithium chloride. Lithium chloride will decompose in the electrical current to form lithium metal. Chlorine gas created from the process will be removed to produce a sodium hypochlorite solution (i.e., bleach) using caustic soda and water. One hundred percent of the chlorine created from the lithium metal production will be used to create sodium hypochlorite, resulting in zero chlorine emissions from the metal production. Chlorine emissions from the sodium hypochlorite storage tank transfers will be controlled by a scrubber. The lithium metal will be purified by adding aluminum powder to remove any nitrogen-containing compounds as aluminum nitride. Particulate emissions from the potassium chloride, lithium chloride, and aluminum powder material handling will be controlled by baghouses.

All-solid-state lithium batteries will be produced by first coating a metal substrate with a slurry of the lithium sulfide from the process plant. Then, the coated cathode and separator battery components will be combined with a lithium metal anode, also produced at the process plant, in a lamination step to create a single layer of a battery cell. The layer will be split and stacked into the desired battery format. Volatile organic emissions from battery production solvents will be controlled by a scrubber. Particulate emissions from the battery production complex will be controlled by a baghouse.

2.3.5 Sulfuric Acid Plant

The sulfuric acid required for leaching the lithium bearing ore will be produced on site in a sulfuric acid plant. In the plant, molten sulfur will be burned with air to produce sulfur dioxide, which is catalytically converted to sulfur trioxide and then absorbed in water to produce sulfuric acid. The process is strongly exothermic and produces a large amount of excess heat that will be converted to steam and electricity. The sulfuric acid plant is expected to produce enough electricity to support all the Project facilities, with leftover capacity sold to the power grid. With the sulfuric acid plant, the Project is expected to be a net exporter of carbon-free electricity.

Sulfur dioxide, sulfuric acid mist, and particulate (primarily consisting of sulfuric acid mist as condensable particulate matter) emissions from the sulfuric acid plant will be controlled by a tail gas scrubber. In order to minimize the emissions from the sulfuric acid plant, LNC has committed to installing a state-of-the-art scrubbing control, which is above customary industry standard. As a result, the sulfur dioxide and acid mist emissions from the sulfuric acid plant will be well below the emission standards (4 pounds SO_2 per ton of acid produced and 0.15 pounds H_2SO_4 per ton of acid produced) in the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Subpart H, Standards of Performance for Sulfuric Acid Plants. While the exact scrubbing system has not yet been determined, LNC has committed to installing a control that, at the minimum, meets the emission levels used in this analysis. The sulfuric acid plant will also emit nitrogen dioxides from the combustion of sulfur in air, but it is not expected to emit any HAPs.

Sulfur for the sulfuric acid plant will be delivered to the site and stored in sulfur storage tanks. Sulfur dioxide and hydrogen sulfide emissions from these tanks will be controlled by caustic scrubbing.

During the initial startup of the sulfuric acid plant and after any maintenance downs, startup burners (one in Phase 1, two in Phase 2) will be required to heat the system prior to feeding molten sulfur. In addition, during initial startup and any time the sulfuric acid plant is down, package boilers (one in Phase 1, two in Phase 2) will be required to maintain heat in the sulfur unloading and storage area. It is estimated that both the startup burners and package boilers will each operate no more than 288 hours per year. The startup burners and package boilers will emit diesel combustion products, including HAPs.

2.3.6 Ancillary Equipment

The Project will also include various ancillary equipment, such as fire pumps, emergency generators, cooling towers, silos, laboratory equipment, and fuel storage tanks. These sources have the potential to emit small amounts of combustion products, including HAPs from fuel combustion, particulates from material handling, and volatile organics from fuel storage.

2.3.7 Criteria Pollutant Emissions

The estimated facility-wide potential annual emissions in tons per year for the two phases of commercial production are presented in Tables 3 and 4. Detailed emission calculations are included in Appendix A.

Table 3. Thacker Pass Phase 1 – Facility-Wide Potential Emissions (ton/yr)

Source Category	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC
Process	71.0	65.1	1.0	78.4	75.8	17.9
Fugitive	66.6	19.3	189.1	392.7	0.5	43.5
Facility Total	137.6	84.5	190.1	471.1	76.2	61.4

Table 4. Thacker Pass Phase 2 – Facility-Wide Potential Emissions (ton/yr)

Source Category	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC
Process	96.3	84.5	1.8	81.2	76.1	35.2
Fugitive	114.6	31.4	285.9	587.7	0.7	67.6
Facility Total	210.9	115.9	287.7	668.9	76.8	102.8

For this analysis, LNC has conservatively used the Phase 2 emission levels from the sulfuric acid plant tail gas for Phase 1, as well. Because of this assumption, the total process emissions show only a small increase between Phases 1 and 2, whereas the fugitive emissions almost double based on the doubling of production between Phases 1 and 2.

2.3.8 HAP and GHG Emissions

As discussed above, the Project is expected to generate HAP and greenhouse gas (GHG) emissions from fuel combustion by process sources and mobile mining equipment. HAP emissions are also generated from dust emissions that contain trace amounts of metals and from the transfer of sodium hypochlorite solution (resulting in chlorine emissions, see Section 2.3.4). GHG emissions in the form of CO_2 are also generated from lithium processing, including from the sulfuric acid plant tail gas scrubber, carbonate destruction, neutralization, and lithium sulfide production.

The facility-wide total HAP emissions, as well as the highest single HAP emissions in tons per year, for the two phases are presented Table 5.

Table 5. Thacker Pass Facility-Wide Hazardous Air Pollutant Emissions (ton/yr)

	Phase 1	Phase 2
Total HAPs	1.39	2.34
Highest Single HAP (Chlorine)	0.28	0.57

The facility-wide GHG emissions in tons per year for the two phases are presented in Table 6.

Table 6. Thacker Pass Facility-Wide Greenhouse Gas Emissions (ton/yr)

Source Category	Phase 1	Phase 2
Process	21,342	42,656
Mobile Tailpipes	58,656	89,932
Facility Total	79,998	132,588

The HAP and GHG emission calculations are provided in Appendix A.

2.3.9 Other Regulated Pollutant Emissions

In addition to the criteria pollutant emissions shown in Tables 3 and 4, the Project is also expected to generate hydrogen sulfide (H_2S) and sulfuric acid mist (H_2SO_4) emissions from the sulfuric acid plant and lithium processing sources, as detailed above. While these pollutants are not HAPs, they are included in this analysis, as they are regulated new source review (NSR) pollutants.

The facility-wide H_2S emissions are 0.43 tons per year during Phase 1 of the Project and 0.86 tons per year during Phase 2 of the Project. The facility-wide H_2SO_4 emissions are 26.70 tons per year during Phase 1 of the Project and 27.85 tons per year during Phase 2 of the Project. The H_2S and H_2SO_4 emission calculations are provided in Appendix A.

2.3.10 Regulatory Basis

As shown in Tables 3 and 4, the facility-wide potential process source emissions for both Project phases are each less than the 250 tons per year threshold (Code of Federal Regulations, Title 40, Part 52.21 [40 CFR 52.21]) for PSD applicability for each criteria pollutant. In addition, as discussed in Section 2.3.9, the facility-wide potential emissions of H_2S and H_2SO_4 are each also less than the PSD applicability threshold of 250 tons per year. Therefore, the overall Project is considered a minor source for NSR.[1]

As discussed in Section 2.3.5, the Project will include a sulfuric acid plant, which is an NSR-listed source category per 40 CFR 52.21(b)(1)(i)(a). Therefore, the PSD applicability threshold for the sulfuric acid plant, including fugitive emissions from the plant, is 100 tons per year, per regulated NSR pollutant. The total potential emissions from the sulfuric acid plant, including the plant and associated sources (e.g., start-up burners, package boilers), in tons per year for the two phases are presented in Tables 7 and 8.

Table 7. Thacker Pass Phase 1 – Sulfuric Acid Plant Potential Emissions (ton/yr)

	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC	H_2S	H_2SO_4
Sulfuric Acid Plant Sources	28.4	28.3	0.8	78.2	75.8	0.1	0.3	25.6

Table 8. Thacker Pass Phase 2 – Sulfuric Acid Plant Potential Emissions (ton/yr)

	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC	H_2S	H_2SO_4
Sulfuric Acid Plant Sources	29.5	29.3	1.6	81.0	76.1	0.1	0.7	25.6

As shown in Tables 7 and 8, the total potential emissions from the sulfuric acid plant are below 100 tons per year for each regulated NSR pollutant. Therefore, the sulfuric acid plant is also considered a minor source for NSR.

Given that the facility-wide potential process source emissions for both Project phases are also below the 100 tons per year threshold for the Title V program, the Project will be considered a minor source, which is not subject to Title V permitting. Furthermore, the emission rates estimated for this analysis are based on the Plan of Operations' operating scenario. It is possible that Phase 1 emissions would be reduced in the event that the initial development includes a

[1] Fugitive emissions are not counted for determining PSD applicability for this source type per 40 CFR 52.21(b)(1)(iii).

lower production rate, which would then be used for the Nevada Division of Environmental Protection air permit application.

As discussed in Section 2.3.8, the Project facility-wide HAP emissions for both Project phases are less than 10 tons per year for a single HAP and 25 tons per year for all HAP emissions in aggregate. Therefore, the Project is considered an area source for National Emission Standards for Hazardous Air Pollutants (NESHAP) applicability.

2.4 Off-Site Transport Emissions

During commercial mining (Phases 1 and 2), reagents for the lithium processing plant will be delivered to the processing plant by trucks from Winnemucca. This route will include travel on US Highway 95, State Route 293, and the Thacker Pass access road, which will be paved from State Route 293 all the way to the processing plant. It is estimated that there will be approximately 21,900 reagent deliveries per year in Phase 1 (an average of 60 deliveries per day) and 43,800 reagent deliveries per year in Phase 2 (an average of 120 deliveries per day). In addition, during commercial mining, the various lithium end products will be shipped by truck to Winnemucca. While the form of the end products and the point of sale will be dependent on evolving markets, it is estimated that there will be approximately 1,460 product shipments per year in Phase 1 and 2,920 product shipments per year in Phase 2. The estimated annual off-site emissions from the reagent and product trucking operations in tons per year for the two phases are presented in Tables 9 and 10.

Table 9. Thacker Pass Phase 1 – Off-Site Trucking Emissions (ton/yr)

Activity	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC
Reagent Trucking	35.47	8.99	3.17	13.09	3.0E-02	0.53
Product Trucking	2.36	0.60	0.21	0.87	2.0E-03	0.04
Total Off-Site Trucking	37.83	9.59	3.38	13.96	3.2E-02	0.57

Table 10. Thacker Pass Phase 2 – Off-Site Trucking Emissions (ton/yr)

Activity	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	VOC
Reagent Trucking	70.93	17.98	6.34	26.18	6.1E-02	1.07
Product Trucking	4.73	1.20	0.42	1.75	4.0E-03	0.07
Total Off-Site Trucking	75.66	19.18	6.77	27.93	6.5E-02	1.14

2.4.1 Off-Site GHG Emissions

The off-site transport of the reagents and end products will also result in GHG emissions. At this point, it is not known whether the lithium end products will be sold locally or shipped further for sale or processing. For a conservative analysis, LNC has assumed that all products

(33,000 tons per year in Phase 1 and 66,000 tons per year in Phase 2) will be transported from Winnemucca by rail to San Francisco. The GHG emissions from off-site trucking and rail transport in tons per year for the two phases are presented in Table 11.

Table 11. Thacker Pass Off-Site Transport Greenhouse Gas Emissions (ton/yr)

Source Category	Phase 1	Phase 2
Reagent Trucking	4,547	9,095
Product Trucking	303	606
Product Transport by Rail	312	623
Total Off-Site Transport	5,162	10,325

3.0 AIR QUALITY ANALYSIS

This section presents the air quality analysis methodology, data sets, and modeling techniques to be used to estimate the changes in ambient air quality levels that could result from the Project. The results of the modeling analysis, including a comparison with the applicable air quality standards, are also discussed in this section.

3.1 Model Selection

Air dispersion models are a collection of mathematical algorithms packaged into a computer program to simulate the atmospheric dispersion of an air pollutant. Air dispersion models typically require source data (emissions, location, physical characteristics, etc.) and meteorological data (wind speed and direction, temperature, mixing height, etc.) to predict pollutant concentrations at downwind receptor locations as a result of a source's emissions. These air dispersion models are widely used to assess changes in the ambient air resulting from a project's air emissions and to evaluate compliance with applicable ambient air quality standards.

The modeling analysis was conducted using the most recent version (19191) of the AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model) modeling system. AERMOD is an enhanced, steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including the treatment of both surface and elevated sources and both simple and complex terrain (EPA 2004a). The AERMOD modeling system is listed as the recommended model for short-range analysis (up to 50 kilometers) in the United States Environmental Protection Agency (EPA)-maintained Guideline on Air Quality Models, which is published as Appendix W to the Code of Federal Regulations, Title 40, Part 51 (40 CFR 51, Appendix W).

AERMOD has been routinely used for NEPA analyses of facilities located in Nevada and elsewhere where the local terrain consists of surrounding valleys and elevated terrain. Based on a review of the terrain surrounding the Project, it is expected that the potential for this terrain regime to generate complex winds (e.g., multi-day stagnation events, shoreline fumigation, other wind circulations) is low, making AERMOD the appropriate model selection for this analysis.

3.2 Modeled Sources

The air pollution sources modeled in this air quality analysis include the following source categories:

- Process emission sources (ore crushing, material conveying, sulfuric acid plant, lithium processing, etc.)

- Fugitive emission sources (drilling; blasting; material loading, unloading, and hauling; dozing, grading, and water truck travel; wind erosion of exposed surfaces; and mobile machinery tailpipes)

3.3 Air Pollutants

The air quality analysis includes modeling for the following air pollutants and averaging periods:

- Carbon monoxide (CO): 8-hour and 1-hour averaging periods
- Hydrogen sulfide (H_2S): 1-hour averaging period
- Nitrogen dioxide (NO_2): Annual and 1-hour averaging periods
- Particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$): Annual and 24-hour averaging periods
- Particulate matter less than 10 microns in aerodynamic diameter (PM_{10}): 24-hour averaging period
- Sulfur dioxide (SO_2): 3-hour and 1-hour averaging periods

3.4 Modeled Emissions

As shown in Section 2.0, of the operational phases, Phase 2 of commercial production will have the highest potential emission rates. Therefore, in order to evaluate the maximum potential impacts from the Project, the air quality impact analysis was conducted using Phase 2 emission rates.

The modeled short-term emission rates for the process sources were derived from the maximum hourly process rates for Phase 2. The long-term emission rates were derived using the maximum hourly process rates and estimated annual utilization factors. The modeled emission rates for the fugitive sources were based on the annual activity rates for Phase 2. The modeled emission rates in grams per second for each source are provided in Appendix A.

3.5 Source Characterization

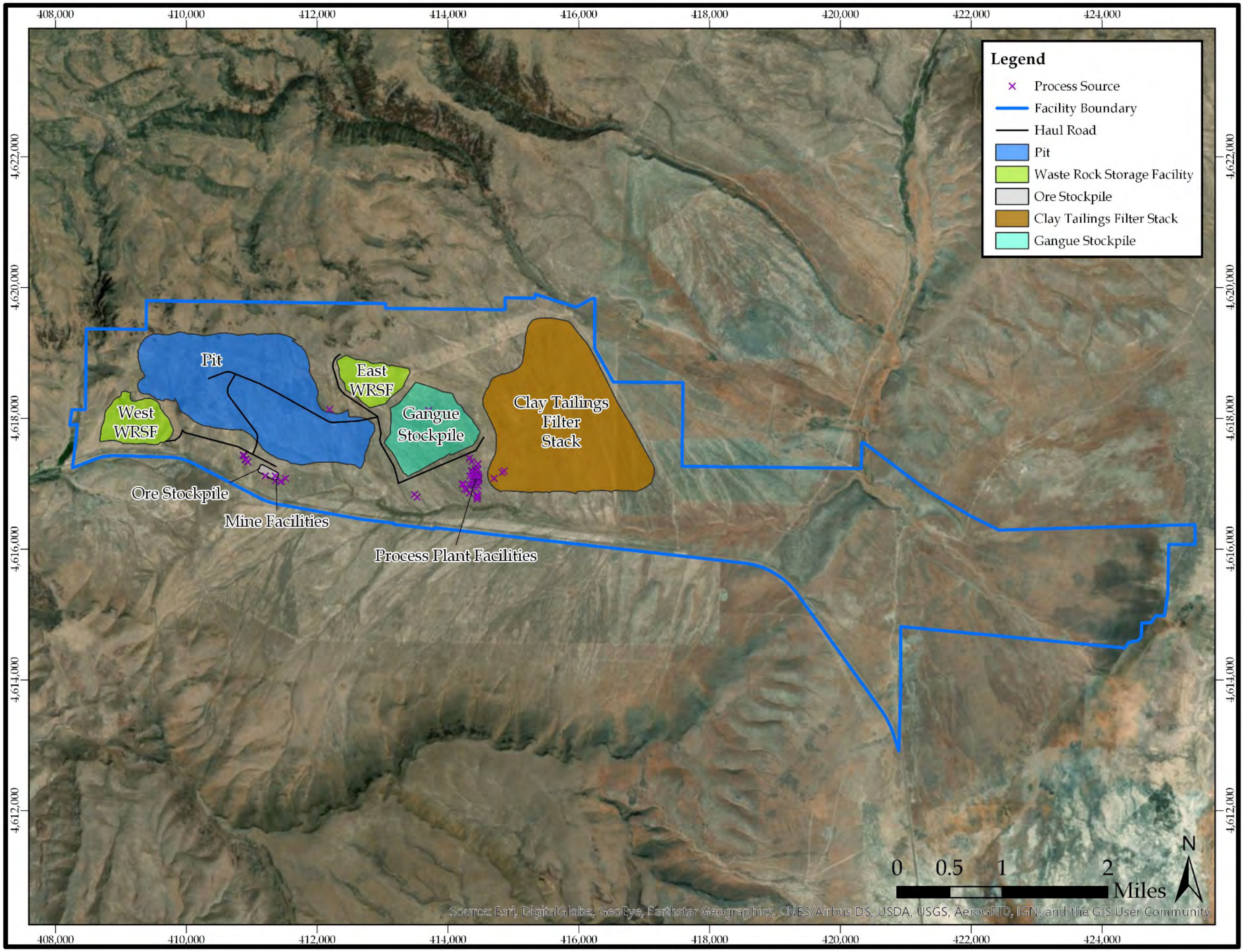
All emission sources at the Project were modeled as POINT, VOLUME, or OPENPIT sources for this analysis. The detailed characterization and model input parameters for each source are provided in Appendix A. Process sources with exhaust stacks, such as the sulfuric acid plant, package boiler, start-up burner, and sources equipped with a baghouse or scrubber (leach tanks, lithium processing sources, reagent handling, etc.), were modeled as POINT sources. Process fugitive sources, such as crushers and material transfers, were modeled as VOLUME sources. All fugitive mining activity locations, except the pit, were characterized as VOLUME sources. The pit was characterized as an OPENPIT source. The haul road network was modeled as a series of VOLUME sources.

Fugitive mining source emissions (drilling; blasting; material loading, unloading, and hauling; dozing, grading, and water truck travel; wind erosion of exposed surfaces; and mobile machinery tailpipes) were aggregated by activity location. These activity locations and the emission activities associated with these locations are presented in Table 12. A facility map showing the general layout of fugitive mining activity locations and process sources is shown in Figure 2.

Table 12. Modeled Fugitive Mining Activity Locations

Model ID	Activity Location	Associated Emission Activities
PIT	Pit	Drilling, ore and waste loading, backfill unloading, dozing, and tailpipes from shovels, dozers, loaders, and drills
PIT_BL	Pit Blasting	Blasting
O_STOCK	Ore Stockpile	Ore unloading, dozing, wind erosion, and tailpipes from dozers and loaders
W_WRSF	West Waste Rock Storage Facility	Waste unloading, dozing, wind erosion, and tailpipes from dozers
E_WRSF	East Waste Rock Storage Facility	Waste unloading, dozing, wind erosion, and tailpipes from dozers
G_STOCK	Gangue Stockpile	Gangue backfill loading, dozing, wind erosion, and tailpipes from dozers and loaders
CTFS	Clay Tailings Filter Stack	Dozing, wind erosion, and tailpipes from dozers
HR*	Haul Roads (series of VOLUME sources)	Ore, waste, and backfill hauling, grading, water trucking, wind erosion, and tailpipes from graders, and haul, water, and service trucks
PROC	Process Plant	Tailpipes from lifts, cranes, service trucks, and other small equipment

Figure 2. Thacker Pass Facility Layout



NAD 1983 UTM Zone 11N

Fugitive emissions from drilling and blasting were estimated based on the overall maximum blasting year. As discussed in Section 2.3.1, based on the pit geology, mining will generally be accomplished using either excavators, truck loaders, or a surface miner, and only occasional blasting may be required.

Material loading and unloading emissions were allocated to each activity location (pit, WRSFs, and stockpile areas) based on the amount of material transferred in each location for each phase. The amount of waste to each storage facility was allocated based on each facility's storage capacity.

Dozing emissions were allocated to each activity location (pit, WRSFs, and stockpile areas) based on the proportion of material handled at each location for each phase. Grading emissions were divided among the road routes based on the proportion of haul truck miles traveled on each route for each phase.

Wind erosion emissions were calculated for each activity location (WRSFs, stockpile areas, and haul roads) based on surface area and erosion potential.

Material-hauling emissions were calculated for the haul road network using vehicle miles traveled (VMT) along each road route. Total hauling, grading, and water truck dust and tailpipe emissions were distributed along the active hauling sections based on the VMT on each route for each phase.

Mobile machinery (except haul trucks, water trucks, service trucks, and graders) emissions were divided among the activity locations (pit, WRSFs, stockpile areas, and process plant) based on equipment type and allocated between the appropriate activity locations (e.g., drill rig emissions were only assigned to pits) based on the proportion of material handled at each location for each phase.

As stated above, all fugitive source activity locations, except the pits, were characterized as VOLUME sources. The pits were characterized as OPENPIT sources. The applicable initial lateral and vertical dispersion coefficients for the VOLUME and OPENPIT sources were determined according to the methods recommended in the AERMOD User's Guide (EPA 2004b) and the Haul Road Workgroup Memorandum (EPA 2012).

A road network for hauling mined material to the appropriate destinations was developed for model input. The haul road network was characterized as a series of adjacent VOLUME sources according to the methods recommended in the Haul Road Workgroup Memorandum (EPA 2012). The initial lateral and vertical dispersion coefficients for the haul road VOLUME sources were determined according to the Haul Road Workgroup Memorandum (EPA 2012). Fugitive dust and tailpipe emissions associated with each haul road route were distributed equally among the segments for that route. Where two haul road routes overlap, the emissions were combined for that road section. The haul road network is also shown in Figure 2.

3.6 Coordinate System

The Universal Transverse Mercator (UTM) coordinate system projected in North American Datum of 1983 (NAD83), Zone 11 was used in the modeling analysis to define all locations in the modeling domain (sources, buildings, and receptors).

3.7 Building Downwash

The effects of building-induced downwash were incorporated into this modeling analysis. Building downwash parameters were calculated using the most recent version of the Building Profile Input Program (BPIP) with the Plume Rise Model Enhancement (PRIME) algorithm (BPIP-PRIME version 04274).

3.8 Receptors

Consistent with other recent NEPA analyses in Nevada, a series of nested receptor grids was used to assess ground-level impacts from the Project's air emissions:

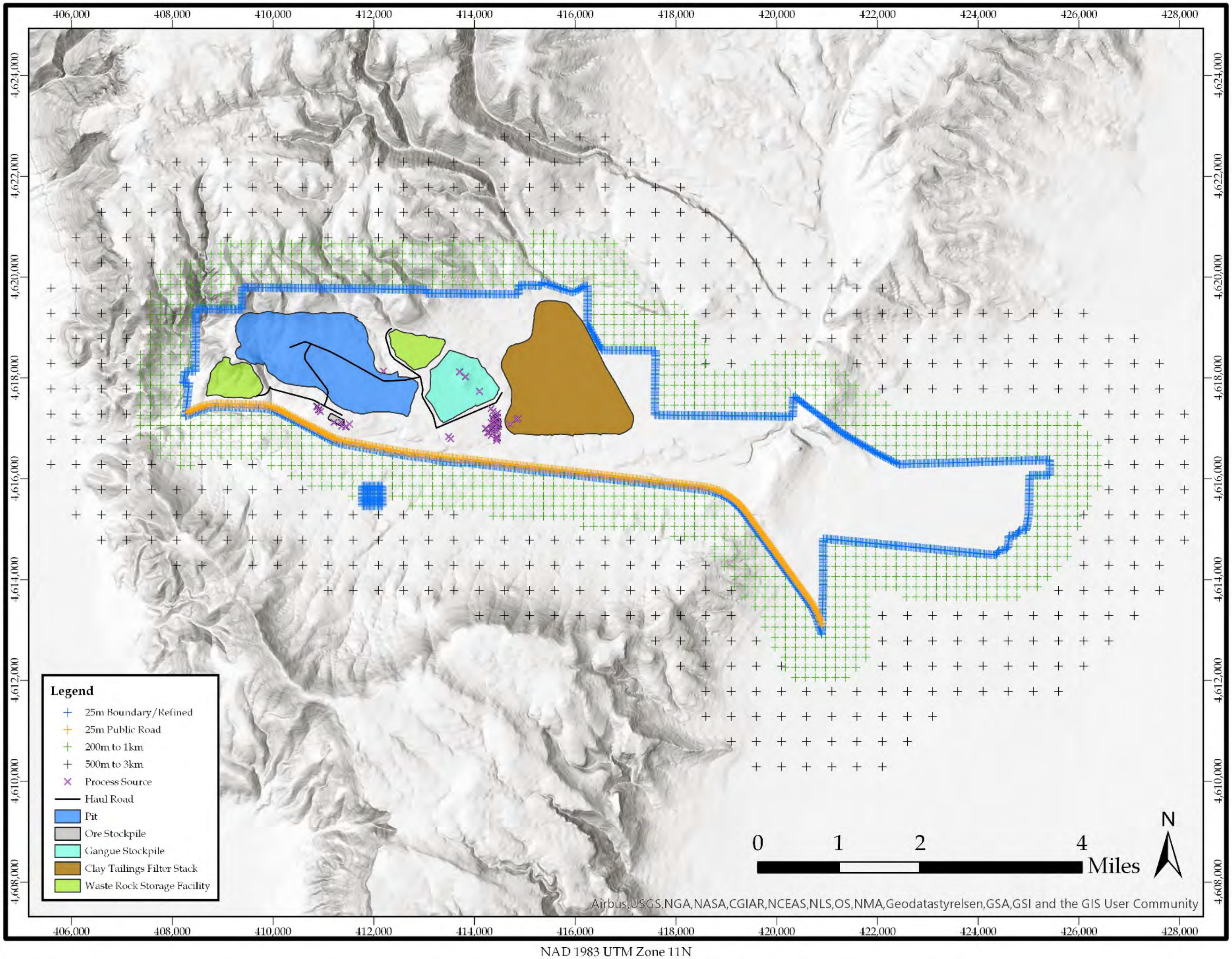
- Near-field receptors at 200-meter spacing, out to 1 km from the modeling boundary
- Far-field receptors at 500-meter spacing, out to 3 km from the modeling boundary

In addition, the modeling analysis included receptors at 25-meter spacing located along the modeling boundary. This modeling boundary delineates where public access is restricted and follows the Plan of Operations boundary. A combination of fences, gates, berms, signs, and terrain will be used along the boundary to restrict public access. Receptors within the modeling boundary were not modeled, with the exception of receptors placed at 25-meter spacing along State Route 293, which runs inside the southern edge of the Plan of Operations boundary. The modeled receptors are shown in Figure 3.

Finally, based on initial modeling runs, maximum impacts for SO_2 (1-hour and 3-hour average) were found to be located in the near-field receptor grid, south of the modeling boundary. Thus, additional receptors at 25-meter spacing were used to evaluate impacts at this location; the additional fine receptor grid is also shown in Figure 3.

All receptors were processed with the AERMOD terrain preprocessor AERMAP (version 18081) to generate receptor terrain elevations and hill height values using 1/3-Arc-Second National Elevation Dataset elevation data obtained from The National Map server (https://viewer.nationalmap.gov/basic) maintained and distributed by the United States Geological Survey. Following the EPA's instructions, the data were download in ArcGrid format and converted to a GeoTIFF file format that is compatible with AERMAP.

Figure 3. Modeled Receptors



3.9 Meteorological Data

AERMOD requires the input of hourly meteorological data to estimate pollutant concentrations in the ambient air resulting from modeled source emissions. The EPA's Guideline on Air Quality Models (40 CFR 51, Appendix W) states that one year of site-specific data or five years of representative hourly surface data should be used for AERMOD dispersion modeling.

This analysis was conducted using one year (4/18/2012–4/17/2013) of site-specific surface meteorological data combined with concurrent upper-air meteorological data from Elko, Nevada. AERMOD-ready meteorological data files were provided by the Nevada Division of Environmental Protection, Bureau of Air Quality Planning (NDEP-BAQP) on August 27, 2019. These files were processed by NDEP-BAQP using version 19191 of the AERMOD meteorological preprocessor AERMET, including adjusted u* (ADJ_U*) processing.

3.10 Background Concentrations

Monitored pollutant concentrations, termed *background concentrations*, are considered to be representative of prevailing air pollution from the existing sources in the region. These background concentrations are added to the modeled ambient impacts from project emissions to estimate the total ambient concentrations at the modeled receptor locations.

Table 13 provides the NDEP-approved background concentrations (in units of micrograms per cubic meter, or $\mu g/m^3$) for air quality impact analyses for projects located in rural areas in Nevada.

Table 13. NDEP-Approved Background Concentrations for Rural Areas of Nevada

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)
CO	8-hour	0
	1-hour	0
H_2S	1-hour	0
NO_2	Annual	0
	1-hour	0
$PM_{2.5}$	Annual	2.3
	24-hour	8
PM_{10}	24-hour	10.2
SO_2	3-hour	0
	1-hour	0

As shown in Table 13, background concentrations of CO, H_2S, NO_2, and SO_2 are considered negligible in rural Nevada by NDEP (NDEP 2017). However, to determine non-zero representative background concentrations for CO, NO_2, and SO_2, a review of nearby ambient monitoring stations collecting CO, NO_2, and SO_2 data that are representative of rural areas, such as the project location, was conducted.

Taking into consideration the surrounding settings (terrain, land use, and proximity of sources), the ambient monitoring data collected at station 06-043-0003 (Yosemite National Park–Turtleback Dome [Yosemite]) in California may be used to provide representative background concentrations for rural areas in Nevada. This station collected CO and NO_2 background concentrations in 2006 and 2007 but not SO_2 data. For similar reasons, monitoring station 06-027-0002 (White Mountain Research Center–Owens Valley Lab [White Mountain]) in California may be considered representative of a rural area in Nevada for conservative SO_2 background concentrations. Both stations (Yosemite and White Mountain in California) are in relatively rural settings in terms of nearby population centers and traffic activity. Ambient monitoring data from these stations were downloaded from the EPA's Air Data Webpage (EPA 2018).

Table 14 provides the proposed representative background concentrations (in units of µg/m^3 and parts per billion [ppb]) for the Project. These background data are a combination of the NDEP-approved H_2S, PM_{10}, and $PM_{2.5}$ background concentrations for rural Nevada and the CO, NO_2, and SO_2 background concentrations measured at the Yosemite and White Mountain stations.

Table 14. Representative Background Concentrations

Pollutant	Averaging Period	Baseline Concentration (ppb)	Baseline Concentration (µg/m^3)	Data Source
CO	8-hour	700	801.4	Yosemite 2006–2007 (highest second high)
	1-hour	900	1,030.4	Yosemite 2006–2007 (highest second high)
H_2S	1-hour	--	0	NDEP approved
NO_2	Annual	1.02	1.9	Yosemite 2006–2007 (annual mean)
	1-hour	4.90	9.2	Yosemite 2006–2007 (average 98th percentile)
$PM_{2.5}$	Annual	--	2.3	NDEP approved
	24-hour	--	8	NDEP approved
PM_{10}	24-hour	--	10.2	NDEP approved
SO_2	3-hour	0.5	1.3	White Mountain 2016–2018 (highest second high)
	1-hour	0.4	1.1	White Mountain 2016–2018 (average 99th percentile)

The EPA trends data show that CO and NO_2 concentrations in the western region (Nevada and California) decreased by 27% and 24%, respectively, from 2007 to 2017 (EPA 2017). Thus, the

Yosemite station 2006–2007 CO and NO_2 background concentrations shown in Table 14 provide a conservatively high estimate of current background concentrations.

3.11 Ambient Air Quality Standards

Ambient air quality standards are maximum concentrations of pollutants in ambient air that are considered protective of public health. These standards are established by environmental regulatory authorities for air pollutants with known or anticipated human health effects. The estimated total ambient concentrations (modeled concentrations plus applicable background concentrations) from this analysis were compared with the EPA-promulgated National Ambient Air Quality Standards (NAAQS) for compliance demonstration. The NAAQS, in units of parts per million (ppm) and/or µg/m^3, are shown in Table 15.

Table 15. NAAQS for Compliance Demonstration

Pollutant	Averaging Period	NAAQS (ppm)	NAAQS (µg/m^3)	Form
CO	8-hour	9	10,000	Not to be exceeded more than once per year
	1-hour	35	40,000	
NO_2	Annual	0.053	100	Annual mean
	1-hour	0.1	188	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
$PM_{2.5}$	Annual	N/A	12	Annual mean, averaged over 3 years
	24-hour	N/A	35	98th percentile, averaged over 3 years
PM_{10}	24-hour	N/A	150	Not to be exceeded more than once per year, on average, over 3 years
SO_2	3-hour	0.5	1,300	Not to be exceeded more than once per year
	1-hour	0.075	196	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

In addition to the criteria pollutants listed in Table 15, the EPA has also promulgated a NAAQS for the ozone 8-hour averaging period. However, unlike the other criteria pollutants, ozone is not directly emitted from industrial sources. Instead, it is formed through a series of complex photochemical reactions involving volatile organic compounds (VOCs), nitrogen oxides (NO_X), and other gases in the atmosphere on a regional scale. Therefore, ozone impacts cannot be modeled using AERMOD.

Even though source-specific ozone impacts were not modeled, ambient conditions pertaining to the ozone formation potential of the Project were evaluated. The Project is located in a rural setting, away from the influence of urban/metropolitan area ozone precursor emissions. The area surrounding the Project is sparsely populated and used primarily for ranching and farming. Accordingly, ozone levels at the Project area are in attainment with the ozone NAAQS (EPA 2019b).

The latest data from the EPA's National Emissions Inventory (NEI) report dashboard indicates that Humboldt County emissions of NO_X and VOC (i.e., ozone precursors) in 2014 (latest year of comprehensive data summaries available), from all sources, were approximately 7,866 tons of NO_X per year and 76,852 tons of VOC per year (EPA 2019c). For comparison, the Project's Phase 2 NO_X and VOC emissions represent a very small fraction of the countywide emissions at approximately 699 tons per year and 103 tons per year, respectively. Given the levels of ozone precursor emissions from the Project, the Project's contribution to ozone formation is not expected to be significant and the Project is not expected to cause or contribute to an exceedance of the ambient standards for ozone.

The EPA has also promulgated a NAAQS for lead (Pb); however, Pb emissions at the Project are negligible (less than 0.01 ton/yr), and therefore, Pb is not addressed further.

3.12 Modeling Methodology

Regulatory default options in AERMOD were used to estimate the ground-level concentrations for all the pollutants and averaging periods. The modeling approach for NO_2 and the treatment of intermittent emissions for 1-hour analyses are detailed in the following subsections.

3.12.1 NO_2 Modeling Method

The NO_X emissions from combustion sources are principally composed of nitrogen oxide (NO) and NO_2. Once in the atmosphere, NO is converted to NO_2 through the following chemical reaction with ambient O_3:

$$NO + O_3 \rightarrow NO_2 + O_2$$

Currently, the EPA's Guideline on Air Quality Models (40 CFR 51, Appendix W) presents a three-tiered approach to convert annual NO_X impacts to annual NO_2 impacts for comparison with the annual NO_2 NAAQS. In the EPA memoranda dated June 28, 2010 and March 1, 2011, (EPA 2010) and (EPA 2011), the applicability of 40 CFR 51, Appendix W is further discussed in the context of modeling for compliance with the 1-hour NO_2 standard. To address the atmospheric conversion process, the Ozone Limiting Method (OLM) with the combined plume option (keywords OLMGROUP ALL) was used to estimate the NO_2 impacts for this analysis.

The additional input parameters for the OLM option include the following:

- Background O_3 Concentrations: The use of the OLM option in AERMOD requires the input of background O_3 concentrations. The O_3 concentration values may be input as a single value, as hourly values to correspond with the meteorological data, or as a temporally varying profile. Hourly O_3 background concentration data from the Great Basin National Park monitoring station for April 18, 2012 through April 17, 2013 (concurrent with the on-site meteorological data) were used for this analysis. These O_3 data are obtained from the EPA's Clean Air Status and Trends Network database.

Missing hourly O_3 values were filled by conservatively using the 90th percentile hourly O_3 concentration for April 18, 2012 through April 17, 2013.

- Ambient Equilibrium NO_2/NO_X Ratio: The AERMOD default NO_2/NO_X ambient equilibrium ratio of 0.90 was used for this analysis.
- In-Stack NO_2/NO_X Ratio: Pertinent literature, stack tests, and previous NEPA analyses were reviewed to determine appropriate in-stack NO_2/NO_X ratios for each NO_X-emitting source. The San Joaquin Valley Air Pollution Control District (SJVAPCD) has provided recommended NO_2/NO_X in-stack ratios for a variety of source categories in the California Air Pollution Control Officers Association (CAPCOA)'s guidance document for NO_2 1-hour modeling (CAPCOA 2011). The SJVAPCD recommends an NO_2/NO_X in-stack ratio in the range of 6% to 11% for heavy-duty diesel trucks. The highest value from the range, 11%, was used for this analysis. The SJVAPCD also recommends a default ratio of 20% for diesel-fired internal combustion (IC) engines and 10% for natural-gas-fired IC engines. For blasting, an NO_2/NO_X in-stack ratio of 3.6% was used. This value is based on a study of NO_X emissions from blasting at open-pit coal mining operations (CSIRO 2008). For the diesel boilers, EPA's NO_2/NO_X in-stack ratio database was reviewed, and an NO_2/NO_X in-stack ratio of 0.74% for diesel boilers at 100% load was used (EPA 2019a). The EPA default NO_2/NO_X in-stack ratio of 50% was used for all unconventional NO_X-emitting sources (e.g., sulfuric acid plant) (EPA 2011).

3.12.2 Treatment of Intermittent Emissions for 1-Hour Analyses

In its guidance on NO_2 and SO_2 1-hour modeling (EPA 2011), the EPA has recognized that intermittent sources that do not operate continuously or frequently enough, specifically emergency generators, are less likely to contribute significantly to the annual distribution of daily maximum 1-hour values. The EPA recommends "that compliance demonstrations for the 1-hour NO_2 NAAQS be based on emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations" (EPA 2011).

The Project will include emergency generators to supply power to critical networks and equipment in the event that the normal power supply is interrupted. The potential to emit for these generators was determined using the 100 hours per year allowed by the applicable New Source Performance Standards (NSPS)/National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations for maintenance and readiness testing; however, emergency generators typically operate for only a few hours and on a random schedule. Thus, the operation of emergency generators is not frequent enough to significantly contribute to the annual distribution of daily maximum 1-hour concentrations. As such, the inclusion of the maximum hourly emission rate does not represent a logical emission scenario. Therefore, emissions from the intermittently operating generators were based on an average hourly rate, rather than the maximum hourly emissions for the 1-hour analyses.

3.13 Cumulative Analysis

The air quality cumulative effect study area (CESA) for the Project is defined as the two airsheds in which the project is located (Quinn River Valley and Kings River Valley Hydrographic Areas, HA 33A and 30A, respectively). No other sources of significant air emissions are located within the CESA boundary, and therefore no large nearby sources were included in the modeling analysis. Potential impacts from small nearby sources, including agricultural activities and traffic, are included in the background concentrations, as discussed in Section 3.10, to estimate the total cumulative impacts.

3.14 Model Results and Compliance with NAAQS and NvAAQS

The modeled maximum concentrations and the estimated total ambient concentrations (modeled concentrations plus background concentrations) and their comparison with the applicable NAAQS are presented in Table 16. In addition, the estimated total ambient concentrations are also compared with the corresponding NvAAQS.

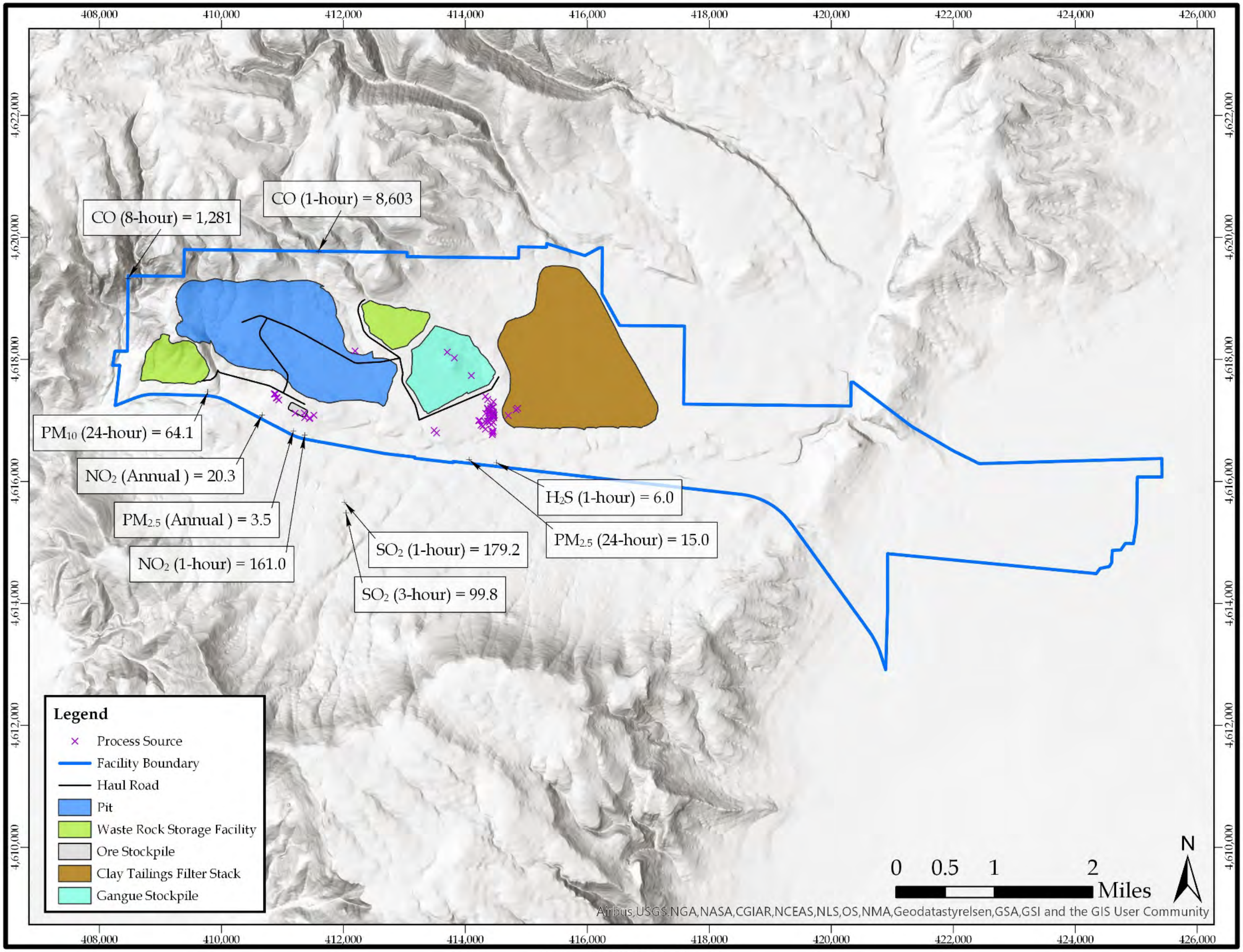
Table 16. Model Results and Comparison with NAAQS and NvAAQS

Pollutant	Averaging Period	Modeled Impact (µg/m³)	Background Concentration (µg/m³)	Total Impact (µg/m³)	NAAQS (µg/m³)	NvAAQS (µg/m³)	Compliance
CO	8-hour[a]	1,280.5	801.4	2,081.9	10,000	7,000[f]	Yes
	1-hour[a]	8,602.8	1,030.4	9,633.2	40,000	40,500	Yes
H_2S	1-hour[e]	6.0	0	6.0	---	112	Yes
NO_2	Annual	20.3	1.9	22.2	100	100	Yes
	1-hour[b]	161.0	9.2	170.2	188	188	Yes
$PM_{2.5}$	Annual	3.5	2.3	5.8	12	12	Yes
	24-hour[c]	15.0	8.0	23.0	35	35	Yes
PM_{10}	24-hour[a]	64.1	10.2	74.3	150	150	Yes
SO_2	3-hour[a]	99.8	1.3	101.1	1,300	1,300	Yes
	1-hour[d]	179.2	1.1	180.3	196	196	Yes

[a] Highest second-high modeled concentration
[b] Highest eighth-high daily maximum 1-hour modeled concentration
[c] Highest eighth-high modeled concentration
[d] Highest fourth-high modeled concentration
[e] Highest first-high modeled concentration
[f] This NvAAQS is 7,000 µg/m³ for sites above 5,000 feet of elevation.

As shown in Table 16, the estimated maximum total ambient concentrations for all the pollutants and averaging periods are below the applicable NAAQS and NvAAQS. The locations of the maximum modeled impacts are shown in Figure 4. As depicted in this figure, the maximum impacts occur at the modeling boundary or at State Route 293 (which is located adjacent to the modeling boundary) for all pollutants and averaging periods with the exception of the maximum impacts for 1-hour and 3-hour SO_2, which occur to the south of the modeling boundary on a refined 25-meter receptor grid.

Figure 4. Locations of the Maximum Modeled Impacts (µg/m³)



3.15 Class I Area AQRV Impact Analysis

In addition to the assessment of short-range air quality impacts from the Project, the potential impacts to air quality related values (AQRVs), including visibility, O_3, and deposition at Federal Class I areas, were also analyzed. The nearest Class I area to the Project is the South Warner Wilderness, located approximately 170 kilometers to the west. The Jarbidge Wilderness is the next closest, located approximately 200 kilometers to the east of the Project. Given that the nearest Class I area is more than 50 kilometers from the Project, in accordance with the Federal Land Managers' Air Quality Related Values Work Group (FLAG) Guidance, an initial screening test using size of emissions (Q) divided by distance (D) (Q/D test) was conducted to determine if further AQRV review would be required (USFS 2010). Using the total SO_2, NO_X, PM_{10}, and H_2SO_4 annual emissions from the Project (984 tons per year), divided by the distance to the South Warner Wilderness (170 kilometers), provides a Q/D value of 5.8. As specified in the FLAG Guidance, because the Project is located more than 50 kilometers from a Class I area and has a Q/D value of less than 10, the Project is considered to have negligible impacts to Class I AQRVs, and no further analysis is required.

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Appendix A: Emission Inventory and Modeling Parameters

Phase 2 Facility-Wide Emissions

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
	PROJECT NO: 270-3-3	PAGE: 1 OF: 1 SHEET: Summary
AIR EMISSION CALCULATIONS	SUBJECT: Summary	DATE: December 13, 2019

Project Phase **Phase 2**

Facility-Wide Emissions

	chk	chk	chk	chk	chk	chk
	PM10	PM2.5	CO	NOX	SO2	VOC
Activity	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr
Process	96.3	84.5	1.8	81.2	76.1	35.2
Fugitive	114.6	31.4	285.9	587.7	0.7	67.6
Total	210.9	115.9	287.7	668.9	76.8	102.8

Short-Term Facility-Wide Emissions

	chk	chk	chk	chk	chk	chk
	PM10	PM2.5	CO	NOX	SO2	H2S
Activity	lb/day	lb/day	lb/hr	lb/hr	lb/hr	lb/hr
Process	887.1	788.3	14.7	61.1	18.3	0.7
Fugitive	1,421.0	217.9	3,101.4	215.7	0.4	-
Total	2,308.1	1,006.2	3,116.0	276.8	18.7	0.7

Facility-Wide Emissions - HAP, GHG, & Other Regulated Pollutants

	chk	chk	chk	chk
	HAP	GHG	H2S	H2SO4
Activity	ton/yr	ton/yr	ton/yr	ton/yr
Process	0.58	42,656	0.86	27.85
Fugitive Dust	0.48	-	-	-
Mobile Tailpipes	1.29	89,932	-	-
Total	2.34	132,588	0.86	27.85

Sulfuric Acid Plant Emissions

		PM10	PM2.5	CO	NOX	SO2	VOC	H2S	H2SO4
Activity		ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr
Sulfuric Acid Plant Sources	SAP	29.5	29.3	1.6	81.0	76.1	0.1	0.7	25.6

Phase 2 Process Source Emissions

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
CR_1	Primary Crusher 1 and associated transfers in (from Feeder 1) and out (to Sizer 1 Feed Conveyor)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.0054	0.0024	0.0004						lb/ton	*AP-42 Table 11.19.2-2 (08/04) tert. crush unctrl. (NDEP 2017)*	Water Sprays	75%
SIZ_1	Mineral Sizer 1 and associated transfers in (from Sizer 1 Feed Conveyor) and out (to Scrubber 1 Feed Bin Conveyor)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.0054	0.0024	0.0004						lb/ton	*AP-42 Table 11.19.2-2 (08/04) tert. crush unctrl. (NDEP 2017)*	Water Sprays	75%
ATT_1	Scrubber 1 Feed Bin Conveyor to Scrubber 1 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 1 (wet process)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
CR_2	Primary Crusher 2 and associated transfers in (from Feeder 2) and out (to Sizer 2 Feed Conveyor)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.0054	0.0024	0.0004						lb/ton	*AP-42 Table 11.19.2-2 (08/04) tert. crush unctrl. (NDEP 2017)*	Water Sprays	75%
SIZ_2	Mineral Sizer 2 and associated transfers in (from Sizer 2 Feed Conveyor) and out (to Scrubber 2 Feed Bin Conveyor)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.0054	0.0024	0.0004						lb/ton	*AP-42 Table 11.19.2-2 (08/04) tert. crush unctrl. (NDEP 2017)*	Water Sprays	75%
ATT_2	Scrubber 2 Feed Bin Conveyor to Scrubber 2 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 2 (wet process)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
WSX_1	Wet Screening 1 transfer to Oversize Conveyor 1	6	144	44,676	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
OSTK_1	Oversize Conveyor 1 to Oversize Stockpile 1	6	144	44,676	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
WSX_2	Wet Screening 2 transfer to Oversize Conveyor 2	6	144	44,676	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
OSTK_2	Oversize Conveyor 2 to Oversize Stockpile 2	6	144	44,676	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GSC_1	Gangue Dewatering Screen 1 transfer to Gangue Conveyor 1	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX1_1	Gangue Conveyor 1 to Gangue Conveyor 2	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX2_1	Gangue Conveyor 2 to Gangue Conveyor 3	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX3_1	Gangue Conveyor 3 to Gangue Stacking Conveyor 1	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GSTK_1	Gangue Stacking Conveyor 1 to Gangue Stockpile 1	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GSC_2	Gangue Dewatering Screen 2 transfer to Gangue Conveyor 4	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX4_2	Gangue Conveyor 4 to Gangue Conveyor 5	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX5_2	Gangue Conveyor 5 to Gangue Conveyor 6	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX6_2	Gangue Conveyor 6 to Gangue Stacking Conveyor 2	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GSTK_2	Gangue Stacking Conveyor 2 to Gangue Stockpile 2	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
LCHT_1	Leach Tanks 1				-	Slurry	24	7,446		*(LNC 2019a)*	0.73	0.73	0.73						lb/hr	*(LNC 2019a), (Rabe 2019)*	Wet Scrubber	
LCHF_1	Leach 1 Filter System				-	Slurry	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						lb/hr	*(LNC 2019a)*	Wet Scrubber	
LCHV_1	Leach 1 Filter Vent				-	Slurry	24	496		*(LNC 2019a)*	0.37	0.37	0.37						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LCHT_2	Leach Tanks 2				-	Slurry	24	7,446		*(LNC 2019a)*	0.73	0.73	0.73						lb/hr	*(LNC 2019a), (Rabe 2019)*	Wet Scrubber	
LCHF_2	Leach 2 Filter System				-	Slurry	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						lb/hr	*(LNC 2019a)*	Wet Scrubber	
LCHV_2	Leach 2 Filter Vent				-	Slurry	24	496		*(LNC 2019a)*	0.37	0.37	0.37						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LHOP_1	Neutralization Lime Feed Hopper 1 loading	12	288	5,760	ton	Lime	24	480		*(LNC 2019a)*	0.0048	0.0028	0.0004						lb/ton	*AP-42 Table 11.12-2 (06/06) hopper loading unctrl. (NDEP 2017)*	Enclosure	50%

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
CR_1	Primary Crusher 1 and associated transfers in (from Feeder 1) and out (to Sizer 1 Feed Conveyor)	0.675	0.300	0.045						16.200	7.200	1.090						2.513	1.117	0.169					
SIZ_1	Mineral Sizer 1 and associated transfers in (from Sizer 1 Feed Conveyor) and out (to Scrubber 1 Feed Bin Conveyor)	0.675	0.300	0.045						16.200	7.200	1.090						2.513	1.117	0.169					
ATT_1	Scrubber 1 Feed Bin Conveyor to Scrubber 1 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 1 (wet process)	1.536	1.536	1.536						36.864	36.864	36.864						5.719	5.719	5.719					
CR_2	Primary Crusher 2 and associated transfers in (from Feeder 2) and out (to Sizer 2 Feed Conveyor)	0.675	0.300	0.045						16.200	7.200	1.090						2.513	1.117	0.169					
SIZ_2	Mineral Sizer 2 and associated transfers in (from Sizer 2 Feed Conveyor) and out (to Scrubber 2 Feed Bin Conveyor)	0.675	0.300	0.045						16.200	7.200	1.090						2.513	1.117	0.169					
ATT_2	Scrubber 2 Feed Bin Conveyor to Scrubber 2 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 2 (wet process)	1.536	1.536	1.536						36.864	36.864	36.864						5.719	5.719	5.719					
WSX_1	Wet Screening 1 transfer to Oversize Conveyor 1	0.003	0.001	0.000						0.065	0.024	0.004						0.010	0.004	0.001					
OSTK_1	Oversize Conveyor 1 to Oversize Stockpile 1	0.003	0.001	0.000						0.065	0.024	0.004						0.010	0.004	0.001					
WSX_2	Wet Screening 2 transfer to Oversize Conveyor 2	0.003	0.001	0.000						0.065	0.024	0.004						0.010	0.004	0.001					
OSTK_2	Oversize Conveyor 2 to Oversize Stockpile 2	0.003	0.001	0.000						0.065	0.024	0.004						0.010	0.004	0.001					
GSC_1	Gangue Dewatering Screen 1 transfer to Gangue Conveyor 1	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX1_1	Gangue Conveyor 1 to Gangue Conveyor 2	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX2_1	Gangue Conveyor 2 to Gangue Conveyor 3	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX3_1	Gangue Conveyor 3 to Gangue Stacking Conveyor 1	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GSTK_1	Gangue Stacking Conveyor 1 to Gangue Stockpile 1	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GSC_2	Gangue Dewatering Screen 2 transfer to Gangue Conveyor 4	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX4_2	Gangue Conveyor 4 to Gangue Conveyor 5	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX5_2	Gangue Conveyor 5 to Gangue Conveyor 6	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX6_2	Gangue Conveyor 6 to Gangue Stacking Conveyor 2	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GSTK_2	Gangue Stacking Conveyor 2 to Gangue Stockpile 2	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
LCHT_1	Leach Tanks 1	0.730	0.730	0.730						17.520	17.520	17.520						2.718	2.718	2.718					
LCHF_1	Leach 1 Filter System	0.020	0.020	0.020						0.480	0.480	0.480						0.074	0.074	0.074					
LCHV_1	Leach 1 Filter Vent	0.370	0.370	0.370						8.880	8.880	8.880						0.092	0.092	0.092					
LCHT_2	Leach Tanks 2	0.730	0.730	0.730						17.520	17.520	17.520						2.718	2.718	2.718					
LCHF_2	Leach 2 Filter System	0.020	0.020	0.020						0.480	0.480	0.480						0.074	0.074	0.074					
LCHV_2	Leach 2 Filter Vent	0.370	0.370	0.370						8.880	8.880	8.880						0.092	0.092	0.092					
LHOP_1	Neutralization Lime Feed Hopper 1 loading	0.029	0.017	0.003						0.691	0.403	0.061						0.007	0.004	0.001					

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
CR_1	Primary Crusher 1 and associated transfers in (from Feeder 1) and out (to Sizer 1 Feed Conveyor)	411,210	4,617,120	1,521.1	VOLUME	6	3.5	6	9	elev src w/o bldg	0.0378	0.0057						0.0049			1.8288	0.25	0.4253		
SIZ_1	Mineral Sizer 1 and associated transfers in (from Sizer 1 Feed Conveyor) and out (to Scrubber 1 Feed Bin Conveyor)	411,365	4,617,047	1,513.9	VOLUME	9	3.5	6	12	elev src w/o bldg	0.0378	0.0057						0.0049			2.7432	0.25	0.4253		
ATT_1	Scrubber 1 Feed Bin Conveyor to Scrubber 1 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 1 (wet process)	411,443	4,617,031	1,507.5	POINT	40	Ambient	12,800	15,340	1.5	0.1935	0.1935						0.1645			12.1920	0.00	44.0969	0.4572	
CR_2	Primary Crusher 2 and associated transfers in (from Feeder 2) and out (to Sizer 2 Feed Conveyor)	411,210	4,617,120	1,521.1	VOLUME	6	3.5	6	9	elev src w/o bldg	0.0378	0.0057						0.0049			1.8288	0.25	0.4253		
SIZ_2	Mineral Sizer 2 and associated transfers in (from Sizer 2 Feed Conveyor) and out (to Scrubber 2 Feed Bin Conveyor)	411,365	4,617,047	1,513.9	VOLUME	9	3.5	6	12	elev src w/o bldg	0.0378	0.0057						0.0049			2.7432	0.25	0.4253		
ATT_2	Scrubber 2 Feed Bin Conveyor to Scrubber 2 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 2 (wet process)	411,443	4,617,031	1,507.5	POINT	40	Ambient	12,800	15,340	1.5	0.1935	0.1935						0.1645			12.1920	0.00	44.0969	0.4572	
WSX_1	Wet Screening 1 transfer to Oversize Conveyor 1	411,452	4,617,038	1,507.5	VOLUME	5	3	6	8	elev src w/o bldg	0.0001	0.0000						0.0000			1.5240	0.21	0.4253		
OSTK_1	Oversize Conveyor 1 to Oversize Stockpile 1	411,358	4,617,120	1,520.0	VOLUME	15	1.5	30	30	srf src	0.0001	0.0000						0.0000			4.5720	0.11	4.2530		
WSX_2	Wet Screening 2 transfer to Oversize Conveyor 2	411,452	4,617,038	1,507.5	VOLUME	5	3	6	8	elev src w/o bldg	0.0001	0.0000						0.0000			1.5240	0.21	0.4253		
OSTK_2	Oversize Conveyor 2 to Oversize Stockpile 2	411,358	4,617,120	1,520.0	VOLUME	15	1.5	30	30	srf src	0.0001	0.0000						0.0000			4.5720	0.11	4.2530		
GSC_1	Gangue Dewatering Screen 1 transfer to Gangue Conveyor 1	414,366	4,617,342	1,441.4	VOLUME	5	4	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.28	0.4253		
GX1_1	Gangue Conveyor 1 to Gangue Conveyor 2	414,328	4,617,395	1,446.9	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GX2_1	Gangue Conveyor 2 to Gangue Conveyor 3	414,098	4,617,735	1,463.2	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GX3_1	Gangue Conveyor 3 to Gangue Stacking Conveyor 1	413,820	4,618,025	1,497.3	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GSTK_1	Gangue Stacking Conveyor 1 to Gangue Stockpile 1	413,703	4,618,120	1,498.2	VOLUME	25	3.5	50	50	srf src	0.0041	0.0006						0.0005			7.6200	0.25	7.0884		
GSC_2	Gangue Dewatering Screen 2 transfer to Gangue Conveyor 4	414,366	4,617,342	1,441.4	VOLUME	5	4	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.28	0.4253		
GX4_2	Gangue Conveyor 4 to Gangue Conveyor 5	414,328	4,617,395	1,446.9	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GX5_2	Gangue Conveyor 5 to Gangue Conveyor 6	414,098	4,617,735	1,463.2	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GX6_2	Gangue Conveyor 6 to Gangue Stacking Conveyor 2	413,820	4,618,025	1,497.3	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GSTK_2	Gangue Stacking Conveyor 2 to Gangue Stockpile 2	413,703	4,618,120	1,498.2	VOLUME	25	3.5	50	50	srf src	0.0041	0.0006						0.0005			7.6200	0.25	7.0884		
LCHT_1	Leach Tanks 1	414,459	4,617,304	1,441.4	POINT	110	248	15,300	24,590	2.5	0.0920	0.0920						0.0782			33.5280	393.15	25.4479	0.7620	
LCHF_1	Leach 1 Filter System	414,387	4,617,078	1,439.8	POINT	110	Ambient	952	952	1.0	0.0025	0.0025						0.0021			33.5280	0.00	6.1576	0.3048	
LCHV_1	Leach 1 Filter Vent	414,431	4,617,078	1,439.8	POINT	60	Ambient	3,750	3,750	1.0	0.0466	0.0466						0.0026			18.2880	0.00	24.2552	0.3048	
LCHT_2	Leach Tanks 2	414,459	4,617,304	1,441.4	POINT	110	248	15,300	24,590	2.5	0.0920	0.0920						0.0782			33.5280	393.15	25.4479	0.7620	
LCHF_2	Leach 2 Filter System	414,387	4,617,078	1,439.8	POINT	110	Ambient	952	952	1.0	0.0025	0.0025						0.0021			33.5280	0.00	6.1576	0.3048	
LCHV_2	Leach 2 Filter Vent	414,431	4,617,078	1,439.8	POINT	60	Ambient	3,750	3,750	1.0	0.0466	0.0466						0.0026			18.2880	0.00	24.2552	0.3048	
LHOP_1	Neutralization Lime Feed Hopper 1 loading	414,389	4,617,031	1,439.8	VOLUME	4	6	8	8	srf src	0.0021	0.0003						0.0000			1.2192	0.43	1.1341		

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
LBUC_1	Neutralization Lime Feed Hopper 1 transfer to Neutralization Tanks 1 via Bucket Elevator	12	288	5,760	ton	Lime	24	480		*(LNC 2019a)*	0.0048	0.0028	0.0004						lb/ton	*AP-42 Table 11.12-2 (06/06) hopper loading unctrl. (NDEP 2017)*	Enclosure	50%
NEUT_1	Neutralization Tanks 1				-	Slurry	24	7,446		*(LNC 2019a)*	0.03	0.03	0.03						lb/hr	*(LNC 2019a)*	Wet Scrubber	
NEUV_1	Neutralization 1 Filter Vent				-	Slurry	24	124		*(LNC 2019a)*	0.29	0.29	0.29						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LHOP_2	Neutralization Lime Feed Hopper 2 loading	12	288	5,760	ton	Lime	24	480		*(LNC 2019a)*	0.0048	0.0028	0.0004						lb/ton	*AP-42 Table 11.12-2 (06/06) hopper loading unctrl. (NDEP 2017)*	Enclosure	50%
LBUC_2	Neutralization Lime Feed Hopper 2 transfer to Neutralization Tanks 2 via Bucket Elevator	12	288	5,760	ton	Lime	24	480		*(LNC 2019a)*	0.0048	0.0028	0.0004						lb/ton	*AP-42 Table 11.12-2 (06/06) hopper loading unctrl. (NDEP 2017)*	Enclosure	50%
NEUT_2	Neutralization Tanks 2				-	Slurry	24	7,446		*(LNC 2019a)*	0.03	0.03	0.03						lb/hr	*(LNC 2019a)*	Wet Scrubber	
NEUV_2	Neutralization 2 Filter Vent				-	Slurry	24	124		*(LNC 2019a)*	0.29	0.29	0.29						lb/hr	*(LNC 2019a)*	Mist Eliminator	
CTLF_1	Clay Tailings Filter 1 to CT Feeder 1	550	13,200	4,095,300	ton	Clay Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTLX_1	CT Feeder 1 to Tailings Conveyor 1 or 2	550	13,200	4,095,300	ton	Clay Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
NTLF_1	Neutralization Tailings Filter 1 to Neutralization Tails Feeder 1	211	5,064	1,571,106	ton	Neut. Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
NTLX_1	Neutralization Tails Feeder 1 to Tailings Conveyor 1	211	5,064	1,571,106	ton	Neut. Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
MGTL_1	Magnesium Sulfate Centrifuge 1 to Mg Screw Conveyor 1	96	2,304	714,816	ton	MgSO4 Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Enclosure	50%
MGTLX_1	Mg Screw Conveyor 1 to Tailings Conveyor 2	96	2,304	714,816	ton	MgSO4 Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	None	
STL_1	Sulfate Salts Centrifuge 1 to Sulfate Screw Conveyor 1	19	456	141,474	ton	Sulfate Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Enclosure	50%
STLX_1	Sulfate Screw Conveyor 1 to Tailings Conveyor 1	19	456	141,474	ton	Sulfate Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	None	
TLX1_1	Tailings Conveyor 1 to Tailings Conveyor 2	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
TLX2_1	Tailings Conveyor 2 to Tailings Conveyor 3	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
TLX3_1	Tailings Conveyor 3 to Tailings Stacker 1	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTSTK_1	Tailings Stacker 1 to Clay Tailing Filter Stack (CTFS) 1	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTLF_2	Clay Tailings Filter 2 to CT Feeder 2	550	13,200	4,095,300	ton	Clay Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTLX_2	CT Feeder 2 to Tailings Conveyor 4 or 5	550	13,200	4,095,300	ton	Clay Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
NTLF_2	Neutralization Tailings Filter 2 to Neutralization Tails Feeder 2	211	5,064	1,571,106	ton	Neut. Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
NTLX_2	Neutralization Tails Feeder 2 to Tailings Conveyor 4	211	5,064	1,571,106	ton	Neut. Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
MGTL_2	Magnesium Sulfate Centrifuge 2 to Mg Screw Conveyor 2	96	2,304	714,816	ton	MgSO4 Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Enclosure	50%
MGTLX_2	Mg Screw Conveyor 2 to Tailings Conveyor 5	96	2,304	714,816	ton	MgSO4 Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	None	
STL_2	Sulfate Salts Centrifuge 2 to Sulfate Screw Conveyor 2	19	456	141,474	ton	Sulfate Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Enclosure	50%
STLX_2	Sulfate Screw Conveyor 2 to Tailings Conveyor 4	19	456	141,474	ton	Sulfate Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	None	
TLX4_2	Tailings Conveyor 4 to Tailings Conveyor 5	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
TLX5_2	Tailings Conveyor 5 to Tailings Conveyor 6	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
TLX6_2	Tailings Conveyor 6 to Tailings Stacker 2	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTSTK_2	Tailings Stacker 2 to Clay Tailing Filter Stack (CTFS) 2	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
LBUC_1	Neutralization Lime Feed Hopper 1 transfer to Neutralization Tanks 1 via Bucket Elevator	0.029	0.017	0.003						0.691	0.403	0.061						0.007	0.004	0.001					
NEUT_1	Neutralization Tanks 1	0.030	0.030	0.030						0.720	0.720	0.720						0.112	0.112	0.112					
NEUV_1	Neutralization 1 Filter Vent	0.290	0.290	0.290						6.960	6.960	6.960						0.018	0.018	0.018					
LHOP_2	Neutralization Lime Feed Hopper 2 loading	0.029	0.017	0.003						0.691	0.403	0.061						0.007	0.004	0.001					
LBUC_2	Neutralization Lime Feed Hopper 2 transfer to Neutralization Tanks 2 via Bucket Elevator	0.029	0.017	0.003						0.691	0.403	0.061						0.007	0.004	0.001					
NEUT_2	Neutralization Tanks 2	0.030	0.030	0.030						0.720	0.720	0.720						0.112	0.112	0.112					
NEUV_2	Neutralization 2 Filter Vent	0.290	0.290	0.290						6.960	6.960	6.960						0.018	0.018	0.018					
CTLF_1	Clay Tailings Filter 1 to CT Feeder 1	0.248	0.091	0.014						5.940	2.178	0.330						0.921	0.338	0.051					
CTLX_1	CT Feeder 1 to Tailings Conveyor 1 or 2	0.248	0.091	0.014						5.940	2.178	0.330						0.921	0.338	0.051					
NTLF_1	Neutralization Tailings Filter 1 to Neutralization Tails Feeder 1	0.095	0.035	0.005						2.279	0.836	0.127						0.353	0.130	0.020					
NTLX_1	Neutralization Tails Feeder 1 to Tailings Conveyor 1	0.095	0.035	0.005						2.279	0.836	0.127						0.353	0.130	0.020					
MGTL_1	Magnesium Sulfate Centrifuge 1 to Mg Screw Conveyor 1	0.144	0.053	0.008						3.456	1.267	0.192						0.536	0.197	0.030					
MGTLX_1	Mg Screw Conveyor 1 to Tailings Conveyor 2	0.288	0.106	0.016						6.912	2.534	0.384						1.072	0.393	0.060					
STL_1	Sulfate Salts Centrifuge 1 to Sulfate Screw Conveyor 1	0.029	0.010	0.002						0.684	0.251	0.038						0.106	0.039	0.006					
STLX_1	Sulfate Screw Conveyor 1 to Tailings Conveyor 1	0.057	0.021	0.003						1.368	0.502	0.076						0.212	0.078	0.012					
TLX1_1	Tailings Conveyor 1 to Tailings Conveyor 2	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
TLX2_1	Tailings Conveyor 2 to Tailings Conveyor 3	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
TLX3_1	Tailings Conveyor 3 to Tailings Stacker 1	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
CTSTK_1	Tailings Stacker 1 to Clay Tailing Filter Stack (CTFS) 1	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
CTLF_2	Clay Tailings Filter 2 to CT Feeder 2	0.248	0.091	0.014						5.940	2.178	0.330						0.921	0.338	0.051					
CTLX_2	CT Feeder 2 to Tailings Conveyor 4 or 5	0.248	0.091	0.014						5.940	2.178	0.330						0.921	0.338	0.051					
NTLF_2	Neutralization Tailings Filter 2 to Neutralization Tails Feeder 2	0.095	0.035	0.005						2.279	0.836	0.127						0.353	0.130	0.020					
NTLX_2	Neutralization Tails Feeder 2 to Tailings Conveyor 4	0.095	0.035	0.005						2.279	0.836	0.127						0.353	0.130	0.020					
MGTL_2	Magnesium Sulfate Centrifuge 2 to Mg Screw Conveyor 2	0.144	0.053	0.008						3.456	1.267	0.192						0.536	0.197	0.030					
MGTLX_2	Mg Screw Conveyor 2 to Tailings Conveyor 5	0.288	0.106	0.016						6.912	2.534	0.384						1.072	0.393	0.060					
STL_2	Sulfate Salts Centrifuge 2 to Sulfate Screw Conveyor 2	0.029	0.010	0.002						0.684	0.251	0.038						0.106	0.039	0.006					
STLX_2	Sulfate Screw Conveyor 2 to Tailings Conveyor 4	0.057	0.021	0.003						1.368	0.502	0.076						0.212	0.078	0.012					
TLX4_2	Tailings Conveyor 4 to Tailings Conveyor 5	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
TLX5_2	Tailings Conveyor 5 to Tailings Conveyor 6	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
TLX6_2	Tailings Conveyor 6 to Tailings Stacker 2	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
CTSTK_2	Tailings Stacker 2 to Clay Tailing Filter Stack (CTFS) 2	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT / VOLUME	rel ht (ft) / rel ht (ft)	temp (F) / width (ft)	flow (dscfm) / vert. ln (ft)	flow (acfm) / grnd ht (ft)	dia (ft) / σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) / ht (m)	temp (K) / σy (m)	vel (m/s) / σz (m)	dia (m)	NO_2/NO_X ISR
LBUC_1	Neutralization Lime Feed Hopper 1 transfer to Neutralization Tanks 1 via Bucket Elevator	414,466	4,617,042	1,439.8	VOLUME	58	6	4	60	elev src w/ bldg	0.0021	0.0003						0.0000			17.6784	0.43	0.5671		
NEUT_1	Neutralization Tanks 1	414,466	4,617,042	1,439.8	POINT	110	Ambient	1,600	1,600	1.0	0.0038	0.0038						0.0032			33.5280	0.00	10.3489	0.3048	
NEUV_1	Neutralization 1 Filter Vent	414,430	4,617,033	1,439.8	POINT	60	Ambient	3,000	3,000	1.0	0.0365	0.0365						0.0005			18.2880	0.00	19.4042	0.3048	
LHOP_2	Neutralization Lime Feed Hopper 2 loading	414,389	4,617,031	1,439.8	VOLUME	4	6	8	8	srf src	0.0021	0.0003						0.0000			1.2192	0.43	1.1341		
LBUC_2	Neutralization Lime Feed Hopper 2 transfer to Neutralization Tanks 2 via Bucket Elevator	414,466	4,617,042	1,439.8	VOLUME	58	6	4	60	elev src w/ bldg	0.0021	0.0003						0.0000			17.6784	0.43	0.5671		
NEUT_2	Neutralization Tanks 2	414,466	4,617,042	1,439.8	POINT	110	Ambient	1,600	1,600	1.0	0.0038	0.0038						0.0032			33.5280	0.00	10.3489	0.3048	
NEUV_2	Neutralization 2 Filter Vent	414,430	4,617,033	1,439.8	POINT	60	Ambient	3,000	3,000	1.0	0.0365	0.0365						0.0005			18.2880	0.00	19.4042	0.3048	
CTLF_1	Clay Tailings Filter 1 to CT Feeder 1	414,443	4,617,076	1,439.8	VOLUME	9.5	4	15	17	elev src w/o bldg	0.0114	0.0017						0.0015			2.8956	0.28	1.0633		
CTLX_1	CT Feeder 1 to Tailings Conveyor 1 or 2	414,463	4,617,075	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0114	0.0017						0.0015			1.5240	0.25	0.4253		
NTLF_1	Neutralization Tailings Filter 1 to Neutralization Tails Feeder 1	414,443	4,617,058	1,439.8	VOLUME	9.5	2	15	17	elev src w/o bldg	0.0044	0.0007						0.0006			2.8956	0.14	1.0633		
NTLX_1	Neutralization Tails Feeder 1 to Tailings Conveyor 1	414,462	4,617,057	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0044	0.0007						0.0006			1.5240	0.25	0.4253		
MGTL_1	Magnesium Sulfate Centrifuge 1 to Mg Screw Conveyor 1	414,461	4,617,113	1,439.8	VOLUME	5	2	6	8	elev src w/o bldg	0.0067	0.0010						0.0009			1.5240	0.14	0.4253		
MGTLX_1	Mg Screw Conveyor 1 to Tailings Conveyor 2	414,475	4,617,089	1,439.8	VOLUME	5	0.83	6	8	elev src w/o bldg	0.0133	0.0020						0.0017			1.5240	0.06	0.4253		
STL_1	Sulfate Salts Centrifuge 1 to Sulfate Screw Conveyor 1	414,460	4,617,139	1,439.8	VOLUME	9.5	2	15	17	elev src w/o bldg	0.0013	0.0002						0.0002			2.8956	0.14	1.0633		
STLX_1	Sulfate Screw Conveyor 1 to Tailings Conveyor 1	414,463	4,617,081	1,439.8	VOLUME	5	0.50	6	8	elev src w/o bldg	0.0026	0.0004						0.0003			1.5240	0.04	0.4253		
TLX1_1	Tailings Conveyor 1 to Tailings Conveyor 2	414,464	4,617,089	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
TLX2_1	Tailings Conveyor 2 to Tailings Conveyor 3	414,704	4,617,081	1,429.7	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
TLX3_1	Tailings Conveyor 3 to Tailings Stacker 1	414,829	4,617,173	1,432.1	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
CTSTK_1	Tailings Stacker 1 to Clay Tailing Filter Stack (CTFS) 1	414,858	4,617,197	1,432.9	VOLUME	25	3.5	50	50	srf src	0.0182	0.0028						0.0023			7.6200	0.25	7.0884		
CTLF_2	Clay Tailings Filter 2 to CT Feeder 2	414,443	4,617,076	1,439.8	VOLUME	9.5	4	15	17	elev src w/o bldg	0.0114	0.0017						0.0015			2.8956	0.28	1.0633		
CTLX_2	CT Feeder 2 to Tailings Conveyor 4 or 5	414,463	4,617,075	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0114	0.0017						0.0015			1.5240	0.25	0.4253		
NTLF_2	Neutralization Tailings Filter 2 to Neutralization Tails Feeder 2	414,443	4,617,058	1,439.8	VOLUME	9.5	2	15	17	elev src w/o bldg	0.0044	0.0007						0.0006			2.8956	0.14	1.0633		
NTLX_2	Neutralization Tails Feeder 2 to Tailings Conveyor 4	414,462	4,617,057	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0044	0.0007						0.0006			1.5240	0.25	0.4253		
MGTL_2	Magnesium Sulfate Centrifuge 2 to Mg Screw Conveyor 2	414,461	4,617,113	1,439.8	VOLUME	5	2	6	8	elev src w/o bldg	0.0067	0.0010						0.0009			1.5240	0.14	0.4253		
MGTLX_2	Mg Screw Conveyor 2 to Tailings Conveyor 5	414,475	4,617,089	1,439.8	VOLUME	5	0.83	6	8	elev src w/o bldg	0.0133	0.0020						0.0017			1.5240	0.06	0.4253		
STL_2	Sulfate Salts Centrifuge 2 to Sulfate Screw Conveyor 2	414,460	4,617,139	1,439.8	VOLUME	9.5	2	15	17	elev src w/o bldg	0.0013	0.0002						0.0002			2.8956	0.14	1.0633		
STLX_2	Sulfate Screw Conveyor 2 to Tailings Conveyor 4	414,463	4,617,081	1,439.8	VOLUME	5	0.50	6	8	elev src w/o bldg	0.0026	0.0004						0.0003			1.5240	0.04	0.4253		
TLX4_2	Tailings Conveyor 4 to Tailings Conveyor 5	414,464	4,617,089	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
TLX5_2	Tailings Conveyor 5 to Tailings Conveyor 6	414,704	4,617,081	1,429.7	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
TLX6_2	Tailings Conveyor 6 to Tailings Stacker 2	414,829	4,617,173	1,432.1	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
CTSTK_2	Tailings Stacker 2 to Clay Tailing Filter Stack (CTFS) 2	414,858	4,617,197	1,432.9	VOLUME	25	3.5	50	50	srf src	0.0182	0.0028						0.0023			7.6200	0.25	7.0884		

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
MGLM_1	Magnesium Precipitation 1 Lime Slaker	14.8	355	110,201	ton	Lime	24	7,446		*(LNC 2019a), thru - (Whitehead 2019)*	0.006	0.006	0.006						gr/dscf	*Vendor Specification (LNC 2019a)*	Wet Scrubber	
MGF_1	Magnesium Precipitation 1 Filter System				-	Slurry	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						lb/hr	*(LNC 2019a)*	Wet Scrubber	
MGV_1	Magnesium Precipitation 1 Filter Vent				-	Slurry	24	124		*(LNC 2019a)*	0.2	0.2	0.2						lb/hr	*(LNC 2019a)*	Mist Eliminator	
MGLM_2	Magnesium Precipitation 2 Lime Slaker	14.8	355	110,201	ton	Lime	24	7,446		*(LNC 2019a), thru - (Whitehead 2019)*	0.006	0.006	0.006						gr/dscf	*Vendor Specification (LNC 2019a)*	Wet Scrubber	
MGF_2	Magnesium Precipitation 2 Filter System				-	Slurry	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						lb/hr	*(LNC 2019a)*	Wet Scrubber	
MGV_2	Magnesium Precipitation 2 Filter Vent				-	Slurry	24	124		*(LNC 2019a)*	0.2	0.2	0.2						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LICM_1	Lithium Carbonate 1 Material Handling				-	Li_2CO_3	24	620		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICV_1	Lithium Carbonate 1 Filter Vent				-	Li_2CO_3	24	124		*(LNC 2019a)*	0.2	0.2	0.2						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LICD_1	Lithium Carbonate 1 Dryer				-	Li_2CO_3	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICP_1	Lithium Carbonate 1 Packaging				-	Li_2CO_3	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICM_2	Lithium Carbonate 2 Material Handling				-	Li_2CO_3	24	620		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICV_2	Lithium Carbonate 2 Filter Vent				-	Li_2CO_3	24	124		*(LNC 2019a)*	0.2	0.2	0.2						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LICD_2	Lithium Carbonate 2 Dryer				-	Li_2CO_3	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICP_2	Lithium Carbonate 2 Packaging				-	Li_2CO_3	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIHD_1	Lithium Hydroxide 1 Dryer				-	LiOH	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIHP_1	Lithium Hydroxide 1 Packaging				-	LiOH	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIHD_2	Lithium Hydroxide 2 Dryer				-	LiOH	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIHP_2	Lithium Hydroxide 2 Packaging				-	LiOH	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LISPR_1	Lithium Sulfide 1 Production				-	Li_2S	24	620		*(LNC 2019a)*								0.27	lb/hr	*20 ppmv H2S (LNC 2019a)*	Caustic Scrubber	
LISP_1	Lithium Sulfide 1 Packaging				-	Li_2S	24	620		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LISPR_2	Lithium Sulfide 2 Production				-	Li_2S	24	620		*(LNC 2019a)*								0.27	lb/hr	*20 ppmv H2S (LNC 2019a)*	Caustic Scrubber	
LISP_2	Lithium Sulfide 2 Packaging				-	Li_2S	24	620		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIME_1	Lime 1 unloading and transfer to Silos (silo unloading through sealed transfers)				-	Lime	24	2,525		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIME_2	Lime 2 unloading and transfer to Silos (silo unloading through sealed transfers)				-	Lime	24	2,525		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
SDA_1	Soda Ash 1 unloading and transfer to Silos (silo unloading through sealed transfers)				-	Lime	24	1,570		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
SDA_2	Soda Ash 2 unloading and transfer to Silos (silo unloading through sealed transfers)				-	Lime	24	1,570		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LMSU_1	Limestone 1 unloading and transfer to Stockpile (Limestone				-	Limestone	24	2,525		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
LMSCR_1	Limestone Crushing 1				-	Limestone	24	6,240		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
LMSL_1	Limestone Silos 1 loading				-	Limestone	24	6,240		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
BATC_1	Battery Production 1 Complex				-	Batteries	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
BATC_2	Battery Production 2 Complex				-	Batteries	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
MGLM_1	Magnesium Precipitation 1 Lime Slaker	0.023	0.023	0.023						0.555	0.555	0.555						0.086	0.086	0.086					
MGF_1	Magnesium Precipitation 1 Filter System	0.020	0.020	0.020						0.480	0.480	0.480						0.074	0.074	0.074					
MGV_1	Magnesium Precipitation 1 Filter Vent	0.200	0.200	0.200						4.800	4.800	4.800						0.012	0.012	0.012					
MGLM_2	Magnesium Precipitation 2 Lime Slaker	0.023	0.023	0.023						0.555	0.555	0.555						0.086	0.086	0.086					
MGF_2	Magnesium Precipitation 2 Filter System	0.020	0.020	0.020						0.480	0.480	0.480						0.074	0.074	0.074					
MGV_2	Magnesium Precipitation 2 Filter Vent	0.200	0.200	0.200						4.800	4.800	4.800						0.012	0.012	0.012					
LICM_1	Lithium Carbonate 1 Material Handling	0.329	0.329	0.329						7.899	7.899	7.899						0.102	0.102	0.102					
LICV_1	Lithium Carbonate 1 Filter Vent	0.200	0.200	0.200						4.800	4.800	4.800						0.012	0.012	0.012					
LICD_1	Lithium Carbonate 1 Dryer	0.429	0.429	0.429						10.286	10.286	10.286						1.596	1.596	1.596					
LICP_1	Lithium Carbonate 1 Packaging	0.069	0.069	0.069						1.646	1.646	1.646						0.255	0.255	0.255					
LICM_2	Lithium Carbonate 2 Material Handling	0.329	0.329	0.329						7.899	7.899	7.899						0.102	0.102	0.102					
LICV_2	Lithium Carbonate 2 Filter Vent	0.200	0.200	0.200						4.800	4.800	4.800						0.012	0.012	0.012					
LICD_2	Lithium Carbonate 2 Dryer	0.429	0.429	0.429						10.286	10.286	10.286						1.596	1.596	1.596					
LICP_2	Lithium Carbonate 2 Packaging	0.069	0.069	0.069						1.646	1.646	1.646						0.255	0.255	0.255					
LIHD_1	Lithium Hydroxide 1 Dryer	0.429	0.429	0.429						10.286	10.286	10.286						1.596	1.596	1.596					
LIHP_1	Lithium Hydroxide 1 Packaging	0.165	0.165	0.165						3.950	3.950	3.950						0.613	0.613	0.613					
LIHD_2	Lithium Hydroxide 2 Dryer	0.429	0.429	0.429						10.286	10.286	10.286						1.596	1.596	1.596					
LIHP_2	Lithium Hydroxide 2 Packaging	0.165	0.165	0.165						3.950	3.950	3.950						0.613	0.613	0.613					
LISPR_1	Lithium Sulfide 1 Production								0.270								6.480								0.084
LISP_1	Lithium Sulfide 1 Packaging	0.165	0.165	0.165						3.950	3.950	3.950						0.051	0.051	0.051					
LISPR_2	Lithium Sulfide 2 Production								0.270								6.480								0.084
LISP_2	Lithium Sulfide 2 Packaging	0.165	0.165	0.165						3.950	3.950	3.950						0.051	0.051	0.051					
LIME_1	Lime 1 unloading and transfer to Silos (silo unloading through sealed transfers)	0.165	0.165	0.165						3.950	3.950	3.950						0.208	0.208	0.208					
LIME_2	Lime 2 unloading and transfer to Silos (silo unloading through sealed transfers)	0.165	0.165	0.165						3.950	3.950	3.950						0.208	0.208	0.208					
SDA_1	Soda Ash 1 unloading and transfer to Silos (silo unloading through sealed transfers)	0.165	0.165	0.165						3.950	3.950	3.950						0.129	0.129	0.129					
SDA_2	Soda Ash 2 unloading and transfer to Silos (silo unloading through sealed transfers)	0.165	0.165	0.165						3.950	3.950	3.950						0.129	0.129	0.129					
LMSU_1	Limestone 1 unloading and transfer to Stockpile (Limestone	2.400	2.400	2.400						57.600	57.600	57.600						3.030	3.030	3.030					
LMSCR_1	Limestone Crushing 1	2.400	2.400	2.400						57.600	57.600	57.600						7.488	7.488	7.488					
LMSL_1	Limestone Silos 1 loading	2.400	2.400	2.400						57.600	57.600	57.600						7.488	7.488	7.488					
BATC_1	Battery Production 1 Complex	0.857	0.857	0.857						20.571	20.571	20.571						3.191	3.191	3.191					
BATC_2	Battery Production 2 Complex	0.857	0.857	0.857						20.571	20.571	20.571						3.191	3.191	3.191					

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
MGLM_1	Magnesium Precipitation 1 Lime Slaker	414,386	4,617,115	1,439.8	POINT	110	Ambient	450	450	0.5	0.0029	0.0029						0.0025			33.5280	0.00	11.6425	0.1524	
MGF_1	Magnesium Precipitation 1 Filter System	414,446	4,617,138	1,439.8	POINT	110	Ambient	952	952	1.0	0.0025	0.0025						0.0021			33.5280	0.00	6.1576	0.3048	
MGV_1	Magnesium Precipitation 1 Filter Vent	414,445	4,617,115	1,439.8	POINT	110	Ambient	2,000	2,000	1.0	0.0252	0.0252						0.0004			33.5280	0.00	12.9361	0.3048	
MGLM_2	Magnesium Precipitation 2 Lime Slaker	414,386	4,617,115	1,439.8	POINT	110	Ambient	450	450	0.5	0.0029	0.0029						0.0025			33.5280	0.00	11.6425	0.1524	
MGF_2	Magnesium Precipitation 2 Filter System	414,446	4,617,138	1,439.8	POINT	110	Ambient	952	952	1.0	0.0025	0.0025						0.0021			33.5280	0.00	6.1576	0.3048	
MGV_2	Magnesium Precipitation 2 Filter Vent	414,445	4,617,115	1,439.8	POINT	110	Ambient	2,000	2,000	1.0	0.0252	0.0252						0.0004			33.5280	0.00	12.9361	0.3048	
LICM_1	Lithium Carbonate 1 Material Handling	414,426	4,617,236	1,441.4	POINT	30	Ambient	1,920	1,920	1.0	0.0415	0.0415						0.0029			9.1440	0.00	12.4187	0.3048	
LICV_1	Lithium Carbonate 1 Filter Vent	414,387	4,617,138	1,439.8	POINT	110	Ambient	2,000	2,000	1.0	0.0252	0.0252						0.0004			33.5280	0.00	12.9361	0.3048	
LICD_1	Lithium Carbonate 1 Dryer	414,380	4,617,160	1,439.8	POINT	110	150	2,500	2,500	1.0	0.0540	0.0540						0.0459			33.5280	338.71	16.1701	0.3048	
LICP_1	Lithium Carbonate 1 Packaging	414,392	4,617,160	1,439.8	POINT	110	Ambient	400	400	0.5	0.0086	0.0086						0.0073			33.5280	0.00	10.3489	0.1524	
LICM_2	Lithium Carbonate 2 Material Handling	414,426	4,617,236	1,441.4	POINT	30	Ambient	1,920	1,920	1.0	0.0415	0.0415						0.0029			9.1440	0.00	12.4187	0.3048	
LICV_2	Lithium Carbonate 2 Filter Vent	414,387	4,617,138	1,439.8	POINT	110	Ambient	2,000	2,000	1.0	0.0252	0.0252						0.0004			33.5280	0.00	12.9361	0.3048	
LICD_2	Lithium Carbonate 2 Dryer	414,380	4,617,160	1,439.8	POINT	110	150	2,500	2,500	1.0	0.0540	0.0540						0.0459			33.5280	338.71	16.1701	0.3048	
LICP_2	Lithium Carbonate 2 Packaging	414,392	4,617,160	1,439.8	POINT	110	Ambient	400	400	0.5	0.0086	0.0086						0.0073			33.5280	0.00	10.3489	0.1524	
LIHD_1	Lithium Hydroxide 1 Dryer	414,363	4,617,201	1,441.4	POINT	110	150	2,500	2,500	1.0	0.0540	0.0540						0.0459			33.5280	338.71	16.1701	0.3048	
LIHP_1	Lithium Hydroxide 1 Packaging	414,365	4,617,189	1,441.4	POINT	110	Ambient	960	960	0.7	0.0207	0.0207						0.0176			33.5280	0.00	13.9710	0.2032	
LIHD_2	Lithium Hydroxide 2 Dryer	414,363	4,617,201	1,441.4	POINT	110	150	2,500	2,500	1.0	0.0540	0.0540						0.0459			33.5280	338.71	16.1701	0.3048	
LIHP_2	Lithium Hydroxide 2 Packaging	414,365	4,617,189	1,441.4	POINT	110	Ambient	960	960	0.7	0.0207	0.0207						0.0176			33.5280	0.00	13.9710	0.2032	
LISPR_1	Lithium Sulfide 1 Production	414,419	4,617,197	1,441.4	POINT	110	100	2,506	3,185	1.0							0.0340				33.5280	310.93	20.6008	0.3048	
LISP_1	Lithium Sulfide 1 Packaging	414,419	4,617,186	1,441.4	POINT	110	Ambient	960	960	0.7	0.0207	0.0207						0.0015			33.5280	0.00	13.9710	0.2032	
LISPR_2	Lithium Sulfide 2 Production	414,419	4,617,197	1,441.4	POINT	110	100	2,506	3,185	1.0							0.0340				33.5280	310.93	20.6008	0.3048	
LISP_2	Lithium Sulfide 2 Packaging	414,419	4,617,186	1,441.4	POINT	110	Ambient	960	960	0.7	0.0207	0.0207						0.0015			33.5280	0.00	13.9710	0.2032	
LIME_1	Lime 1 unloading and transfer to Silos (silo unloading through sealed transfers)	414,457	4,616,969	1,436.5	POINT	80	Ambient	960	960	0.7	0.0207	0.0207						0.0060			24.3840	0.00	13.9710	0.2032	
LIME_2	Lime 2 unloading and transfer to Silos (silo unloading through sealed transfers)	414,457	4,616,969	1,436.5	POINT	80	Ambient	960	960	0.7	0.0207	0.0207						0.0060			24.3840	0.00	13.9710	0.2032	
SDA_1	Soda Ash 1 unloading and transfer to Silos (silo unloading through sealed transfers)	414,395	4,616,969	1,436.5	POINT	80	Ambient	960	960	0.7	0.0207	0.0207						0.0037			24.3840	0.00	13.9710	0.2032	
SDA_2	Soda Ash 2 unloading and transfer to Silos (silo unloading through sealed transfers)	414,395	4,616,969	1,436.5	POINT	80	Ambient	960	960	0.7	0.0207	0.0207						0.0037			24.3840	0.00	13.9710	0.2032	
LMSU_1	Limestone 1 unloading and transfer to Stockpile (Limestone	414,359	4,616,988	1,436.5	POINT	80	Ambient	20,000	20,000	1.5	0.3024	0.3024						0.0872			24.3840	0.00	57.4938	0.4572	
LMSCR_1	Limestone Crushing 1	414,318	4,616,986	1,436.5	POINT	80	Ambient	20,000	20,000	1.5	0.3024	0.3024						0.2154			24.3840	0.00	57.4938	0.4572	
LMSL_1	Limestone Silos 1 loading	414,375	4,616,989	1,436.5	POINT	80	Ambient	20,000	20,000	1.5	0.3024	0.3024						0.2154			24.3840	0.00	57.4938	0.4572	
BATC_1	Battery Production 1 Complex	413,487	4,616,837	1,460.3	POINT	40	Ambient	5,000	5,000	1.0	0.1080	0.1080						0.0918			12.1920	0.00	32.3403	0.3048	
BATC_2	Battery Production 2 Complex	413,487	4,616,837	1,460.3	POINT	40	Ambient	5,000	5,000	1.0	0.1080	0.1080						0.0918			12.1920	0.00	32.3403	0.3048	

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
BATS_1	Battery Production 1 Solvent				-	Solvent	24	7,446		*(LNC 2019a)*							4.6		lb/hr	*(LNC 2019a)*	Scrubber	
BATS_2	Battery Production 2 Solvent				-	Solvent	24	7,446		*(LNC 2019a)*							4.6		lb/hr	*(LNC 2019a)*	Scrubber	
	Sodium Hypochlorite Tank 1				-	NaClO	24	4,380		*(LNC 2019a)*										*Cl2 emissions only, see HAPs*	Scrubber	
	Sodium Hypochlorite Tank 2				-	NaClO	24	4,380		*(LNC 2019a)*										*Cl2 emissions only, see HAPs*	Scrubber	
LICLM_1	Lithium Chloride 1 Material Handling				-	LiCl	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICLM_2	Lithium Chloride 2 Material Handling				-	LiCl	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
KCLM_1	Potassium Chloride 1 Material Handling				-	KCl	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
KCLM_2	Potassium Chloride 2 Material Handling				-	KCl	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
ALM_1	Aluminum Powder 1 Material Handling				-	Al	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
ALM_2	Aluminum Powder 2 Material Handling				-	Al	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
S2T_1	Sulfur Storage Tanks 1				-	Sulfur	24	8,760		*(LNC 2019a)*						0.075		0.080	lb/hr	*10 ppmv SO2, 20 ppmv H2S (LNC 2019a)*	Caustic Scrubber	
S2T_2	Sulfur Storage Tanks 2				-	Sulfur	24	8,760		*(LNC 2019a)*						0.075		0.080	lb/hr	*10 ppmv SO2, 20 ppmv H2S (LNC 2019a)*	Caustic Scrubber	
BOIL_1	Package Boiler 1	67.4	1,618	19,411	MMBtu	Diesel	24	288		*(LNC 2019a), MMBtu - (Whitehead 2019)*	0.020	0.020	0.020	0.037	0.100	0.0015	0.004		lb/MMBtu	*(LNC 2019a); SO2: mass balance w/ 15 ppm S (ULSD)*	Industry standard controls	
BOIL_2	Package Boiler 2	67.4	1,618	19,411	MMBtu	Diesel	24	288		*(LNC 2019a), MMBtu - (Whitehead 2019)*	0.020	0.020	0.020	0.037	0.100	0.0015	0.004		lb/MMBtu	*(LNC 2019a); SO2: mass balance w/ 15 ppm S (ULSD)*	Industry standard controls	
BURN_1	Start-Up Burner 1	89.3	2,143	25,718	MMBtu	Diesel	24	288		*(LNC 2019a), MMBtu - (Whitehead 2019)*	0.0236	0.0164	0.0111	0.0357	0.1429	0.0015	0.0014		lb/MMBtu	*AP-42 Tables 1.3-1, 1.3-2, 1.3-3 & 1.3-6 (05/10) Industrial Boilers, distillate oil; SO2: mass balance w/ 15 ppm S (ULSD)*	None	
BURN_2	Start-Up Burner 2	89.3	2,143	25,718	MMBtu	Diesel	24	288		*(LNC 2019a), MMBtu - (Whitehead 2019)*	0.0236	0.0164	0.0111	0.0357	0.1429	0.0015	0.0014		lb/MMBtu	*AP-42 Tables 1.3-1, 1.3-2, 1.3-3 & 1.3-6 (05/10) Industrial Boilers, distillate oil; SO2: mass balance w/ 15 ppm S (ULSD)*	None	
SAP_1	Sulfuric Acid Plant	79.3	1,904	675,789	ton	Sulfur	24	8,520		*(LNC 2019a), (Chemetics 2018)*	6.4	6.4	6.4		17.7	17.7			lb/hr	*(LNC 2019a), (Chemetics 2018), (Rabe 2019)*	Tail Gas Scrubber	
COOL_1	Cooling Tower 1	760,860			Gal	Water	24	8,760		*(LNC 2019a)*	0.1586	0.1586	0.1586						lb/hr	*(LNC 2019a), 500 ppm TDS - (Whitehead 2019), 0.005% drift loss estimated from similar CT*	None	
COOL_2	Cooling Tower 2	760,860			Gal	Water	24	8,760	*500 ppm*	*(LNC 2019a)*	0.1586	0.1586	0.1586						lb/hr	*(NDEP 2017), 500 ppm TDS - (Whitehead 2019), 0.005% drift loss estimated from similar CT*	None	
FIRE1_1	Fire Pump 1 (Mine)	175	4,200	17,500	hp	Diesel	24	100	*9.3 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	2.6E-04	2.6E-04	2.6E-04	1.8E-03	6.1E-03	1.1E-05	2.2E-04		lb/hp-hr	*(Clarke 2019); SO2: mass balance w/ 15 ppm S (ULSD) (NDEP 2019)*	None	
FIRE2_1	Fire Pump 2 (Process)	175	4,200	17,500	hp	Diesel	24	100	*9.3 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	2.6E-04	2.6E-04	2.6E-04	1.8E-03	6.1E-03	1.1E-05	2.2E-04		lb/hp-hr	*(Clarke 2019); SO2: mass balance w/ 15 ppm S (ULSD) (NDEP 2019)*	None	
FIRE3_2	Fire Pump 3 (Process)	175	4,200	17,500	hp	Diesel	24	100	*9.3 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	2.6E-04	2.6E-04	2.6E-04	1.8E-03	6.1E-03	1.1E-05	2.2E-04		lb/hp-hr	*(Clarke 2019); SO2: mass balance w/ 15 ppm S (ULSD) (NDEP 2019)*	None	
GEN1_1	Emergency Generator 1 (Mine)	134	3,216	13,400	hp	Propane	24	100	*13.9 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	0.0005	0.0005	0.0005	0.0088	0.0044	3.6E-05	0.0022		lb/hp-hr	*CO, NOX, VOC: 40 CFR 60 Subpart JJJJ, Table 1; PM, SO2: (CARB 1991)*	None	
GEN2_1	Emergency Generator 2 (Mine)	134	3,216	13,400	hp	Propane	24	100	*13.9 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	0.0005	0.0005	0.0005	0.0088	0.0044	3.6E-05	0.0022		lb/hp-hr	*CO, NOX, VOC: 40 CFR 60 Subpart JJJJ, Table 1; PM, SO2: (CARB 1991)*	None	
LAB_1	Laboratory				-	Samples	24	2,190		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
PRILL_1	Ammonium Nitrate Prill Silo 1 Loading	80	80	29,200	ton	Prill	1	365	*80 ton capacity*	*(Whitehead 2019)*	0.02	0.007	0.0011						lb/ton	*AP-42 Table 8.3-2 (07/93) bulk load unctrl. (NDEP 2017)*	None	
PRILU_1	Ammonium Nitrate Prill Silo 1 Unloading	80	80	29,200	ton	Prill	1	365	*80 ton capacity*	*(Whitehead 2019)*	0.02	0.007	0.0011						lb/ton	*AP-42 Table 8.3-2 (07/93) bulk load unctrl. (NDEP 2017)*	None	
PRILL_2	Ammonium Nitrate Prill Silo 2 Loading	80	80	29,200	ton	Prill	1	365	*80 ton capacity*	*(Whitehead 2019)*	0.02	0.007	0.0011						lb/ton	*AP-42 Table 8.3-2 (07/93) bulk load unctrl. (NDEP 2017)*	None	

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
BATS_1	Battery Production 1 Solvent							4.600								110.400								17.126	
BATS_2	Battery Production 2 Solvent							4.600								110.400								17.126	
	Sodium Hypochlorite Tank 1																								
	Sodium Hypochlorite Tank 2																								
LICLM_1	Lithium Chloride 1 Material Handling	0.069	0.069	0.069						1.646	1.646	1.646						0.150	0.150	0.150					
LICLM_2	Lithium Chloride 2 Material Handling	0.069	0.069	0.069						1.646	1.646	1.646						0.150	0.150	0.150					
KCLM_1	Potassium Chloride 1 Material Handling	0.165	0.165	0.165						3.950	3.950	3.950						0.360	0.360	0.360					
KCLM_2	Potassium Chloride 2 Material Handling	0.165	0.165	0.165						3.950	3.950	3.950						0.360	0.360	0.360					
ALM_1	Aluminum Powder 1 Material Handling	0.069	0.069	0.069						1.646	1.646	1.646						0.150	0.150	0.150					
ALM_2	Aluminum Powder 2 Material Handling	0.069	0.069	0.069						1.646	1.646	1.646						0.150	0.150	0.150					
S2T_1	Sulfur Storage Tanks 1						0.075		0.080						1.796		1.911						0.328		0.349
S2T_2	Sulfur Storage Tanks 2						0.075		0.080						1.796		1.911						0.328		0.349
BOIL_1	Package Boiler 1	1.348	1.348	1.348	2.494	6.740	0.100	0.270		32.352	32.352	32.352	59.851	161.760	2.404	6.470		0.194	0.194	0.194	0.359	0.971	0.014	0.039	
BOIL_2	Package Boiler 2	1.348	1.348	1.348	2.494	6.740	0.100	0.270		32.352	32.352	32.352	59.851	161.760	2.404	6.470		0.194	0.194	0.194	0.359	0.971	0.014	0.039	
BURN_1	Start-Up Burner 1	2.105	1.467	0.989	3.189	12.757	0.133	0.128		50.518	35.210	23.728	76.543	306.171	3.185	3.062		0.303	0.211	0.142	0.459	1.837	0.019	0.018	
BURN_2	Start-Up Burner 2	2.105	1.467	0.989	3.189	12.757	0.133	0.128		50.518	35.210	23.728	76.543	306.171	3.185	3.062		0.303	0.211	0.142	0.459	1.837	0.019	0.018	
SAP_1	Sulfuric Acid Plant	6.400	6.400	6.400		17.700	17.700			153.600	153.600	153.600		424.800	424.800			27.264	27.264	27.264		75.402	75.402		
COOL_1	Cooling Tower 1	0.159	0.159	0.159						3.807	3.807	3.807						0.695	0.695	0.695					
COOL_2	Cooling Tower 2	0.159	0.159	0.159						3.807	3.807	3.807						0.695	0.695	0.695					
FIRE1_1	Fire Pump 1 (Mine)	0.046	0.046	0.046	0.309	1.061	0.002	0.039		1.111	1.111	1.111	7.408	25.463	0.046	0.926		0.002	0.002	0.002	0.015	0.053	0.000	0.002	
FIRE2_1	Fire Pump 2 (Process)	0.046	0.046	0.046	0.309	1.061	0.002	0.039		1.111	1.111	1.111	7.408	25.463	0.046	0.926		0.002	0.002	0.002	0.015	0.053	0.000	0.002	
FIRE3_2	Fire Pump 3 (Process)	0.046	0.046	0.046	0.309	1.061	0.002	0.039		1.111	1.111	1.111	7.408	25.463	0.046	0.926		0.002	0.002	0.002	0.015	0.053	0.000	0.002	
GEN1_1	Emergency Generator 1 (Mine)	0.070	0.070	0.070	1.182	0.591	0.005	0.295		1.668	1.668	1.668	28.360	14.180	0.117	7.090		0.003	0.003	0.003	0.059	0.030	0.000	0.015	
GEN2_1	Emergency Generator 2 (Mine)	0.070	0.070	0.070	1.182	0.591	0.005	0.295		1.668	1.668	1.668	28.360	14.180	0.117	7.090		0.003	0.003	0.003	0.059	0.030	0.000	0.015	
LAB_1	Laboratory	0.429	0.429	0.429						10.286	10.286	10.286						0.469	0.469	0.469					
PRILL_1	Ammonium Nitrate Prill Silo 1 Loading	1.600	0.560	0.085						1.600	0.560	0.085						0.292	0.102	0.015					
PRILU_1	Ammonium Nitrate Prill Silo 1 Unloading	1.600	0.560	0.085						1.600	0.560	0.085						0.292	0.102	0.015					
PRILL_2	Ammonium Nitrate Prill Silo 2 Loading	1.600	0.560	0.085						1.600	0.560	0.085						0.292	0.102	0.015					

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS													
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
BATS_1	Battery Production 1 Solvent	413,528	4,616,794	1,460.3	POINT	40	Ambient	5,000	5,000	1.0											12.1920	0.00	32.3403	0.3048	
BATS_2	Battery Production 2 Solvent	413,528	4,616,794	1,460.3	POINT	40	Ambient	5,000	5,000	1.0											12.1920	0.00	32.3403	0.3048	
	Sodium Hypochlorite Tank 1	414,439	4,616,822	1,428.1	POINT	40	Ambient	17	17	0.3											12.1920	0.00	0.9896	0.1016	
	Sodium Hypochlorite Tank 2	414,439	4,616,822	1,428.1	POINT	40	Ambient	17	17	0.3											12.1920	0.00	0.9896	0.1016	
LICLM_1	Lithium Chloride 1 Material Handling	414,457	4,616,822	1,428.1	POINT	40	Ambient	400	400	0.5	0.0086	0.0086						0.0043			12.1920	0.00	10.3489	0.1524	
LICLM_2	Lithium Chloride 2 Material Handling	414,457	4,616,822	1,428.1	POINT	40	Ambient	400	400	0.5	0.0086	0.0086						0.0043			12.1920	0.00	10.3489	0.1524	
KCLM_1	Potassium Chloride 1 Material Handling	414,449	4,616,793	1,428.1	POINT	40	Ambient	960	960	0.7	0.0207	0.0207						0.0104			12.1920	0.00	13.9710	0.2032	
KCLM_2	Potassium Chloride 2 Material Handling	414,449	4,616,793	1,428.1	POINT	40	Ambient	960	960	0.7	0.0207	0.0207						0.0104			12.1920	0.00	13.9710	0.2032	
ALM_1	Aluminum Powder 1 Material Handling	414,441	4,616,766	1,428.1	POINT	40	Ambient	400	400	0.5	0.0086	0.0086						0.0043			12.1920	0.00	10.3489	0.1524	
ALM_2	Aluminum Powder 2 Material Handling	414,441	4,616,766	1,428.1	POINT	40	Ambient	400	400	0.5	0.0086	0.0086						0.0043			12.1920	0.00	10.3489	0.1524	
S2T_1	Sulfur Storage Tanks 1	414,428	4,616,932	1,436.9	POINT	60	500	750	1,635	1.0					0.0094	0.0094	0.0100			0.0094	18.2880	533.15	10.5753	0.3048	
S2T_2	Sulfur Storage Tanks 2	414,428	4,616,932	1,436.9	POINT	60	500	750	1,635	1.0					0.0094	0.0094	0.0100			0.0094	18.2880	533.15	10.5753	0.3048	
BOIL_1	Package Boiler 1	414,287	4,616,907	1,436.9	POINT	60	350	18,131	36,240	2.5	0.1698	0.1698	0.3142	0.8492	0.0126	0.0126		0.0056	0.0279	0.0004	18.2880	449.82	37.5043	0.7620	0.0074
BOIL_2	Package Boiler 2	414,287	4,616,907	1,436.9	POINT	60	350	18,131	36,240	2.5	0.1698	0.1698	0.3142	0.8492	0.0126	0.0126		0.0056	0.0279	0.0004	18.2880	449.82	37.5043	0.7620	0.0074
BURN_1	Start-Up Burner 1	414,265	4,616,929	1,436.9	POINT	60	350	24,022	48,015	3.0	0.1848	0.1246	0.4018	1.6074	0.0167	0.0167		0.0041	0.0528	0.0005	18.2880	449.82	34.5073	0.9144	0.5
BURN_2	Start-Up Burner 2	414,265	4,616,929	1,436.9	POINT	60	350	24,022	48,015	3.0	0.1848	0.1246	0.4018	1.6074	0.0167	0.0167		0.0041	0.0528	0.0005	18.2880	449.82	34.5073	0.9144	0.5
SAP_1	Sulfuric Acid Plant	414,329	4,616,857	1,436.9	POINT	213	73	110,414	142,365	6.0	0.8064	0.8064		2.2302	2.2302	2.2302		0.7843	2.1691	2.1691	65.0000	296.15	25.5784	1.8288	0.5
COOL_1	Cooling Tower 1	414,453	4,617,226	1,441.4	POINT	30	Ambient		1,000,000	24.0	0.0200	0.0200						0.0200			9.1440	0.00	11.2293	7.3152	
COOL_2	Cooling Tower 2	414,453	4,617,226	1,441.4	POINT	30	Ambient		1,000,000	24.0	0.0200	0.0200						0.0200			9.1440	0.00	11.2293	7.3152	
FIRE1_1	Fire Pump 1 (Mine)	411,516	4,617,085	1,510.5	POINT	14	966	255	826	0.3	0.0058	0.0058	0.0389	0.0015	0.0000	0.0002		0.0001	0.0015	0.0000	4.2672	792.04	48.0835	0.1016	0.2
FIRE2_1	Fire Pump 2 (Process)	414,457	4,617,215	1,441.4	POINT	14	966	255	826	0.3	0.0058	0.0058	0.0389	0.0015	0.0000	0.0002		0.0001	0.0015	0.0000	4.2672	792.04	48.0835	0.1016	0.2
FIRE3_2	Fire Pump 3 (Process)	414,457	4,617,215	1,441.4	POINT	14	966	255	826	0.3	0.0058	0.0058	0.0389	0.0015	0.0000	0.0002		0.0001	0.0015	0.0000	4.2672	792.04	48.0835	0.1016	0.2
GEN1_1	Emergency Generator 1 (Mine)	410,940	4,617,336	1,533.8	POINT	5	960	275	888	0.3	0.0088	0.0088	0.1489	0.0008	0.0000	0.0006		0.0001	0.0008	0.0000	1.5240	788.71	51.6927	0.1016	0.1
GEN2_1	Emergency Generator 2 (Mine)	410,940	4,617,336	1,533.8	POINT	5	960	275	888	0.3	0.0088	0.0088	0.1489	0.0008	0.0000	0.0006		0.0001	0.0008	0.0000	1.5240	788.71	51.6927	0.1016	0.1
LAB_1	Laboratory	414,333	4,617,098	1,439.8	POINT	40	Ambient	2,500	2,500	1.0	0.0540	0.0540						0.0135			12.1920	0.00	16.1701	0.3048	
PRILL_1	Ammonium Nitrate Prill Silo 1 Loading	412,191	4,618,139	1,535.7	POINT	30	Ambient	N/A	0.039	0.5	0.0706	0.0107						0.0004			9.1440	0.00	0.0010	0.1524	
PRILU_1	Ammonium Nitrate Prill Silo 1 Unloading	412,191	4,618,139	1,535.7	VOLUME	11	2	4	13	elev src w/o bldg	0.0706	0.0107						0.0004			3.3528	0.14	0.2835		
PRILL_2	Ammonium Nitrate Prill Silo 2 Loading	412,191	4,618,139	1,535.7	POINT	30	Ambient	N/A	0.039	0.5	0.0706	0.0107						0.0004			9.1440	0.00	0.0010	0.1524	

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
PRILU_2	Ammonium Nitrate Prill Silo 2 Unloading	80	80	29,200	ton	Prill	1	365	*80 ton capacity*	*(Whitehead 2019)*	0.02	0.007	0.0011						lb/ton	*AP-42 Table 8.3-2 (07/93) bulk load unctrl. (NDEP 2017)*	None	
	Gasoline Tank (Mine)			111,000	Gal	Gasoline	24	8,760		*(LNC 2019a)*							1.3E-01		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Gasoline Tank (Process)			44,000	Gal	Gasoline	24	8,760		*(LNC 2019a)*							4.9E-02		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank, Off Road (Mine)			6,050,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							5.1E-03		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank, Highway (Mine)			40,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							2.2E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank (Process)			63,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							7.0E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank 1 (Acid Plant)			321,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							7.7E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank 2 (Acid Plant)			321,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							7.7E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Oil Tank			114,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							5.9E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Coolant Tank			24,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							9.1E-06		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Used Oil Tank			114,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							2.6E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Used Coolant Tank			24,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							9.1E-06		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
Total																						

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
PRILU_2	Ammonium Nitrate Prill Silo 2 Unloading	1.600	0.560	0.085						1.600	0.560	0.085						0.292	0.102	0.015					
	Gasoline Tank (Mine)							0.128								3.073								0.561	
	Gasoline Tank (Process)							0.049								1.173								0.214	
	Diesel Tank, Off Road (Mine)							0.005								0.124								0.023	
	Diesel Tank, Highway (Mine)							0.000								0.005								0.001	
	Diesel Tank (Process)							0.001								0.017								0.003	
	Diesel Tank 1 (Acid Plant)							0.001								0.018								0.003	
	Diesel Tank 2 (Acid Plant)							0.001								0.018								0.003	
	Bulk Oil Tank							0.001								0.014								0.003	
	Bulk Coolant Tank							0.000								0.000								0.000	
	Bulk Used Oil Tank							0.000								0.006								0.001	
	Bulk Used Coolant Tank							0.000								0.000								0.000	
Total		**50.2**	**39.1**	**33.2**	**14.7**	**61.1**	**18.3**	**10.9**	**0.7**	**1,057.2**	**887.1**	**788.3**	**351.7**	**1,465.4**	**439.9**	**261.3**	**16.8**	**118.1**	**96.3**	**84.5**	**1.8**	**81.2**	**76.1**	**35.2**	**0.9**

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
PRILU_2	Ammonium Nitrate Prill Silo 2 Unloading	412,191	4,618,139	1,535.7	VOLUME	11	2	4	13	elev src w/o bldg	0.0706	0.0107						0.0004			3.3528	0.14	0.2835		
	Gasoline Tank (Mine)	410,885	4,617,431	1,538.8																					
	Gasoline Tank (Process)	414,219	4,616,997	1,436.5																					
	Diesel Tank, Off Road (Mine)	410,870	4,617,438	1,539.0																					
	Diesel Tank, Highway (Mine)	410,870	4,617,433	1,538.6																					
	Diesel Tank (Process)	414,232	4,616,998	1,436.5																					
	Diesel Tank 1 (Acid Plant)	414,256	4,616,921	1,436.9																					
	Diesel Tank 2 (Acid Plant)	414,256	4,616,921	1,436.9																					
	Bulk Oil Tank	410,867	4,617,432	1,538.4																					
	Bulk Coolant Tank	410,904	4,617,376	1,533.8																					
	Bulk Used Oil Tank	410,913	4,617,372	1,533.8																					
	Bulk Used Coolant Tank	410,900	4,617,368	1,533.8																					
Total											**4.9278**	**4.1792**	**1.8466**	**7.150**	**2.3077**	**2.3097**	**0.0881**	**2.4316**	**2.3369**	**2.1899**					

Phase 2 Fugitive Source Emissions

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Mining Activity Emissions Summary

By Area/Model ID

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY	CO_PPH	CO_TPY	NOX_PPH	NOX_TPY	SO2_PPH	SO2_TPY	VOC_TPY
Area/	Location of	PM	PM10		PM2.5		CO		NOX		SO2		VOC
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
PIT	Pit	15.83	587.02	8.88	67.93	6.73	23.17	101.47	44.01	192.77	0.05	0.21	18.19
PIT_BL	Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.00	0
O_STOCK	Ore Stockpile	6.90	15.43	2.82	6.02	1.10	2.22	9.70	2.80	12.26	0.00	0.02	3.49
W_WRSF	West WRSF	3.79	8.48	1.55	3.31	0.60	1.22	5.33	1.54	6.74	0.00	0.01	1.92
E_WRSF	East WRSF	1.55	3.46	0.63	1.35	0.25	0.50	2.18	0.63	2.75	0.00	0.00	0.78
G_STOCK	Gangue Stockpile	3.63	8.22	1.50	3.04	0.56	1.08	4.73	1.36	5.98	0.00	0.01	1.70
CTFS	Clay Tailings Filter Stack	14.30	31.88	5.82	12.59	2.30	4.66	20.42	5.89	25.80	0.01	0.04	7.35
HR	Haul Roads	392.86	503.93	91.97	105.37	19.23	27.67	121.19	76.02	332.96	0.09	0.41	30.92
PROC	Process Plant	0.64	3.48	0.64	3.35	0.61	2.70	11.81	1.87	8.21	0.00	0.02	3.28
Total		441.00	1,421.00	114.57	217.92	31.42	3,101.38	285.93	215.75	587.71	0.38	0.71	67.63

By Activity

	PM_TPY chk	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk
	PM	PM10		PM2.5		CO		NOX		SO2		VOC
Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
Open Pit Drilling	3.16	547.39	1.64	31.58	0.09							
Open Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.00	
Onsite Hauling	124.61	141.40	25.80	14.14	2.58							
Material Load / Unload	1.72	4.46	0.81	0.67	0.12							
Mobile Equipment (Tailpipes)	18.50	101.35	18.50	99.96	18.24	63.20	276.82	134.12	587.47	0.16	0.71	67.63
Dozing	16.07	11.05	2.02	9.24	1.69							
Grading	197.77	241.33	44.04	33.59	6.13							
Water Truck Travel	61.00	69.22	12.63	6.92	1.26							
Wind Erosion	16.68	45.71	8.34	6.86	1.25							
Total	441.00	1,421.00	114.57	217.92	31.42	3,101.38	285.93	215.75	587.71	0.38	0.71	67.63

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Project Phase Phase 2

Mining Activity Source Parameters Summary

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M	SXINIT_M	SYINIT_M	PITVOL_M3	ANGL_DEG
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z	Pit X	Pit Y	Pit Vol.	Angle
Model ID	Activity	Type	E m	N m	m	m	m	m	m	m	m^3	deg
PIT	Pit	OPENPIT	409,625	4,617,550	1,564.5	4.36	-	-	2,720.00	1,649.11	2.5E+08	-
PIT_BL	Pit Blasting	VOLUME	410,560	4,618,577	1,597.3	75.00	20.93	34.88	-	-	-	-
O_STOCK	Ore Stockpile	VOLUME	411,254	4,617,174	1,525.8	4.36	47.45	4.05	-	-	-	-
W_WRSF	West WRSF	VOLUME	409,214	4,617,951	1,503.6	4.36	186.56	4.05	-	-	-	-
E_WRSF	East WRSF	VOLUME	412,839	4,618,603	1,548.9	4.36	171.15	4.05	-	-	-	-
G_STOCK	Gangue Stockpile	VOLUME	413,702	4,617,832	1,492.0	4.36	261.41	4.05	-	-	-	-
CTFS	Clay Tailings Filter Stack	VOLUME	415,659	4,617,957	1,471.2	3.49	355.22	3.24	-	-	-	-
HR	Haul Roads	VOLUME	See worksheet: ROADS			4.36	14.13	4.05	-	-	-	-
PROC	Process Plant	VOLUME	414,342	4,617,062	1,439.7	1.79	166.34	1.67	-	-	-	-

			PM10_PPD	PM2.5_PPD	PM2.5_TPY	CO_PPH	NOX_PPH	NOX_TPY	SO2_PPH	SO2_TPY	
	Source		PM10	PM2.5	PM2.5	CO	NOX	NOX	SO2	SO2	NO2/NOX
Model ID	Type	Units	24-hr	24-hr	Annual	1-hr & 8-hr	1-hr	Annual	1-hr & 3-hr	Annual	ISR
PIT	OPENPIT	g/s/m2	6.87E-07	7.95E-08	4.31E-08	6.51E-07	1.24E-06	1.24E-06	1.32E-09	1.32E-09	0.11
PIT_BL	VOLUME	g/s	1.3603	0.0785	0.0013	382.8039	10.2843	0.0070	0.0274	0.0000	0.0357
O_STOCK	VOLUME	g/s	0.0810	0.0316	0.0316	0.2791	0.3527	0.3527	0.0005	0.0005	0.11
W_WRSF	VOLUME	g/s	0.0445	0.0174	0.0174	0.1534	0.1939	0.1939	0.0003	0.0003	0.11
E_WRSF	VOLUME	g/s	0.0182	0.0071	0.0071	0.0627	0.0792	0.0792	0.0001	0.0001	0.11
G_STOCK	VOLUME	g/s	0.0431	0.0160	0.0160	0.1361	0.1720	0.1720	0.0002	0.0002	0.11
CTFS	VOLUME	g/s	0.1674	0.0661	0.0661	0.5873	0.7421	0.7421	0.0010	0.0010	0.11
HR	VOLUME	g/s	2.6456	0.5532	0.5532	3.4861	9.5782	9.5782	0.0118	0.0118	0.11
PROC	VOLUME	g/s	0.0183	0.0176	0.0176	0.3396	0.2361	0.2361	0.0005	0.0005	0.11
			chk	chk	chk	chk	chk	chk	chk	chk	

Conversions

3.28084	ft/m	8,760	hr/yr
453.592	g/lb	24	hr/day
2,000	lb/ton	3,600	sec/hr

Project Phase Phase 2

Open Pit Drilling

Activity Information

Blasting schedule	6 day/yr		*Based on blasts/yr, with 1 blast per day*
Annual blast holes drilled	4,858 hole/yr	hpy	*(Whitehead 2019a)*

Emission Factors

TSP (PM)	1.3 lb/hole	*AP-42, Table 11.9-4, 7/98 (overburden)*

PM Scaling Factors

PM_{10}	0.52	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*
$PM_{2.5}$	0.03	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*

Emissions

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
	Location of	PM	PM10		PM2.5	
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
PIT	Pit	3.16	547.39	1.64	31.58	0.09
Total	Open Pit Drilling	3.16	547.39	1.64	31.58	0.09

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	PITVOL_M3	SXINIT_M	SYINIT_M	ANGL_DEG
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	Pit Vol.	Pit X	Pit Y	Angle
Model ID	Activity	Type	E m	N m	m	m	m^3	m	m	deg
PIT	Pit	OPENPIT	409,625	4,617,550	1,565	4.36	2.5E+08	2,720	1,649	0

(LNC 2019)

Conversions
2,000 lb/ton

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Project Phase Phase 2

Open Pit Blasting

Activity Information

Blast area	108,200 ft^2/blast	ft2	*(Whitehead 2019a)*
Blasts per year	6 blast/yr	bpy	*(Whitehead 2019b)*
ANFO consumption	272 ton/yr	AN_tpy	*(Whitehead 2019a)*
ANFO diesel content	8%		*AP-42, Table 13.3-1, 2/80 (ANFO max. FO content)*

Emission Factors

Emission factor equation	TSP (lb/blast) = 0.000014 x $A^{1.5}$	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*
A = Area per blast	108,200 ft^2	
TSP (PM)	498.27 lb/blast	
CO	67 lb CO/ton - ANFO	*AP-42, Table 13.3-1, 2/80 (ANFO)*
NOX	0.9 kg/t-ANFO	*(CSIRO 2008)*
	1.8 lb NOX/ton - ANFO	
SO2	4.8E-03 lb SO2/ton-ANFO	*Based on 15 ppm S in FO and a maximum of 8% FO in ANFO*

$$\frac{1.5\text{E-}05\ \text{lb S}}{\text{lb FO}} \times \frac{64.064\ \text{lb SO2}}{32.065\ \text{lb S}} \times \frac{8\%\ \text{lb FO}}{\text{lb ANFO}} \times \frac{2{,}000\ \text{lb ANFO}}{\text{ton ANFO}} = \frac{0.00480\ \text{lb SO2}}{\text{ton ANFO}}$$

PM Scaling Factors

PM_{10}	0.52	*AP-42, Tab. 11.9-1, 7/98 (blasting, overburden)*
$PM_{2.5}$	0.03	*AP-42, Tab. 11.9-1, 7/98 (blasting, overburden)*

Emissions

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY	CO_PPH	CO_TPY	NOX_PPH	NOX_TPY	SO2_PPH	SO2_TPY
	Location of	PM	PM10		PM2.5		CO		NOX(1)		SO2	
Model ID	Activity	ton/yr	lb/day(2)	ton/yr	lb/day(2)	ton/yr	lb/hr(2)	ton/yr	lb/hr(2)	ton/yr	lb/hr(2)	ton/yr
PIT_BL	Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.001
Total	Open Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.001

(1) *NO2 / NOX In-Stack Ratio (ISR):* 3.57% *(CSIRO 2008)*

(2) *Short-term emissions (lb/day and lb/hr) are based on the annual blasting emissions divided by the annual number of blasts.*

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
PIT_BL	Pit Blasting	VOLUME	410,560	4,618,577	1,597	75	20.93	34.88

(LNC 2019)

Blast height (BH)	150 m	*(CSIRO 2008)*	Sigma divider			
Blast width	90 m	*(CSIRO 2008)*	Rel. Ht.	2	of BH	*(EPA 2004b)*
Blast depth	90 m	*(CSIRO 2008)*	S-y	4.3	of SL	*(EPA 2004b)*
Equal area side length (SL)	90 m		S-z	4.3	of BH	*(EPA 2004b)*

Conversions

2,000 lb/ton	1.102 ton/t	64.0638 M.W. SO2
2.205 lb/kg	453.59 g/lb	32.065 M.W. S

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Project Phase Phase 2

Onsite Hauling

Activity Information

Operating schedule 365 day/yr

Hauling Routes, Production Rates and Distances tpy

Origin Model ID	Route Origin	Destination Model ID	Route Destination	Material Type	Material Hauled [(1)] Rate ton/yr	Truck Loads load/yr	One-Way Hauling [(2)] mi	Total Travel [(3)] VMT/yr
Unpaved Roads								
PIT- *PIT*	Pit	*O_STOCK*	Ore Stockpile	Ore	6,200,000	39,491	1.41	111,237
PIT- *PIT*	Pit	*W_WRSF*	West WRSF	Waste	3,408,000	21,708	2.09	90,629
PIT- *PIT*	Pit	*E_WRSF*	East WRSF	Waste	1,392,000	8,867	2.55	45,290
G_S *G_STOCK*	Gangue Stockpile	*PIT*	Pit	Gangue	3,023,076	19,256	3.36	129,253
Total					14,023,076			376,409

(1) *(LNC 2019)*

(2) *Estimated mileage based on Thacker Pass Site Layout (LNC 2019c)*

(3) *Total VMT distributed based on Material Hauled and One-Way Hauling distance.*

Truck Fleet

Truck	Payload Capacity ton	Empty Weight ton	Quantity of trucks	Average Weight ton		
CAT 785D	157	118	14	196.5	*Loaded trucks one way*	*(LNC 2019a)*

Emission Factors

Unpaved roads

Emission factor equation	$E = k(s/12)^a (W/3)^b [(365-P)/365]$				*AP-42, Sec. 13.2.2, Eq. 1a, 11/06*
s = Surface material silt content	1.7 %				*(EPA 2003)*
W = Mean vehicle weight	196.5 ton				
P = Days/year with ≥0.01 in precip.	70 day/yr				*AP-42 Fig. 13.2.2-1, 11/06*
	PM	PM10	PM2.5		
k = Size-specific empirical constant	4.9	1.5	0.15		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
a = Size-specific empirical constant	0.7	0.9	0.9		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
b = Size-specific empirical constant	0.45	0.45	0.45		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
E = Size-specific emission factor	6.62	1.37	0.14	lb/VMT	

Emission Controls

Unpaved roads - periodic application of water and chemical dust suppressant

Control efficiency: 90% *(Air Sciences 2018)*

Conversions

2,000 lb/ton

5,280 ft/mi

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Project Phase Phase 2

Onsite Hauling - continued

Hauling Emissions by Route

		Material Hauled	PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
Route	Route	Material	PM	PM10		PM2.5	
Origin	Destination	Type	ton/yr	lb/day	ton/yr	lb/day	ton/yr
Unpaved Roads							
Pit	Ore Stockpile	Ore	36.82	41.79	7.63	4.18	0.76
Pit	West WRSF	Waste	30.00	34.04	6.21	3.40	0.62
Pit	East WRSF	Waste	14.99	17.01	3.10	1.70	0.31
Gangue Stockpile	Pit	Gangue	42.79	48.55	8.86	4.86	0.89
Total			124.61	141.40	25.80	14.14	2.58

Emissions by Area

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
		PM	PM10		PM2.5	
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
HR	Haul Roads	124.61	141.40	25.80	14.14	2.58

See worksheet ROADS for haul road (HR) emissions by Model ID.

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
HR	Haul Roads	VOLUME	See worksheet: ROADS			4.36	14.13	4.05

Truck Specs	m	
Vehicle height (VH) CAT 785D	5.1	*(Caterpillar 2019)*
Road width (RW)	24.4	*(LNC 2019)*

Plume Parameter	Calculation	Const.	Value (m)	
Plume top (PT) - unpaved	1.7 x VH	1.7	8.71	*(EPA 2012)*
Release height - unpaved	0.5 x PT	0.5	4.36	*(EPA 2012)*
Plume width (PW)	RW + 6 m	6	30.38	*(EPA 2012)*
Sigma-z - unpaved	PT / 2.15	2.15	4.05	*(EPA 2012)*
Sigma-y	PW / 2.15	2.15	14.13	*(EPA 2012)*

Conversions

2,000 lb/ton

3.28 ft/m

12 in/ft

Project Phase Phase 2

Material Load / Unload

Activity Information

Operating schedule 365 day/yr

Throughput Rates chk

Model ID	Location of Activity	No. of Xfers	Rate ton/yr	Total Rate ton/yr	Xfer Description
PIT	Pit	1	11,000,000	11,000,000	Load
G_STOCK	Gangue Stockpile	1	3,023,076	3,023,076	Load
O_STOCK	Ore Stockpile	1	6,200,000	6,200,000	Unload
W_WRSF	West WRSF	1	3,408,000	3,408,000	Unload
E_WRSF	East WRSF	1	1,392,000	1,392,000	Unload
PIT	Pit	1	3,023,076	3,023,076	Unload

Emission Factors

		PM	PM10	PM2.5		
k = Particle size multiplier		0.74	0.35	0.053		*AP-42, Sec. 13.2.4, Pg. 4, 11/06*
E = Emission factor	Load	0.00021	0.0001	0.000015	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck loading - crushed stone)*
	Unload	0.00003	0.000016	0.0000024	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck unloading - fragmented stone)*

Emissions by Model ID

			chk	PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
	Location of		Total Rate	PM	PM10		PM2.5	
Model ID	Activity		ton/yr	ton/yr	lb/day	ton/yr	lb/day	ton/yr
PIT	Pit	Load	11,000,000	1.16	3.01	0.55	0.46	0.083
G_STOCK	Gangue Stockpile	Load	3,023,076	0.32	0.83	0.15	0.13	0.023
O_STOCK	Ore Stockpile	Unload	6,200,000	0.10	0.27	0.05	0.04	0.008
W_WRSF	West WRSF	Unload	3,408,000	0.06	0.15	0.03	0.02	0.004
E_WRSF	East WRSF	Unload	1,392,000	0.02	0.06	0.01	0.01	0.002
PIT	Pit	Unload	3,023,076	0.05	0.13	0.02	0.02	0.004
Total	Material Load / Unload		28,046,152	1.72	4.46	0.81	0.67	0.12

Conversions

2,000 lb/ton

Project Phase Phase 2

Material Load / Unload - continued

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
O_STOCK	Ore Stockpile	VOLUME	411,254	4,617,174	1,526	4.36	47	4.05
W_WRSF	West WRSF	VOLUME	409,214	4,617,951	1,504	4.36	187	4.05
E_WRSF	East WRSF	VOLUME	412,839	4,618,603	1,549	4.36	171	4.05
G_STOCK	Gangue Stockpile	VOLUME	413,702	4,617,832	1,492	4.36	261	4.05

Vehicle height (VH) CAT 785D 5.1 m

Plume Parameter	Calculation	Const.	Value (m)
Plume top (PT)	1.7 x VH	1.7	8.71
Release height	0.5 x PT	0.5	4.36
Sigma-z	PT / 2.15	2.15	4.05

(EPA 2012)

S-y = length of side / 4.3 *(EPA 2004b)*

Location of Activity	Area[1] m^2	Length of side m	S-y
Ore Stockpile	41,623	204	47
West WRSF	643,544	802	187
East WRSF	541,645	736	171
Gangue Stockpile	1,263,489	1,124	261

[1] *(LNC 2019)*

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Project Phase Phase 2

Mobile Equipment (Tailpipes)

Activity Information

Operating schedule 24 hr/day 365 day/yr

On-Road Mobile Equipment [(1)]

Equipment	Total Units	Use	Fuel	EPA Tier	Rating hp	Oper. hr/yr	Avg Load Factor[(2)]	Output hp-hr/yr	Speed mi/hr[(3)]	VMT/yr	MOVES Class[(4)]
Ford F250 XLT Superduty	6	Mine	Diesel	4	450	8,760	51%	12,023,100	35	935,130	LHD<=10K
Ford F350 XLT Superduty	2	Mine	Diesel	4	450	8,760	51%	4,007,700	35	311,710	LHD<=14K
Ford F150 XLT Supercrew	4	Mine	Gasoline	n/a	395	8,760	51%	7,035,740	35	623,420	LDT
Water Truck (Process)	1	Process	Diesel	4	450	1,140	51%	260,775	20	11,590	LHD<=14K
Maintenance Service Truck	4	Process	Gasoline	n/a	385	1,040	51%	814,147	20	42,293	LHD45
1/2 Ton Pickups	7	Process	Gasoline	n/a	395	1,040	51%	1,461,763	20	74,013	LDT
Ambulance	1	Process	Gasoline	n/a	385	100	51%	19,571	20	1,017	LHD45
Fire Truck	1	Process	Gasoline	n/a	385	100	51%	19,571	20	1,017	LHD45

(1) *(LNC 2019a)* (2) *Average load factor for mining equipment* (3) *Estimate* (4) *(EPA 2015)*

EPA MOVES 2014b Emission Factors

Class	Description	Emission Factor (lb/VMT)[(1)] PM	PM10	PM2.5	CO	NOX	SO2	VOC
LDT	Gasoline - Passenger Truck	2.2E-04	2.2E-04	3.9E-05	7.1E-03	5.4E-04	2.2E-05	2.1E-04
LHD<=10K	Diesel - Light Commercial Truck	3.6E-04	3.6E-04	1.6E-04	2.6E-03	3.7E-03	1.4E-05	4.5E-04
LHD<=14K	Diesel - Light Commercial Truck	1.0E-03	1.0E-03	4.8E-04	3.1E-03	6.8E-03	2.4E-05	1.1E-03
LHD45	Gasoline - Single Unit Short-haul Truck	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03

(1) *(MOVES 2019)*

On-Road Equipment	MOVES Class	Emission Factor (lb/VMT) PM	PM10	PM2.5	CO	NOX	SO2	VOC
Ford F250 XLT Superduty	LHD<=10K	3.6E-04	3.6E-04	1.6E-04	2.6E-03	3.7E-03	1.4E-05	4.5E-04
Ford F350 XLT Superduty	LHD<=14K	1.0E-03	1.0E-03	4.8E-04	3.1E-03	6.8E-03	2.4E-05	1.1E-03
Ford F150 XLT Supercrew	LDT	2.2E-04	2.2E-04	3.9E-05	7.1E-03	5.4E-04	2.2E-05	2.1E-04
Water Truck (Process)	LHD<=14K	1.0E-03	1.0E-03	4.8E-04	3.1E-03	6.8E-03	2.4E-05	1.1E-03
Maintenance Service Truck	LHD45	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03
1/2 Ton Pickups	LDT	2.2E-04	2.2E-04	3.9E-05	7.1E-03	5.4E-04	2.2E-05	2.1E-04
Ambulance	LHD45	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03
Fire Truck	LHD45	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03

On-Road Equipment Emissions by Area

Area ID	Activity	PM ton/yr	PM10 lb/day	PM10 ton/yr	PM2.5 lb/day	PM2.5 ton/yr	CO lb/hr	CO ton/yr	NOX lb/hr	NOX ton/yr	SO2 lb/hr	SO2 ton/yr	VOC ton/yr
HR	Ford F250 XLT Super	0.17	0.93	0.17	0.42	0.08	0.27	1.20	0.40	1.74	0.0015	0.007	0.21
HR	Ford F350 XLT Super	0.16	0.85	0.16	0.41	0.07	0.11	0.48	0.24	1.07	0.0008	0.004	0.17
HR	Ford F150 XLT Super	0.07	0.37	0.07	0.07	0.01	0.51	2.22	0.04	0.17	0.0016	0.007	0.07
PROC	Water Truck (Process	0.01	0.03	0.01	0.02	0.00	0.00	0.02	0.01	0.04	0.0000	0.000	0.01
PROC	Maintenance Service	0.02	0.08	0.02	0.01	0.00	0.14	0.62	0.02	0.09	0.0003	0.001	0.04
PROC	1/2 Ton Pickups	0.01	0.04	0.01	0.01	0.00	0.06	0.26	0.00	0.02	0.0002	0.001	0.01
PROC	Ambulance	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.0000	0.000	0.00
PROC	Fire Truck	0.0004	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.0000	0.000	0.00
Total	On-Road Equipment	0.42	2.32	0.42	0.93	0.17	1.10	4.84	0.72	3.13	0.00	0.02	0.50

Conversions

2,000 lb/ton

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Project Phase Phase 2

Mobile Equipment (Tailpipes) - continued

Off-Road Vehicles

Final emission factor options:

EPA Engine Certification Data

EPA Non-Road Standards

EPA AP-42 - Diesel

AP-42 Emission Factors

	Emission Factor (lb/hp-hr)					
Engine Description	PM	CO	NOX	VOC	Reference	0
Diesel industrial engines ≤600 hp	0.0022	0.0067	0.0310	0.0025	*AP-42, Table 3.3-1, 10-96*	1
Large stationary diesel engines >600 hp	0.0007	0.0055	0.0240	0.00064	*AP-42, Table 3.4-1, 10-96*	600

EPA Engine Certification Data [(1)]

			Emission Factor (lb/hp-hr)[(3)]					
Vehicle Descriptio	Engine Description	EPA Family No.	PM	PM10	PM2.5	CO	NOX	VOC
Surface Miner	2006 Cummins QST 30, 1050 hp	6CEXL030.AAB[(2)]	0.00014	0.00014	0.00014	0.0014	0.0092	0.00064
Haul Truck	2006 CAT 3512C HD, 1450 hp	6CPXL58.6T2E[(2)]	0.00022	0.00022	0.00022	0.0026	0.0087	0.00064
Service Truck	2003 Cummins C8.3-215, 215 hp	3CEXL0505ABD[(2)]	0.00028	0.00028	0.00028	0.0012	0.0097	0.0025

[(1)] *(LNC 2019a)*

[(2)] *No EPA Certification VOC emission factor was provided, so AP-42, Table 3.4-1 was used.*

[(3)] *(EPA 2019)*

SO2 emission factor:

Diesel Sulfur Content 0.0015% *40 CFR 80.510 sulfur content of non-road diesel*

$$\frac{0.0015\%\ \text{lb S}}{\text{lb Fuel}} \times \frac{6.943\ \text{lb Fuel}}{\text{gal Fuel}} \times \frac{64.064\ \text{lb SO2}}{32.065\ \text{lb S}} = \frac{0.000208\ \text{lb SO2}}{\text{gal Fuel}}$$

Conversions

292.9 kW-hr/MMBtu	32.065 lb S
1.341 hp/kW	64.064 lb SO2
453.592 g/lb	6.943 lb/gal distillate oil

Project Phase Phase 2

Mobile Equipment (Tailpipes) - continued

Mobile Equipment Specifications and Activity [(1)]

Equipment	Category	Total Units	Model Year[(2),(3)]	Rating hp	Oper. hr/yr	Avg Load Factor[(4)]	Output hp-hr/yr	Diesel gal/yr	Rating kW	Power Category	
Hydraulic Excavator	Shovel	3	2006	1,530	8,760	65%	26,135,460	1,306,773	1,141	kW>560	chk
Surface Miner	Shovel	1	2006	1,050	8,760	65%	5,978,700	298,935	783	kW>560	chk
Haul Truck	Mining Truck	14	2006	1,450	8,760	35%	62,239,800	3,111,990	1,081	kW>560	chk
Dozer	Dozer	5	2006	600	8,760	58%	15,111,000	755,550	447	225≤kW<450, ≤2010	chk
Water Truck	Mining Truck	2	2006	1,025	8,760	35%	6,285,300	314,265	764	kW>560	chk
Grader	Grader	2	2006	304	8,760	40%	2,130,432	106,522	227	225≤kW<450, ≤2010	chk
Fuel/Lube Truck	Mining Truck	3	2006	375	8,760	35%	3,449,250	172,463	280	225≤kW<450, ≤2010	chk
Crane	Telehandler	1	2007	160	8,760	35%	490,560	24,528	119	75≤kW<130, ≤2011	chk
Telehandler	Telehandler	1	2007	142	8,760	35%	435,372	21,769	106	75≤kW<130, ≤2011	chk
Front End Loader	Loader	1	2006	973	8,760	58%	4,901,001	245,050	726	kW>560	chk
Service Truck	Mining Truck	2	2003	215	8,760	35%	1,318,380	65,919	160	130≤kW<225, ≤2010	chk
Skid Steer	Skid Steer	1	2008	74	8,760	58%	374,249	18,712	55	37≤kW<56, Opt2	chk
Manlift	Skid Steer	1	2015	67	8,760	58%	337,479	16,874	50	37≤kW<56, Opt2	chk
Drill Rigs [(5),(6)]	Shovel	1	2015	560	144	65%	52,416	2,621	418	130≤kW<560, Ph-out	chk
Forklift	Skid Steer	8	2015	75	1,139	58%	392,955	19,648	56	56≤kW<75, Ph-out	chk
Carry Deck Crane	Telehandler	2	2015	50	1,139	35%	39,865	1,993	37	37≤kW<56, Opt2	chk
Skid Steer	Skid Steer	3	2015	74	8,760	58%	1,122,747	56,137	55	37≤kW<56, Opt2	chk
Manlift - 340AJ	Skid Steer	2	2015	25	1,139	58%	32,484	1,624	18	8≤kW<19	chk
Manlift - 740AJ	Skid Steer	2	2015	67	1,139	58%	87,760	4,388	50	37≤kW<56, Opt2	chk
Telehandler	Telehandler	2	2015	142	8,760	35%	870,744	43,537	106	75≤kW<130, Ph-out	chk
Backhoe	Backhoe	1	2015	102	1,139	53%	60,993	3,050	76	75≤kW<130, Ph-out	chk
Mobile Crane	Telehandler	1	2015	164	475	35%	27,265	1,363	122	75≤kW<130, Ph-out	chk

(1) *(LNC 2019a)*

(2) *Oldest model year listed based on tier rating*

(3) *(Whitehead 2019c)*

(4) *Average medium application load factor by equipment category (Caterpillar 2016), pages 25-9 to 25-40.*

(5) *(LNC 2019)*

(6) *(Sandvik 2019)*

Conversions

1.341 hp/kW

7,000 Btu/hp-hr

140,000 Btu/gal diesel

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Mobile Equipment (Tailpipes) - continued

EPA Non-Road Standards

	Model		EPA	EPA Non-Road Standards (g/kW-hr)				
Equipment	Year	Power Category	Tier	PM	CO	NOX	VOC	Lookup ID
Hydraulic Excavator	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Surface Miner	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Haul Truck	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Dozer	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Water Truck	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Grader	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Fuel/Lube Truck	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Crane	2007	75≤kW<130, ≤2011	3	0.3	5	4	-	§89-75≤kW<130 2007
Telehandler	2007	75≤kW<130, ≤2011	3	0.3	5	4	-	§89-75≤kW<130 2007
Front End Loader	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Service Truck	2003	130≤kW<225, ≤2010	2	0.2	3.5	6.6	-	§89-130≤kW<225 2003
Skid Steer	2008	37≤kW<56, Opt2	3	0.4	5	4.7	-	§89-37≤kW<75 2008
Manlift	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Drill Rigs	2015	130≤kW<560, Ph-out	4	0.02	3.5	0.4	0.19	T4-130≤kW≤560 2015
Forklift	2015	56≤kW<75, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015
Carry Deck Crane	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Skid Steer	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Manlift - 340AJ	2015	8≤kW<19	4	0.4	6.6	7.5	7.5	T4-8≤kW<19 2015
Manlift - 740AJ	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Telehandler	2015	75≤kW<130, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015
Backhoe	2015	75≤kW<130, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015
Mobile Crane	2015	75≤kW<130, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015

Project Phase Phase 2

Mobile Equipment (Tailpipes) - continued

Final Emission Factors

Equipment	PM lb/hp-hr	CO lb/hp-hr	NOX lb/hp-hr[1]	VOC lb/hp-hr[1]	SO2 lb/gal	Final Emission Factor
Hydraulic Excavator	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Surface Miner	0.00014	0.00140	0.00921	0.00064	0.00021	*EPA Engine Certification Data*
Haul Truck	0.00022	0.00265	0.00875	0.00064	0.00021	*EPA Engine Certification Data*
Dozer	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Water Truck	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Grader	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Fuel/Lube Truck	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Crane	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Telehandler	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Front End Loader	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Service Truck	0.00028	0.00118	0.00970	0.00247	0.00021	*EPA Engine Certification Data*
Skid Steer	0.00066	0.00822	0.00773	0.00247	0.00021	*EPA Non-Road Standards*
Manlift	0.00005	0.00822	0.00773	0.00773	0.00021	*EPA Non-Road Standards*
Drill Rigs	0.00003	0.00575	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Forklift	0.00003	0.00822	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Carry Deck Crane	0.00005	0.00822	0.00773	0.00773	0.00021	*EPA Non-Road Standards*
Skid Steer	0.00066	0.00822	0.00773	0.00247	0.00021	*EPA Non-Road Standards*
Manlift - 340AJ	0.00066	0.01085	0.01233	0.01233	0.00021	*EPA Non-Road Standards*
Manlift - 740AJ	0.00005	0.00822	0.00773	0.00773	0.00021	*EPA Non-Road Standards*
Telehandler	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Backhoe	0.00003	0.00822	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Mobile Crane	0.00003	0.00822	0.00066	0.00031	0.00021	*EPA Non-Road Standards*

[1] *If the EPA Non-Road Standard is a combined NOX+VOC limit, then NOX = NOX+VOC and VOC is taken from AP-42.*

Conversions

453.592 g/lb

1.341 hp/kW

Project Phase Phase 2

Mobile Equipment (Tailpipes) - continued

Emissions by Area

		PM	PM10		PM2.5		CO		NOX		SO2		VOC
		chk	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
PIT	Hydraulic Excavator	4.30	23.54	4.30	23.54	4.30	17.17	75.19	31.39	137.49	0.031	0.136	8.37
PIT	Surface Miner	0.43	2.34	0.43	2.34	0.43	0.95	4.18	6.28	27.52	0.007	0.031	1.92
HR	Haul Truck	6.96	38.13	6.96	38.13	6.96	18.81	82.37	62.14	272.18	0.074	0.324	19.94
MINE	Dozer	2.48	13.61	2.48	13.61	2.48	9.93	43.47	11.34	49.69	0.018	0.079	18.66
HR	Water Truck	1.03	5.66	1.03	5.66	1.03	4.13	18.08	7.55	33.07	0.007	0.033	2.01
HR	Grader	0.35	1.92	0.35	1.92	0.35	1.40	6.13	1.60	7.00	0.003	0.011	2.63
HR	Fuel/Lube Truck	0.57	3.11	0.57	3.11	0.57	2.27	9.92	2.59	11.34	0.004	0.018	4.26
MINE	Crane	0.12	0.66	0.12	0.66	0.12	0.46	2.02	0.37	1.61	0.001	0.003	0.61
MINE	Telehandler	0.11	0.59	0.11	0.59	0.11	0.41	1.79	0.33	1.43	0.001	0.002	0.54
MINE	Front End Loader	0.81	4.41	0.81	4.41	0.81	3.22	14.10	5.89	25.78	0.00582	0.02549	1.57
HR	Service Truck	0.18	1.01	0.18	1.01	0.18	0.18	0.78	1.46	6.39	0.002	0.007	1.63
MINE	Skid Steer	0.12	0.67	0.12	0.67	0.12	0.35	1.54	0.33	1.45	0.0004	0.002	0.46
MINE	Manlift	0.01	0.05	0.01	0.05	0.01	0.32	1.39	0.30	1.30	0.000	0.002	1.30
PIT	Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.00	0.02	0.000	0.000	0.01
PROC	Forklift	0.01	0.04	0.01	0.04	0.01	0.37	1.62	0.03	0.13	0.000	0.002	0.06
PROC	Carry Deck Crane	0.00	0.01	0.00	0.01	0.00	0.04	0.16	0.04	0.15	0.000	0.000	0.15
PROC	Skid Steer	0.37	2.02	0.37	2.02	0.37	1.05	4.61	0.99	4.34	0.001	0.006	1.39
PROC	Manlift - 340AJ	0.01	0.06	0.01	0.06	0.01	0.04	0.18	0.05	0.20	0.000	0.000	0.20
PROC	Manlift - 740AJ	0.00	0.01	0.00	0.01	0.00	0.08	0.36	0.08	0.34	0.000	0.000	0.34
PROC	Telehandler	0.21	1.18	0.21	1.18	0.21	0.82	3.58	0.65	2.86	0.001	0.005	1.08
PROC	Backhoe	0.00	0.01	0.00	0.01	0.00	0.06	0.25	0.00	0.02	0.000	0.000	0.01
PROC	Mobile Crane	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.00	0.01	0.000	0.000	0.00
	Total Non-Road Emissions	18.07	99.03	18.07	99.03	18.07	62.10	271.98	133.41	584.33	0.16	0.69	67.14
	Total On-Road Emissions	0.42	2.32	0.42	0.93	0.17	1.10	4.84	0.72	3.13	0.004	0.019	0.50
	Total Tailpipe Emissions	18.50	101.35	18.50	99.96	18.24	63.20	276.82	134.12	587.47	0.16	0.71	67.63

Conversions

2,000 lb/ton
453.59 g/lb

Project Phase Phase 2

Mobile Equipment (Tailpipes) - continued

Subtotals by Area

		chk	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk
		PM	PM10		PM2.5		CO		NOX		SO2		VOC
Area		ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
HR	Haul Roads	9.49	51.98	9.49	50.72	9.26	27.67	121.19	76.02	332.96	0.09	0.41	30.92
PIT	Pit	4.73	25.89	4.73	25.89	4.73	18.16	79.52	37.68	165.03	0.04	0.17	10.29
MINE	Mine	3.65	20.00	3.65	20.00	3.65	14.68	64.31	18.55	81.26	0.03	0.11	23.14
PROC	Process Plant	0.64	3.48	0.64	3.35	0.61	2.70	11.81	1.87	8.21	0.00	0.02	3.28
Total	Mobile Tailpipes	18.50	101.35	18.50	99.96	18.24	63.20	276.82	134.12	587.47	0.16	0.71	67.63

MINE = Pits, dumps, and stockpiles

Short-term emissions are based on annual emissions divided by 365 day/yr and 24 hr/day.

Emission Allocation by Model ID

	Area ID				Location of		Total Rate				
Model ID	*HR*	*PIT*	*MINE*	*PROC*	Activity		ton/yr	HR	PIT	MINE	PROC
PIT		*PIT*	*MINE*		Pit		14,023,076	-	100.0%	34.1%	-
O_STOCK			*MINE*		Ore Stockpile		6,200,000	-	-	15.1%	-
W_WRSF			*MINE*		West WRSF		3,408,000	-	-	8.3%	-
E_WRSF			*MINE*		East WRSF		1,392,000	-	-	3.4%	-
G_STOCK			*MINE*		Gangue Stockpile		3,023,076	-	-	7.4%	-
CTFS			*MINE*		Clay Tailings Filter Stack	Clay_tpy	13,045,392	-	-	31.7%	-
HR	*HR*				Haul Roads			100.0%	-	-	-
PROC				*PROC*	Process Plant			-	-	-	100.0%

Project Phase Phase 2

Mobile Equipment (Tailpipes) - continued

Emissions by Model ID

		chk PM_TPY	chk PM10_PPD	chk PM10_TPY	chk PM2.5_PPD	chk PM2.5_TPY	chk CO_PPH	chk CO_TPY	chk NOX_PPH	chk NOX_TPY	chk SO2_PPH	chk SO2_TPY	chk VOC_TPY
		PM	PM10		PM2.5		CO		NOX[1]		SO2		VOC
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
PIT	Mobile Tailpipes	5.97	32.72	5.97	32.72	5.97	23.17	101.47	44.01	192.77	0.05	0.21	18.19
O_STOCK	Mobile Tailpipes	0.55	3.02	0.55	3.02	0.55	2.22	9.70	2.80	12.26	0.00	0.02	3.49
W_WRSF	Mobile Tailpipes	0.30	1.66	0.30	1.66	0.30	1.22	5.33	1.54	6.74	0.0021	0.0093	1.92
E_WRSF	Mobile Tailpipes	0.12	0.68	0.12	0.68	0.12	0.50	2.18	0.63	2.75	0.001	0.004	0.78
G_STOCK	Mobile Tailpipes	0.27	1.47	0.27	1.47	0.27	1.08	4.73	1.36	5.98	0.0019	0.0083	1.70
CTFS	Mobile Tailpipes	1.16	6.35	1.16	6.35	1.16	4.66	20.42	5.89	25.80	0.01	0.04	7.35
HR	Mobile Tailpipes	9.49	51.98	9.49	50.72	9.26	27.67	121.19	76.02	332.96	0.093	0.409	30.92
PROC	Mobile Tailpipes	0.64	3.48	0.64	3.35	0.61	2.70	11.81	1.87	8.21	0.00	0.02	3.28

[1] *NO2 / NOX In-Stack Ratio (ISR):* 11% *(CAPCOA 2011)*

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
CTFS	Clay Tailings Filter Stack	VOLUME	415,659	4,617,957	1,471	3.49	355	3.24
PROC	Process Plant	VOLUME	414,342	4,617,062	1,440	1.79	166	1.67

Vehicle height (VH):
CAT D10 Dozer 4.10 m *(Caterpillar 2016)*

Plume Parameter	Calculation	Const.	Value (m)
Plume top (PT)	1.7 x VH	1.7	6.97
Release height	0.5 x PT	0.5	3.49
Sigma-z	PT / 2.15	2.15	3.24

(EPA 2012)

Vehicle height (VH):
CAT 246D Skid Stee 2.11 m *(Caterpillar 2016)*

Plume Parameter	Calculation	Const.	Value (m)
Plume top (PT)	1.7 x VH	1.7	3.59
Release height	0.5 x PT	0.5	1.79
Sigma-z	PT / 2.15	2.15	1.67

(EPA 2012)

S-y = length of side / 4.3 *(EPA 2004b)*

Location of Activity	Area[1] m^2	Length of side m	S-y
Clay Tailings Filter Stack	2,333,086	1,527	355
Process Plant	511,599	715	166

[1] *(LNC 2019)*

Project Phase Phase 2

Dozing and Grading

Activity Information

Operating schedule 365 day/yr
Average Grader Speed 11.8 mile/hr (LNC 2019a)

Dozer and Grader Fleet

Equipment	Activity
Dozer	43,800 hr/yr
Grader	17,520 hr/yr
	206,736 VMT/yr

Dozing Emission Factors

Emission Factor Equation	TSP (lb/hr) = 5.7 $(s)^{1.2}/(M)^{1.3}$	*AP-42, Tab. 11.9-1, 07/98, (bulldozing, overburden)*
	PM15 (lb/hr) = 1.0 $(s)^{1.5}/(M)^{1.4}$	*AP-42, Tab. 11.9-1, 07/98, (bulldozing, overburden)*
s = Surface material silt content	1.7 %	*(EPA 2003)*
M = Material moisture content	7.9 %	*AP-42, Table 11.9-3, 07/98, (bulldozers, overburden)*
TSP(PM)	0.734 lb/hr	
PM15	0.123 lb/hr	

Dozing PM Scaling Factors

PM10	0.75	*AP-42, Tab. 11.9-1, 07/98, (applies to PM15 EF, footnote d)*
PM2.5	0.105	*AP-42, Tab. 11.9-1, 07/98, (applies to TSP EF, footnote e)*

Grading Emission Factors

Emission Factor Equation	TSP (lb/VMT) = 0.04 $(S)^{2.5}$	*AP-42, Tab. 11.9-1, 07/98, (grading)*
	PM15 (lb/VMT) = 0.051 $(S)^{2}$	*AP-42, Tab. 11.9-1, 07/98, (grading)*
S - Grader average speed	11.8 mile/hr	
TSP(PM)	19.132 lb/VMT	
PM15	7.101 lb/VMT	

Grading PM Scaling Factors

PM10	0.6	*AP-42, Tab. 11.9-1, 07/98, (applies to PM15 EF, footnote d)*
PM2.5	0.031	*AP-42, Tab. 11.9-1, 07/98, (applies to TSP EF, footnote e)*

Emission Controls

Unpaved roads - periodic application of water and chemical dust suppressant
Control efficiency: 90% *(Air Sciences 2018)*

Emissions by Area

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
		PM	PM10		PM2.5	
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
MINE	Dozing	16.07	11.05	2.02	9.24	1.69
HR	Grading	197.77	241.33	44.04	33.59	6.13

Conversions
2,000 lb/ton

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
	PROJECT NO: 270-3-3	PAGE: 18 OF: 22 SHEET: Mine
AIR EMISSION CALCULATIONS	SUBJECT: Mining Activity	DATE: December 13, 2019

Project Phase Phase 2

Dozing and Grading - continued

Emissions by Model ID		chk PM_TPY	chk PM10_PPD	chk PM10_TPY	chk PM2.5_PPD	chk PM2.5_TPY
		PM	PM10		PM2.5	
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
PIT	Dozing	5.48	3.77	0.69	3.15	0.58
O_STOCK	Dozing	2.42	1.67	0.30	1.39	0.25
W_WRSF	Dozing	1.33	0.92	0.17	0.77	0.14
E_WRSF	Dozing	0.54	0.37	0.07	0.31	0.06
G_STOCK	Dozing	1.18	0.81	0.15	0.68	0.12
CTFS	Dozing	5.10	3.51	0.64	2.93	0.54
HR	Grading	197.77	241.33	44.04	33.59	6.13

Project Phase Phase 2

Water Truck Travel

Activity Information

Operating schedule	365 day/yr	
Average truck speed	12 mph	*(LNC 2019a)*

Truck Fleet

Water Truck	Payload Capacity ton	Empty Weight ton	Gross Weight ton	Oper. hr/yr	Average Weight ton	
CAT 777G	83.4	105	188	17,520	147	*(LNC 2019a)*

Total vehicle miles traveled (VMT) 210,240 VMT/yr

Emission Factors

Emission factor equation	$E = k(s/12)^a (W/3)^b [(365-P)/365]$	*AP-42, Sec. 13.2.2, Eq. 1a, 11/06*
s = Surface material silt content	1.7 %	*(EPA 2003)*
W = Mean vehicle weight	147 ton	
P = Days/year with ≥0.01 in precip.	70 day/yr	*AP-42 Fig. 13.2.2-1, 11/06*

	PM	PM10	PM2.5		
k = Size-specific empirical constant	4.9	1.5	0.15		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
a = Size-specific empirical constant	0.7	0.9	0.9		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
b = Size-specific empirical constant	0.45	0.45	0.45		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
E = Size-specific emission factor	5.80	1.20	0.12	lb/VMT	

Emission Controls

Periodic application of water and chemical dust suppressant

Control efficiency: 90% *(Air Sciences 2018)*

Emissions by Area

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
		PM	PM10		PM2.5	
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
HR	Water Truck Travel	61.00	69.22	12.63	6.92	1.26

Conversions

2,000 lb/ton

8.34 lb H_2O/gal

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
	PROJECT NO: 270-3-3	PAGE: 20 OF: 22 SHEET: Mine
AIR EMISSION CALCULATIONS	SUBJECT: Mining Activity	DATE: December 13, 2019

Project Phase Phase 2

Wind Erosion

Activity Information

Operating schedule 365 day/yr

Erodible Area

Model ID	Location of Activity		Surface Type	Total Rate ton/yr	Erodible Area (acre/yr)[(1),(2)] Flat	Pile
O_STOCK	Ore Stockpile		Pile	6,200,000		736
W_WRSF	West WRSF		Pile	3,408,000		404
E_WRSF	East WRSF		Pile	1,392,000		165
G_STOCK	Gangue Stockpile	Gangue_tpy	Pile	3,023,076		359
CTFS	Clay Tailings Filter Stack	Clay_tpy	Pile	13,045,392		1,548
HR	Haul Roads		Flat		91	

(1) *Based on total haul road length of* *15,137 m* *and width of* *24.4 m*

(2) *Pile surface area calculations:*

Truck dump (TD) size	157.0 ton	
Material density	132.2 lb/ft^3	*AP-42, Table 11.9-6, average of overburden density, 10/98*
	0.066 ton/ft^3	
Material specific volume	15.1 ft^3/ton	
TD volume (V)	2,376 ft^3	

Conical surface calculations

Side slope	38 deg	*Typical value*
	0.7 rad	

Conical surface area (SA)	Π × r × (h^2 + r^2)^0.5
Conical volume (V)	(Π × h × r^2) ÷ 3
Conical base radius	r = s × cos(slope)
Conical height	h = s × sin(slope)
Sloped side length	s = (h^2 + r^2)^0.5

Solution of conical volume equation

Replacing h and r with s × sin(slope) and s × cos(slope), respectively:

s = [3 × V/(pi × sin(slope) × cos^2(slope)]^(1/3)	18.1 ft
r	14.3 ft
h	11.1 ft
SA	811 ft^2
	0.019 acre
	1.2E-4 acre/ton-TD

Scaling Factors

PM10	0.5	*AP-42, Pg. 13.2.5-3, 11/06*
PM2.5	0.075	*AP-42, Pg. 13.2.5-3, 11/06*

Conversions

4,046.86 m^2/acre

43,560 ft^2/acre

1,609.34 m/mi

Project Phase Phase 2

Wind Erosion - continued ***Wind erosion calculations based on 4/18/2012 through 4/17/2013 Thacker Pass on-site meteorological data. (Air Sciences 2019)***

chk

Wind erosion subtotals by surface type

	PM	PM10	PM2.5
	lb	lb	lb
Pile Subtotal	10.388	5.194	0.779
Flat Surface Subtotal [(1)]	0.000	0.000	0.000

[(1)] *The threshold wind speed to disturb flat surfaces of 16.04 m/s was never exceeded.*

Final Emission Factors (lb/acre-yr)

Surface Type	PM	PM10	PM2.5
Pile	10.39	5.19	0.78
Flat	--	--	--

Emissions by Model ID

				PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
	Location of	Control[(1)]		PM	PM10		PM2.5	
Model ID	Activity		Type	ton/yr	lb/day	ton/yr	lb/day	ton/yr
O_STOCK	Ore Stockpile	--	Pile	3.82	10.47	1.91	1.570	0.287
W_WRSF	West WRSF	--	Pile	2.10	5.75	1.05	0.863	0.158
E_WRSF	East WRSF	--	Pile	0.86	2.35	0.43	0.353	0.064
G_STOCK	Gangue Stockpile	--	Pile	1.86	5.10	0.93	0.766	0.140
CTFS	Clay Tailings Filter Stacl	--	Pile	8.04	22.03	4.02	3.304	0.603
HR	Haul Roads	90%	Flat	0	0	0	0	0
Total	Wind Erosion			16.68	45.71	8.34	6.86	1.25

Conversions

2,000 lb/ton

Project Phase Phase 2

Wind Erosion - continued

Dump Surface Wind Erosion Event Emission Calculations - Notes

(1) u10 = wind speed at 10 meters reference height, m/s

(2) u10+ = fastest-mile wind speed, m/s

Based on hourly to fastest-mile wind speed conversion factor of 1.2 *(EPA 1994)*

(3) Pile: u* = friction velocity, m/s = (us/ur) × 0.1 × u10+ *AP-42, Sec. 13.2.5, Eqs. 6 & 7, 11/06*

Area ID	A	B	C	
(us/ur)	0.9	0.6	0.2	*AP-42, Page 13.2.5-10, 11/06*

Flat surface:

u* = friction velocity, m/s = 0.053 × u10+ *AP-42, Sec. 13.2.5, Eq. 4, 11/06*

(4) Hours elapsed since previous wind erosion event

(5) Erodible surface area = hours elapsed since previous erosion event × hourly erodible surface area (acre) × surface regime area fraction Surface regime area fractions:

Area ID	A	B	C	
% Surface	0.12	0.48	0.4	*AP-42, Page 13.2.5-10, 11/06*

(6) Erosion potential, g/m^2, = P = 58(u* - ut*)^2 + 25(u* - ut*); P = 0 for u* ≤ ut*

where, ut* = threshold friction velocity = 1.02 m/s *AP-42, Page 13.2.5-5 (overburden), 11/06*

P converted to lb/acre by multiplying with: 0.0022046 lb/g and 4,046.86 m^2/acre

Solving u* = (us/ur) × 0.1 × u10+ for u10, when u* = ut* = 1.02 m/s and u10+ = u* × 1.2

yields the following minimum wind speeds to disturb the each stockpile surface regime:

ID-A	9.44	m/s
ID-B	14.17	m/s
ID-C	42.50	m/s

The threshold wind speed to disturb flat surfaces is 1.02/0.053/1.2

Flat surface 16.04 m/s

The maximum hourly wind speed in the onsite data is 15.1 m/s, which is less than the threshold wind speeds to cause a disturbance of stockpile regime ID-C and flat surfaces.

(7) PM emissions, lb = P (lb/acre) × erodible surface area (acre)

(8) Total PM emissions, lb = PM (ID-A), lb + PM (ID-B), lb + PM(ID-C), lb

(9) Total PM10 emissions, lb = total PM emissions, lb × PM10 scaling factors of 0.5 *AP-42, Page 13.2.5-3, 11/06*

(10) Total PM2.5 emissions, lb = total PM emissions, lb × PM2.5 scaling factors of 0.075 *AP-42, Page 13.2.5-3, 11/06*

Phase 2 HAP, GHG, & Other Pollutant Emissions

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
	PROJECT NO: 270-3-3	PAGE: 1 OF: 13 SHEET: HAP&GHG
AIR EMISSION CALCULATIONS	SUBJECT: HAP and GHG Emissions	DATE: December 13, 2019

Hazardous Air Pollutants and Greenhouse Gas Emissions - Stationary Sources **Project Phase** Phase 2

HAP Emissions Summary - Stationary Sources

Pollutant/Group		Emissions ton/yr
1,1,1-Trichloroethane		1.49E-06
1,1,2,2-Tetrachloroethane		5.09E-06
1,1,2-Trichloroethane		4.04E-06
1,3-Butadiene		4.16E-05
1,3-Dichloropropene		3.36E-06
2-Methylnaphthalene	POM	4.22E-06
2,2,4-Trimethylpentane		3.18E-05
Acenaphthene	POM	4.36E-07
Acenaphthylene	POM	1.69E-06
Acetaldehyde		1.21E-03
Acrolein		6.72E-04
Anthracene	POM	3.73E-07
Benz(a)anthracene	POM	3.28E-07
Benzene		2.40E-04
Benzo(a)pyrene	POM	3.67E-08
Benzo(e)pyrene		5.28E-08
Benzo(b)fluoranthene	POM	4.05E-08
Benzo(g,h,i)perylene	POM	1.62E-07
Benzo(k)fluoranthene	POM	3.03E-08
Biphenyl		2.70E-05
Carbon Tetrachloride		4.67E-06
Chlorine		**5.69E-01**
Chlorobenzene		3.87E-06
Chloroform		3.62E-06
Chrysene	POM	1.57E-07
Dibenz(a,h)anthracene	POM	1.14E-07
Ethylbenzene		5.45E-06
Ethylene Dibromide		5.63E-06
Fluoranthene	POM	1.63E-06
Fluorene	POM	6.42E-06
Formaldehyde		7.15E-03
Hexane		1.41E-04
Indeno(1,2,3-cd)pyrene	POM	7.32E-08
Methanol		3.18E-04
Methylene Chloride		2.54E-06
Naphthalene	POM	3.32E-05
OCDD		1.96E-11
o-Xylene		6.89E-07
PAH		3.42E-06
Phenanthrene	POM	7.13E-06
Phenol		3.05E-06
Pyrene	POM	1.11E-06
Styrene		3.00E-06
Tetrachloroethane		3.15E-07
Toluene		1.71E-04
Vinyl Chloride		1.90E-06
Xylenes		7.91E-05

Pollutant/Group	Emissions ton/yr
Antimony	5.57E-03
Arsenic	5.35E-02
Beryllium	2.42E-03
Cadmium	2.88E-04
Chromium	4.03E-03
Cobalt	3.11E-03
Lead	5.87E-03
Manganese	2.96E-01
Mercury	1.35E-04
Nickel	6.48E-03
Phosphorus	9.98E-02
Selenium	1.29E-03
POM Subtotal	*5.71E-05*
Highest Single HAP: Chlorine	0.57
Total HAP	1.06

Chlorine 22 #N/A chk

GHG Emissions Summary - Stationary Sources

Source Category	CO2e *(ton/yr)*
Diesel Combustion	7,416
Natural Gas/Propane Combustion	17
Lithium Processing Sources	35,223
Total GHGs	**42,656**

chk

Conversions

2,000	lb/ton	1.341	hp/kW
907.184	kg/ton	1,000,000	Btu/MMBtu
		1,000	gal/10^3 gal

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Hazardous Air Pollutants and Greenhouse Gas Emissions - Mobile Sources **Project Phase** Phase 2

HAP Emissions Summary - Mobile Sources

Pollutant/Group		Emissions ton/yr
1,1,1-Trichloroethane		0.00E+00
1,1,2,2-Tetrachloroethane		0.00E+00
1,1,2-Trichloroethane		0.00E+00
1,3-Butadiene		7.11E-03
1,3-Dichloropropene		0.00E+00
2-Methylnaphthalene	POM	0.00E+00
2,2,4-Trimethylpentane		0.00E+00
Acenaphthene	POM	1.99E-03
Acenaphthylene	POM	4.33E-03
Acetaldehyde		1.49E-01
Acrolein		1.97E-02
Anthracene	POM	7.95E-04
Benz(a)anthracene	POM	5.35E-04
Benzene		4.56E-01
Benzo(a)pyrene	POM	1.29E-04
Benzo(e)pyrene		0.00E+00
Benzo(b)fluoranthene	POM	4.28E-04
Benzo(g,h,i)perylene	POM	2.94E-04
Benzo(k)fluoranthene	POM	1.09E-04
Biphenyl		0.00E+00
Carbon Tetrachloride		0.00E+00
Chlorine		0.00E+00
Chlorobenzene		0.00E+00
Chloroform		0.00E+00
Chrysene	POM	6.29E-04
Dibenz(a,h)anthracene	POM	2.34E-04
Ethylbenzene		0.00E+00
Ethylene Dibromide		0.00E+00
Fluoranthene	POM	2.87E-03
Fluorene	POM	1.00E-02
Formaldehyde		2.44E-01
Hexane		0.00E+00
Indeno(1,2,3-cd)pyrene	POM	2.21E-04
Methanol		0.00E+00
Methylene Chloride		0.00E+00
Naphthalene	POM	6.34E-02
OCDD		0.00E+00
o-Xylene		0.00E+00
PAH		0.00E+00
Phenanthrene	POM	2.04E-02
Phenol		0.00E+00
Pyrene	POM	2.24E-03
Styrene		0.00E+00
Tetrachloroethane		0.00E+00
Toluene		1.78E-01
Vinyl Chloride		0.00E+00
Xylenes		1.23E-01

Pollutant/Group	Emissions ton/yr
Antimony	0.00E+00
Arsenic	0.00E+00
Beryllium	0.00E+00
Cadmium	0.00E+00
Chromium	0.00E+00
Cobalt	0.00E+00
Lead	0.00E+00
Manganese	0.00E+00
Mercury	0.00E+00
Nickel	0.00E+00
Phosphorus	0.00E+00
Selenium	0.00E+00
POM Subtotal	*1.09E-01*
Total HAP	1.29

chk

GHG Emissions Summary - Mobile Sources

Source Category	CO2e *(ton/yr)*
Gasoline & Diesel Mobile Machinery	89,932
Total GHGs	**89,932**

chk

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Hazardous Air Pollutants and Greenhouse Gas Emissions - Summary **Project Phase** Phase 2

Stationary Sources

Phase	Description		HAP ton/yr	CO2e ton/yr
Phase 1	Package Boiler 1	SAP	5.3E-04	1,588
Phase 2	Package Boiler 2	SAP	5.3E-04	1,588
Phase 1	Start-Up Burner 1	SAP	7.0E-04	2,104
Phase 2	Start-Up Burner 2	SAP	7.0E-04	2,104
Phase 1	Fire Pump 1 (Mine)		2.5E-04	11
Phase 1	Fire Pump 2 (Process)		2.5E-04	11
Phase 2	Fire Pump 3 (Process)		2.5E-04	11
Phase 1	Emergency Generator 1 (Mine)		4.6E-03	9
Phase 1	Emergency Generator 2 (Mine)		4.6E-03	9
Phase 2	Tail Gas Scrubber (Sulfuric Acid Plant	SAP	N/A	1,157
Phase 2	Carbonate Destruction	SAP	N/A	22,276
Phase 2	Neutralization		N/A	5,470
Phase 2	Lithium Sulfide Production		N/A	6,320
Phase 1	Sodium Hypochlorite Tank 1		0.28	N/A
Phase 2	Sodium Hypochlorite Tank 2		0.28	N/A
Total			0.58	42,656
			chk	chk

Fugitive Sources

Phase	Description	HAP ton/yr	CO2e ton/yr
Phase 2	Fugitive Dust Sources - HAP Emissions	0.48	N/A
Total		0.48	N/A

Mobile Sources

Description	HAP ton/yr	CO2e ton/yr	
Total Mobile Gasoline Engines	0.13	5,085	Gasoline
Total Mobile Diesel Engines	1.16	84,847	Diesel
Total	1.29	89,932	
	chk	chk	

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Stationary Source - Diesel External Combustion **Project Phase** Phase 2

Thru_unit

Source Data hr/yr Thru_hr

		Operation	Fuel Consumption		HAP	CO2e
Phase	**Description**	hr/yr	MMBtu/hr	MMBtu/yr	ton/yr	ton/yr
Phase 1	Package Boiler 1	288	67.4	19,411	5.31E-04	1,588
Phase 2	Package Boiler 2	288	67.4	19,411	5.31E-04	1,588
Phase 1	Start-Up Burner 1	288	89.3	25,718	7.04E-04	2,104
Phase 2	Start-Up Burner 2	288	89.3	25,718	7.04E-04	2,104
Total			313	90,259		
					chk	chk

Diesel HAP Emission Factors and Emissions

Pollutant	POM	Emission Factor*		Emissions	
		lb/10^3 gal	lb/MMBtu**	lb/hr	ton/yr
Benzene		2.14E-04	3.00E-08	9.39E-06	1.35E-06
Ethylbenzene		6.36E-05	8.90E-09	2.79E-06	4.02E-07
Formaldehyde		3.30E-02	4.62E-06	1.45E-03	2.08E-04
Naphthalene	POM	1.13E-03	1.58E-07	4.96E-05	7.14E-06
1,1,1-Trichloroethane		2.36E-04	3.30E-08	1.04E-05	1.49E-06
Toluene		6.20E-03	8.68E-07	2.72E-04	3.92E-05
o-Xylene		1.09E-04	1.53E-08	4.78E-06	6.89E-07
Anthracene	POM	1.22E-06	1.71E-10	5.35E-08	7.71E-09
Benzo(g,h,i)perylene	POM	2.26E-06	3.16E-10	9.92E-08	1.43E-08
Phenanthrene	POM	1.05E-05	1.47E-09	4.61E-07	6.63E-08
OCDD		3.10E-09	4.34E-13	1.36E-10	1.96E-11
Antimony			0.00E+00	0.00E+00	0.00E+00
Arsenic			4.00E-06	1.25E-03	1.81E-04
Beryllium			3.00E-06	9.40E-04	1.35E-04
Cadmium			3.00E-06	9.40E-04	1.35E-04
Chromium			3.00E-06	9.40E-04	1.35E-04
Cobalt			0.00E+00	0.00E+00	0.00E+00
Lead			9.00E-06	2.82E-03	4.06E-04
Manganese			6.00E-06	1.88E-03	2.71E-04
Mercury			3.00E-06	9.40E-04	1.35E-04
Nickel			3.00E-06	9.40E-04	1.35E-04
Phosphorus			0.00E+00	0.00E+00	0.00E+00
Selenium			1.50E-05	4.70E-03	6.77E-04
POM Subtotal				*5.02E-05*	*7.23E-06*
Total HAP				1.72E-02	2.47E-03

** AP-42, Table 1.3-9, (5/10), Fuel Oil Combustion*

*** Heat Content of* 0.14 MMBtu/gal diesel

Diesel GHG Emission Factors:	73.96 *kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03 *kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04 *kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Diesel GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	7,359	1	7,359
CH4	0.30	25	7.46
N2O	0.06	298	17.79
Total GHG			7,384

** 40 CFR 98, Table A-1*

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Stationary Source - Diesel Engines **Project Phase** Phase 2

Source Data Thru_unit Thru_hr hr/yr

		Power Rating		Operation	Output	Fuel Consumption*		HAP	CO2e
Phase	**Description**	kW	hp	hr/yr	hp-hr/yr	MMBtu/hr	MMBtu/yr	ton/yr	ton/yr
Phase 1	Fire Pump 1 (Mine)	130	175	100	17,500	1.3	130	2.5E-04	10.7
Phase 1	Fire Pump 2 (Process)	130	175	100	17,500	1.3	130	2.5E-04	10.7
Phase 2	Fire Pump 3 (Process)	130	175	100	17,500	1.3	130	2.5E-04	10.7
Total Small Diesel Engines (<=600 hp)					52,500	3.9	391		
Total Large Diesel Engines (>600 hp)					0	0.0	0		

** Estimated brake specific fuel consumption for Clarke diesel fire pumps* 7,440 *Btu/hp-hr* *(Clarke 2019)* chk chk

Diesel HAP Emission Factors and Emissions

Pollutant	**POM**	**Emission Factor***		**Emissions**	
		Small Diesel Engines <=600 hp	Large Diesel Engines >600 hp		
		lb/MMBtu	lb/MMBtu	lb/hr	ton/yr
Benzene		9.33E-04	7.76E-04	3.64E-03	1.82E-04
Toluene		4.09E-04	2.81E-4	1.60E-03	7.99E-05
Xylenes		2.85E-04	1.93E-4	1.11E-03	5.57E-05
1,3-Butadiene		3.91E-05	0.00E+0	1.53E-04	7.64E-06
Formaldehyde		1.18E-03	7.89E-5	4.61E-03	2.30E-04
Acetaldehyde		7.67E-04	2.52E-5	3.00E-03	1.50E-04
Acrolein		9.25E-05	7.88E-6	3.61E-04	1.81E-05
Naphthalene	POM	8.48E-05	1.30E-4	3.31E-04	1.66E-05
Acenaphthylene	POM	5.06E-06	9.23E-6	1.98E-05	9.88E-07
Acenaphthene	POM	1.42E-06	4.68E-6	5.55E-06	2.77E-07
Fluorene	POM	2.92E-05	1.28E-5	1.14E-04	5.70E-06
Phenanthrene	POM	2.94E-05	4.08E-05	1.15E-04	5.74E-06
Anthracene	POM	1.87E-06	1.23E-06	7.30E-06	3.65E-07
Fluoranthene	POM	7.61E-06	4.03E-06	2.97E-05	1.49E-06
Pyrene	POM	4.78E-06	3.71E-06	1.87E-05	9.34E-07
Benz(a)anthracene	POM	1.68E-06	6.22E-07	6.56E-06	3.28E-07
Chrysene	POM	3.53E-07	1.53E-06	1.38E-06	6.89E-08
Benzo(b)fluoranthene	POM	9.91E-08	1.11E-06	3.87E-07	1.94E-08
Benzo(k)fluoranthene	POM	1.55E-07	2.18E-07	6.05E-07	3.03E-08
Benzo(a)pyrene	POM	1.88E-07	2.57E-07	7.34E-07	3.67E-08
Indeno(1,2,3-cd)pyrene	POM	3.75E-07	4.14E-07	1.46E-06	7.32E-08
Dibenz(a,h)anthracene	POM	5.85E-07	3.46E-07	2.29E-06	1.14E-07
Benzo(g,h,i)perylene	POM	4.89E-07	5.56E-07	1.91E-06	9.55E-08
POM Subtotal				*6.56E-04*	*3.28E-05*
Total HAP				1.51E-02	7.57E-04

** AP-42, Table 3.3-2, (10/96), Diesel Industrial Engines; Tables 3.4-3 & 3.4-4, (10/96), Large Stationary Diesel Engines*

Stationary Source - Diesel Engines - Continued **Project Phase** Phase 2

Diesel GHG Emission Factors:	73.96 *kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03 *kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04 *kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Diesel Combustion 391 *MMBtu/yr*

Diesel GHG Emissions

Greenhouse Gas	**Emissions** ton/yr	**Global Warming Potential***	**CO2e** ton/yr
CO2	31.8	1	31.8
CH4	1.3E-03	25	3.2E-02
N2O	2.6E-04	298	7.7E-02
Total GHG			32.0

** 40 CFR 98, Table A-1*

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Mobile Source - Diesel & Gasoline Engines **Project Phase** Phase 2

Source Data

Description	Fuel	Output hp-hr/yr	Fuel Consumptior MMBtu/yr*	HAP ton/yr	CO2e ton/yr
Total Mobile Gasoline Engines	Gasoline	9,350,792	65,456	1.3E-01	5,085
Total Mobile Small Diesel Engines (<=600 hp)	Diesel	42,625,527	298,379	5.8E-01	24,409
Total Mobile Large Diesel Engines (>600 hp)	Diesel	105,540,261	738,782	5.8E-01	60,437

** Based on brake specific fuel consumption of* 7,000 *Btu/hp-hr* *AP-42, Table 3.3-1* chk chk

Diesel and Gasoline HAP Emission Factors and Emissions

Pollutant	POM	Emission Factor* Gasoline Engines & Small Diesel Engines <=600 hp lb/MMBtu	Emission Factor* Large Diesel Engines >600 hp lb/MMBtu	Emissions ton/yr
Benzene		9.33E-04	7.76E-04	4.56E-01
Toluene		4.09E-04	2.81E-4	1.78E-01
Xylenes		2.85E-04	1.93E-4	1.23E-01
1,3-Butadiene		3.91E-05	0.00E+0	7.11E-03
Formaldehyde		1.18E-03	7.89E-5	2.44E-01
Acetaldehyde		7.67E-04	2.52E-5	1.49E-01
Acrolein		9.25E-05	7.88E-6	1.97E-02
Naphthalene	POM	8.48E-05	1.30E-4	6.34E-02
Acenaphthylene	POM	5.06E-06	9.23E-6	4.33E-03
Acenaphthene	POM	1.42E-06	4.68E-6	1.99E-03
Fluorene	POM	2.92E-05	1.28E-5	1.00E-02
Phenanthrene	POM	2.94E-05	4.08E-05	2.04E-02
Anthracene	POM	1.87E-06	1.23E-06	7.95E-04
Fluoranthene	POM	7.61E-06	4.03E-06	2.87E-03
Pyrene	POM	4.78E-06	3.71E-06	2.24E-03
Benz(a)anthracene	POM	1.68E-06	6.22E-07	5.35E-04
Chrysene	POM	3.53E-07	1.53E-06	6.29E-04
Benzo(b)fluoranthene	POM	9.91E-08	1.11E-06	4.28E-04
Benzo(k)fluoranthene	POM	1.55E-07	2.18E-07	1.09E-04
Benzo(a)pyrene	POM	1.88E-07	2.57E-07	1.29E-04
Indeno(1,2,3-cd)pyrene	POM	3.75E-07	4.14E-07	2.21E-04
Dibenz(a,h)anthracene	POM	5.85E-07	3.46E-07	2.34E-04
Benzo(g,h,i)perylene	POM	4.89E-07	5.56E-07	2.94E-04
POM Subtotal				*1.09E-01*
Total HAP				1.29E+00

** AP-42, Table 3.3-2, (10/96), Gasoline and Diesel Industrial Engines; Tables 3.4-3 & 3.4-4, (10/96), Large Stationary Diesel and all Stationary Dual-fuel Engines*

Mobile Source - Diesel & Gasoline Engines - Continued **Project Phase** Phase 2

Diesel GHG Emission Factors:	73.96 *kg* CO_2/*MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03 *kg* CH_4/*MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04 *kg* N_2O/*MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Diesel Combustion 1,037,161 *MMBtu/yr*

Diesel GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	84,557	1	84,557
CH4	3.4	25	86
N2O	0.7	298	204
Total GHG			84,847

** 40 CFR 98, Table A-1*

Gasoline GHG Emission Factors:	70.22 *kg* CO_2/*MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) Motor Gasoline*
	3.0E-03 *kg* CH_4/*MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum Products*
	6.0E-04 *kg* N_2O/*MMBtu*	*41 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum Products*

Total Gasoline Combustion 65,456 *MMBtu/yr*

Gasoline GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	5,066.5	1	5,066.5
CH4	0.2	25	5.4
N2O	0.0	298	12.9
Total GHG			5,084.9

** 40 CFR 98, Table A-1*

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Stationary Source - Natural Gas/Propane Engines **Project Phase** Phase 2

Source Data Thru_Mat hr/yr Other

Phase	Description	Fuel	Operation hr/yr	gal/hr	Fuel Consumption MMBtu/hr*	MMBtu/yr	HAP ton/yr	CO2e ton/yr
Phase 1	Emergency Generator 1 (Mine)	Propane	100	13.9	1.3	127	4.6E-03	8.7
Phase 1	Emergency Generator 2 (Mine)	Propane	100	13.9	1.3	127	4.6E-03	8.7
Total					2.5	254	9.2E-03	17.4

* *Heat Content of* 0.0915 MMBtu/gal Propane chk chk

Propane GHG Emission Factors:

61.71	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) LPG*
3.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
6.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Propane Combustion 254 *MMBtu/yr*

Propane GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	17.3	1	17.3
CH4	8.4E-04	25	2.1E-02
N2O	1.7E-04	298	5.0E-02
Total GHG			17.4

* *40 CFR 98, Table A-1 (12/2014)*

Natural Gas GHG Emission Factors:

53.06	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) Natural Gas*
1.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Natural Gas*
1.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Natural Gas*

Total Natural Gas Combustion 0 *MMBtu/yr*

Natural Gas GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	0.00	1	0.0
CH4	0.0E+00	25	0.0E+00
N2O	0.0E+00	298	0.0E+00
Total GHG			0.0

* *40 CFR 98, Table A-1 (12/2014)*

Stationary Source - Natural Gas/Propane Engines - Continued **Project Phase** Phase 2

Natural Gas/Propane HAP Emission Factors and Emissions

		Emission Factor*	Emissions	
Pollutant	**POM**	lb/MMBtu**	lb/hr	ton/yr
1,1,2,2-Tetrachloroethane		4.00E-05	1.02E-04	5.09E-06
1,1,2-Trichloroethane		3.18E-05	8.09E-05	4.04E-06
1,3-Butadiene		2.67E-04	6.79E-04	3.40E-05
1,3-Dichloropropene		2.64E-05	6.72E-05	3.36E-06
2-Methylnaphthalene		3.32E-05	8.45E-05	4.22E-06
2,2,4-Trimethylpentane		2.50E-04	6.36E-04	3.18E-05
Acenaphthene	POM	1.25E-06	3.18E-06	1.59E-07
Acenaphthylene	POM	5.53E-06	1.41E-05	7.03E-07
Acetaldehyde		8.36E-03	2.13E-02	1.06E-03
Acrolein		5.14E-03	1.31E-02	6.54E-04
Benzene		4.40E-04	1.12E-03	5.60E-05
Benzo(b)fluoranthene	POM	1.66E-07	4.22E-07	2.11E-08
Benzo(e)pyrene		4.15E-07	1.06E-06	5.28E-08
Benzo(g,h,i)perylene		4.14E-07	1.05E-06	5.27E-08
Biphenyl	POM	2.12E-04	5.39E-04	2.70E-05
Carbon Tetrachloride		3.67E-05	9.34E-05	4.67E-06
Chlorobenzene		3.04E-05	7.73E-05	3.87E-06
Chloroform		2.85E-05	7.25E-05	3.62E-06
Chrysene	POM	6.93E-07	1.76E-06	8.81E-08
Ethylbenzene		3.97E-05	1.01E-04	5.05E-06
Ethylene Dibromide		4.43E-05	1.13E-04	5.63E-06
Fluoranthene	POM	1.11E-06	2.82E-06	1.41E-07
Fluorene	POM	5.67E-06	1.44E-05	7.21E-07
Formaldehyde		5.28E-02	1.34E-01	6.72E-03
Methanol		2.50E-03	6.36E-03	3.18E-04
Methylene Chloride		2.00E-05	5.09E-05	2.54E-06
Hexane		1.11E-03	2.82E-03	1.41E-04
Naphthalene	POM	7.44E-05	1.89E-04	9.46E-06
PAH		2.69E-05	6.84E-05	3.42E-06
Phenanthrene	POM	1.04E-05	2.65E-05	1.32E-06
Phenol		2.40E-05	6.10E-05	3.05E-06
Pyrene	POM	1.36E-06	3.46E-06	1.73E-07
Styrene		2.36E-05	6.00E-05	3.00E-06
Tetrachloroethane		2.48E-06	6.31E-06	3.15E-07
Toluene		4.08E-04	1.04E-03	5.19E-05
Vinyl Chloride		1.49E-05	3.79E-05	1.90E-06
Xylenes		1.84E-04	4.68E-04	2.34E-05
POM Subtotal			*7.95E-04*	*3.98E-05*
Total HAP			1.84E-01	9.18E-03

**AP-42, Table 3.2-2 (7/00) Natural Gas-fired 4-Stroke Lean-Burn Engines*

***Natural Gas HAPs assumed for propane*

Fugitive Dust Sources - HAP Emissions **Project Phase** Phase 2

Activity Information PM_TPY

Activity			PM ton/yr	
Open Pit Drilling			3.16	*See Mine Sheet*
Open Pit Blasting			1.49	*See Mine Sheet*
Onsite Hauling			124.61	*See Mine Sheet*
Material Load / Unload			1.72	*See Mine Sheet*
Mobile Equipment (Tailpipes)			N/A	*Combustion HAP. See page 7*
Dozing			16.07	*See Mine Sheet*
Grading			197.77	*See Mine Sheet*
Water Truck Travel			61.00	*See Mine Sheet*
Wind Erosion			16.68	*See Mine Sheet*
Process Sources	Gangue	Ore	24.83	*See Process Sheet for Ore and Gangue Processes*
Ore/Waste Subtotal			447.33	
			chk	

*Ore and Waste Dust HAP Concentrations * and Emissions*

Pollutant	Ore/Waste ppm	Emissions ton/yr
Antimony	12.46	5.57E-03
Arsenic	119.12	5.33E-02
Beryllium	5.10	2.28E-03
Cadmium	0.34	1.53E-04
Chromium	8.72	3.90E-03
Cobalt	6.95	3.11E-03
Lead	12.22	5.47E-03
Manganese	659.99	2.95E-01
Nickel	14.19	6.35E-03
Phosphorus	223.10	9.98E-02
Selenium	1.38	6.17E-04
Total HAP		4.76E-01

** (LNC 2019b)*

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Lithium Processing Sources - GHG Emissions **Project Phase** Phase 2

Lithium Processing CO2 Emissions

	CO2 Emissions ton/yr	
Tail Gas Scrubber (Sulfuric Acid Plant)	1,157	*(LNC 2019a)*
Carbonate Destruction	22,276	*(Schonlau 2019)*
Neutralization	5,470	*(Schonlau 2019)*
Lithium Sulfide Production	6,320	*(Schonlau 2019)*
Total CO2	35,223	

Lithium Processing GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	35,223	1	35,223

** 40 CFR 98, Table A-1 (12/2014)*

Conversions

2,000 lb/ton

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AIR EMISSION CALCULATIONS	SUBJECT: HAP and GHG Emissions	DATE: December 13, 2019

Lithium Processing Sources - HAP & Other Regulated Pollutant Emissions **Project Phase** Phase 2

Lithium Processing Sulfuric Acid Mist Emissions hr/yr

			Operation	H2SO4 Emissions		
Phase	**Description**		hr/yr	lb/hr	ton/yr	
Phase 1	Leach Tanks 1		7,446	0.3	1.12	*(LNC 2019a)*
Phase 1	Leach 1 Filter System		7,446	0.003	0.01	*(LNC 2019a)*
Phase 1	Leach 1 Filter Vent		496	0.067	0.02	*(LNC 2019a)*
Phase 2	Leach Tanks 2		7,446	0.3	1.12	*(LNC 2019a)*
Phase 2	Leach 2 Filter System		7,446	0.003	0.01	*(LNC 2019a)*
Phase 2	Leach 2 Filter Vent		496	0.067	0.02	*(LNC 2019a)*
Phase 2	Sulfuric Acid Plant	SAP	8,520	6.0	25.56	*(Rabe 2019)*
Total H2SO4				6.74	27.85	

Sodium Hypochlorite Tank Chlorine Emissions hr/yr

		Operation	Cl2 Emissions		
Phase	**Description**	hr/yr	lb/hr	ton/yr	
Phase 1	Sodium Hypochlorite Tank 1	4,380	0.13	0.28	*(LNC 2019a)*
Phase 2	Sodium Hypochlorite Tank 2	4,380	0.13	0.28	*(LNC 2019a)*
Total Cl2			0.26	0.57	

Conversions
2,000 lb/ton

Phase 1 Facility-Wide Emissions

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Project Phase **Phase 1**

Facility-Wide Emissions

	chk	chk	chk	chk	chk	chk
Activity	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr
Process	71.0	65.1	1.0	78.4	75.8	17.9
Fugitive	66.6	19.3	189.1	392.7	0.5	43.5
Total	137.6	84.5	190.1	471.1	76.2	61.4

Short-Term Facility-Wide Emissions

	chk	chk	chk	chk	chk	chk
Activity	PM10 lb/day	PM2.5 lb/day	CO lb/hr	NOX lb/hr	SO2 lb/hr	H2S lb/hr
Process	614.1	564.7	8.7	40.5	18.0	0.3
Fugitive	1,158.3	151.7	3,079.3	171.2	0.3	-
Total	1,772.4	716.4	3,087.9	211.7	18.3	0.3

Facility-Wide Emissions - HAP, GHG, & Other Regulated Pollutants

	chk	chk	chk	chk
Activity	HAP ton/yr	GHG ton/yr	H2S ton/yr	H2SO4 ton/yr
Process	0.30	21,342	0.43	26.70
Fugitive Dust	0.28	-	-	-
Mobile Tailpipes	0.82	58,656	-	-
Total	1.39	79,998	0.43	26.70

Sulfuric Acid Plant Emissions

Activity		PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr	H2SO4 ton/yr
Sulfuric Acid Plant Sources	SAP	28.4	28.3	0.8	78.2	75.8	0.1	0.3	25.6

Phase 1 Process Source Emissions

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
CR_1	Primary Crusher 1 and associated transfers in (from Feeder 1) and out (to Sizer 1 Feed Conveyor)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.0054	0.0024	0.0004						lb/ton	*AP-42 Table 11.19.2-2 (08/04) tert. crush unctrl. (NDEP 2017)*	Water Sprays	75%
SIZ_1	Mineral Sizer 1 and associated transfers in (from Sizer 1 Feed Conveyor) and out (to Scrubber 1 Feed Bin Conveyor)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.0054	0.0024	0.0004						lb/ton	*AP-42 Table 11.19.2-2 (08/04) tert. crush unctrl. (NDEP 2017)*	Water Sprays	75%
ATT_1	Scrubber 1 Feed Bin Conveyor to Scrubber 1 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 1 (wet process)	500	12,000	3,723,000	ton	Ore	24	7,446		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
WSX_1	Wet Screening 1 transfer to Oversize Conveyor 1	6	144	44,676	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
OSTK_1	Oversize Conveyor 1 to Oversize Stockpile 1	6	144	44,676	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GSC_1	Gangue Dewatering Screen 1 transfer to Gangue Conveyor 1	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX1_1	Gangue Conveyor 1 to Gangue Conveyor 2	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX2_1	Gangue Conveyor 2 to Gangue Conveyor 3	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GX3_1	Gangue Conveyor 3 to Gangue Stacking Conveyor 1	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
GSTK_1	Gangue Stacking Conveyor 1 to Gangue Stockpile 1	197	4,728	1,466,862	ton	Gangue	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
LCHT_1	Leach Tanks 1				-	Slurry	24	7,446		*(LNC 2019a)*	0.73	0.73	0.73						lb/hr	*(LNC 2019a), (Rabe 2019)*	Wet Scrubber	
LCHF_1	Leach 1 Filter System				-	Slurry	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						lb/hr	*(LNC 2019a)*	Wet Scrubber	
LCHV_1	Leach 1 Filter Vent				-	Slurry	24	496		*(LNC 2019a)*	0.37	0.37	0.37						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LHOP_1	Neutralization Lime Feed Hopper 1 loading	12	288	5,760	ton	Lime	24	480		*(LNC 2019a)*	0.0048	0.0028	0.0004						lb/ton	*AP-42 Table 11.12-2 (06/06) hopper loading unctrl. (NDEP 2017)*	Enclosure	50%
LBUC_1	Neutralization Lime Feed Hopper 1 transfer to Neutralization Tanks 1 via Bucket Elevator	12	288	5,760	ton	Lime	24	480		*(LNC 2019a)*	0.0048	0.0028	0.0004						lb/ton	*AP-42 Table 11.12-2 (06/06) hopper loading unctrl. (NDEP 2017)*	Enclosure	50%
NEUT_1	Neutralization Tanks 1				-	Slurry	24	7,446		*(LNC 2019a)*	0.03	0.03	0.03						lb/hr	*(LNC 2019a)*	Wet Scrubber	
NEUV_1	Neutralization 1 Filter Vent				-	Slurry	24	124		*(LNC 2019a)*	0.29	0.29	0.29						lb/hr	*(LNC 2019a)*	Mist Eliminator	
CTLF_1	Clay Tailings Filter 1 to CT Feeder 1	550	13,200	4,095,300	ton	Clay Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTLX_1	CT Feeder 1 to Tailings Conveyor 1 or 2	550	13,200	4,095,300	ton	Clay Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
NTLF_1	Neutralization Tailings Filter 1 to Neutralization Tails Feeder 1	211	5,064	1,571,106	ton	Neut. Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
NTLX_1	Neutralization Tails Feeder 1 to Tailings Conveyor 1	211	5,064	1,571,106	ton	Neut. Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
MGTL_1	Magnesium Sulfate Centrifuge 1 to Mg Screw Conveyor 1	96	2,304	714,816	ton	MgSO4 Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Enclosure	50%
MGTLX_1	Mg Screw Conveyor 1 to Tailings Conveyor 2	96	2,304	714,816	ton	MgSO4 Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	None	
STL_1	Sulfate Salts Centrifuge 1 to Sulfate Screw Conveyor 1	19	456	141,474	ton	Sulfate Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Enclosure	50%
STLX_1	Sulfate Screw Conveyor 1 to Tailings Conveyor 1	19	456	141,474	ton	Sulfate Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	None	
TLX1_1	Tailings Conveyor 1 to Tailings Conveyor 2	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
TLX2_1	Tailings Conveyor 2 to Tailings Conveyor 3	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
TLX3_1	Tailings Conveyor 3 to Tailings Stacker 1	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
CTSTK_1	Tailings Stacker 1 to Clay Tailing Filter Stack (CTFS) 1	876	21,024	6,522,696	ton	Tailings	24	7,446		*(LNC 2019a)*	0.0030	0.0011	0.0002						lb/ton	*AP-42 Table 11.19.2-2 (08/04) conv. unctrl. (NDEP 2017)*	Similar to Wet Trommel	85%
MGLM_1	Magnesium Precipitation 1 Lime Slaker	14.8	355	110,201	ton	Lime	24	7,446		*(LNC 2019a), thru - (Whitehead 2019)*	0.006	0.006	0.006						gr/dscf	*Vendor Specification (LNC 2019a)*	Wet Scrubber	

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
CR_1	Primary Crusher 1 and associated transfers in (from Feeder 1) and out (to Sizer 1 Feed Conveyor)	0.675	0.300	0.045						16.200	7.200	1.090						2.513	1.117	0.169					
SIZ_1	Mineral Sizer 1 and associated transfers in (from Sizer 1 Feed Conveyor) and out (to Scrubber 1 Feed Bin Conveyor)	0.675	0.300	0.045						16.200	7.200	1.090						2.513	1.117	0.169					
ATT_1	Scrubber 1 Feed Bin Conveyor to Scrubber 1 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 1 (wet process)	1.536	1.536	1.536						36.864	36.864	36.864						5.719	5.719	5.719					
WSX_1	Wet Screening 1 transfer to Oversize Conveyor 1	0.003	0.001	0.000						0.065	0.024	0.004						0.010	0.004	0.001					
OSTK_1	Oversize Conveyor 1 to Oversize Stockpile 1	0.003	0.001	0.000						0.065	0.024	0.004						0.010	0.004	0.001					
GSC_1	Gangue Dewatering Screen 1 transfer to Gangue Conveyor 1	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX1_1	Gangue Conveyor 1 to Gangue Conveyor 2	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX2_1	Gangue Conveyor 2 to Gangue Conveyor 3	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GX3_1	Gangue Conveyor 3 to Gangue Stacking Conveyor 1	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
GSTK_1	Gangue Stacking Conveyor 1 to Gangue Stockpile 1	0.089	0.033	0.005						2.128	0.780	0.118						0.330	0.121	0.018					
LCHT_1	Leach Tanks 1	0.730	0.730	0.730						17.520	17.520	17.520						2.718	2.718	2.718					
LCHF_1	Leach 1 Filter System	0.020	0.020	0.020						0.480	0.480	0.480						0.074	0.074	0.074					
LCHV_1	Leach 1 Filter Vent	0.370	0.370	0.370						8.880	8.880	8.880						0.092	0.092	0.092					
LHOP_1	Neutralization Lime Feed Hopper 1 loading	0.029	0.017	0.003						0.691	0.403	0.061						0.007	0.004	0.001					
LBUC_1	Neutralization Lime Feed Hopper 1 transfer to Neutralization Tanks 1 via Bucket Elevator	0.029	0.017	0.003						0.691	0.403	0.061						0.007	0.004	0.001					
NEUT_1	Neutralization Tanks 1	0.030	0.030	0.030						0.720	0.720	0.720						0.112	0.112	0.112					
NEUV_1	Neutralization 1 Filter Vent	0.290	0.290	0.290						6.960	6.960	6.960						0.018	0.018	0.018					
CTLF_1	Clay Tailings Filter 1 to CT Feeder 1	0.248	0.091	0.014						5.940	2.178	0.330						0.921	0.338	0.051					
CTLX_1	CT Feeder 1 to Tailings Conveyor 1 or 2	0.248	0.091	0.014						5.940	2.178	0.330						0.921	0.338	0.051					
NTLF_1	Neutralization Tailings Filter 1 to Neutralization Tails Feeder 1	0.095	0.035	0.005						2.279	0.836	0.127						0.353	0.130	0.020					
NTLX_1	Neutralization Tails Feeder 1 to Tailings Conveyor 1	0.095	0.035	0.005						2.279	0.836	0.127						0.353	0.130	0.020					
MGTL_1	Magnesium Sulfate Centrifuge 1 to Mg Screw Conveyor 1	0.144	0.053	0.008						3.456	1.267	0.192						0.536	0.197	0.030					
MGTLX_1	Mg Screw Conveyor 1 to Tailings Conveyor 2	0.288	0.106	0.016						6.912	2.534	0.384						1.072	0.393	0.060					
STL_1	Sulfate Salts Centrifuge 1 to Sulfate Screw Conveyor 1	0.029	0.010	0.002						0.684	0.251	0.038						0.106	0.039	0.006					
STLX_1	Sulfate Screw Conveyor 1 to Tailings Conveyor 1	0.057	0.021	0.003						1.368	0.502	0.076						0.212	0.078	0.012					
TLX1_1	Tailings Conveyor 1 to Tailings Conveyor 2	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
TLX2_1	Tailings Conveyor 2 to Tailings Conveyor 3	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
TLX3_1	Tailings Conveyor 3 to Tailings Stacker 1	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
CTSTK_1	Tailings Stacker 1 to Clay Tailing Filter Stack (CTFS) 1	0.394	0.145	0.022						9.461	3.469	0.525						1.468	0.538	0.081					
MGLM_1	Magnesium Precipitation 1 Lime Slaker	0.023	0.023	0.023						0.555	0.555	0.555						0.086	0.086	0.086					

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
CR_1	Primary Crusher 1 and associated transfers in (from Feeder 1) and out (to Sizer 1 Feed Conveyor)	411,210	4,617,120	1,521.1	VOLUME	6	3.5	6	9	elev src w/o bldg	0.0378	0.0057						0.0049			1.8288	0.25	0.4253		
SIZ_1	Mineral Sizer 1 and associated transfers in (from Sizer 1 Feed Conveyor) and out (to Scrubber 1 Feed Bin Conveyor)	411,365	4,617,047	1,513.9	VOLUME	9	3.5	6	12	elev src w/o bldg	0.0378	0.0057						0.0049			2.7432	0.25	0.4253		
ATT_1	Scrubber 1 Feed Bin Conveyor to Scrubber 1 Feed Bin and Feed Bin Feeders (3) to Attrition Scrubber 1 (wet process)	411,443	4,617,031	1,507.5	POINT	40	Ambient	12,800	15,340	1.5	0.1935	0.1935						0.1645			12.1920	0.00	44.0969	0.4572	
WSX_1	Wet Screening 1 transfer to Oversize Conveyor 1	411,452	4,617,038	1,507.5	VOLUME	5	3	6	8	elev src w/o bldg	0.0001	0.0000						0.0000			1.5240	0.21	0.4253		
OSTK_1	Oversize Conveyor 1 to Oversize Stockpile 1	411,358	4,617,120	1,520.0	VOLUME	15	1.5	30	30	srf src	0.0001	0.0000						0.0000			4.5720	0.11	4.2530		
GSC_1	Gangue Dewatering Screen 1 transfer to Gangue Conveyor 1	414,366	4,617,342	1,441.4	VOLUME	5	4	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.28	0.4253		
GX1_1	Gangue Conveyor 1 to Gangue Conveyor 2	414,328	4,617,395	1,446.9	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GX2_1	Gangue Conveyor 2 to Gangue Conveyor 3	414,098	4,617,735	1,463.2	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GX3_1	Gangue Conveyor 3 to Gangue Stacking Conveyor 1	413,820	4,618,025	1,497.3	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0041	0.0006						0.0005			1.5240	0.25	0.4253		
GSTK_1	Gangue Stacking Conveyor 1 to Gangue Stockpile 1	413,703	4,618,120	1,498.2	VOLUME	25	3.5	50	50	srf src	0.0041	0.0006						0.0005			7.6200	0.25	7.0884		
LCHT_1	Leach Tanks 1	414,459	4,617,304	1,441.4	POINT	110	248	15,300	24,590	2.5	0.0920	0.0920						0.0782			33.5280	393.15	25.4479	0.7620	
LCHF_1	Leach 1 Filter System	414,387	4,617,078	1,439.8	POINT	110	Ambient	952	952	1.0	0.0025	0.0025						0.0021			33.5280	0.00	6.1576	0.3048	
LCHV_1	Leach 1 Filter Vent	414,431	4,617,078	1,439.8	POINT	60	Ambient	3,750	3,750	1.0	0.0466	0.0466						0.0026			18.2880	0.00	24.2552	0.3048	
LHOP_1	Neutralization Lime Feed Hopper 1 loading	414,389	4,617,031	1,439.8	VOLUME	4	6	8	8	srf src	0.0021	0.0003						0.0000			1.2192	0.43	1.1341		
LBUC_1	Neutralization Lime Feed Hopper 1 transfer to Neutralization Tanks 1 via Bucket Elevator	414,466	4,617,042	1,439.8	VOLUME	58	6	4	60	elev src w/ bldg	0.0021	0.0003						0.0000			17.6784	0.43	0.5671		
NEUT_1	Neutralization Tanks 1	414,466	4,617,042	1,439.8	POINT	110	Ambient	1,600	1,600	1.0	0.0038	0.0038						0.0032			33.5280	0.00	10.3489	0.3048	
NEUV_1	Neutralization 1 Filter Vent	414,430	4,617,033	1,439.8	POINT	60	Ambient	3,000	3,000	1.0	0.0365	0.0365						0.0005			18.2880	0.00	19.4042	0.3048	
CTLF_1	Clay Tailings Filter 1 to CT Feeder 1	414,443	4,617,076	1,439.8	VOLUME	9.5	4	15	17	elev src w/o bldg	0.0114	0.0017						0.0015			2.8956	0.28	1.0633		
CTLX_1	CT Feeder 1 to Tailings Conveyor 1 or 2	414,463	4,617,075	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0114	0.0017						0.0015			1.5240	0.25	0.4253		
NTLF_1	Neutralization Tailings Filter 1 to Neutralization Tails Feeder 1	414,443	4,617,058	1,439.8	VOLUME	9.5	2	15	17	elev src w/o bldg	0.0044	0.0007						0.0006			2.8956	0.14	1.0633		
NTLX_1	Neutralization Tails Feeder 1 to Tailings Conveyor 1	414,462	4,617,057	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0044	0.0007						0.0006			1.5240	0.25	0.4253		
MGTL_1	Magnesium Sulfate Centrifuge 1 to Mg Screw Conveyor 1	414,461	4,617,113	1,439.8	VOLUME	5	2	6	8	elev src w/o bldg	0.0067	0.0010						0.0009			1.5240	0.14	0.4253		
MGTLX_1	Mg Screw Conveyor 1 to Tailings Conveyor 2	414,475	4,617,089	1,439.8	VOLUME	5	0.83	6	8	elev src w/o bldg	0.0133	0.0020						0.0017			1.5240	0.06	0.4253		
STL_1	Sulfate Salts Centrifuge 1 to Sulfate Screw Conveyor 1	414,460	4,617,139	1,439.8	VOLUME	9.5	2	15	17	elev src w/o bldg	0.0013	0.0002						0.0002			2.8956	0.14	1.0633		
STLX_1	Sulfate Screw Conveyor 1 to Tailings Conveyor 1	414,463	4,617,081	1,439.8	VOLUME	5	0.50	6	8	elev src w/o bldg	0.0026	0.0004						0.0003			1.5240	0.04	0.4253		
TLX1_1	Tailings Conveyor 1 to Tailings Conveyor 2	414,464	4,617,089	1,439.8	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
TLX2_1	Tailings Conveyor 2 to Tailings Conveyor 3	414,704	4,617,081	1,429.7	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
TLX3_1	Tailings Conveyor 3 to Tailings Stacker 1	414,829	4,617,173	1,432.1	VOLUME	5	3.5	6	8	elev src w/o bldg	0.0182	0.0028						0.0023			1.5240	0.25	0.4253		
CTSTK_1	Tailings Stacker 1 to Clay Tailing Filter Stack (CTFS) 1	414,858	4,617,197	1,432.9	VOLUME	25	3.5	50	50	srf src	0.0182	0.0028						0.0023			7.6200	0.25	7.0884		
MGLM_1	Magnesium Precipitation 1 Lime Slaker	414,386	4,617,115	1,439.8	POINT	110	Ambient	450	450	0.5	0.0029	0.0029						0.0025			33.5280	0.00	11.6425	0.1524	

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
MGF_1	Magnesium Precipitation 1 Filter System				-	Slurry	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						lb/hr	*(LNC 2019a)*	Wet Scrubber	
MGV_1	Magnesium Precipitation 1 Filter Vent				-	Slurry	24	124		*(LNC 2019a)*	0.2	0.2	0.2						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LICM_1	Lithium Carbonate 1 Material Handling				-	Li_2CO_3	24	620		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICV_1	Lithium Carbonate 1 Filter Vent				-	Li_2CO_3	24	124		*(LNC 2019a)*	0.2	0.2	0.2						lb/hr	*(LNC 2019a)*	Mist Eliminator	
LICD_1	Lithium Carbonate 1 Dryer				-	Li_2CO_3	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LICP_1	Lithium Carbonate 1 Packaging				-	Li_2CO_3	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIHD_1	Lithium Hydroxide 1 Dryer				-	LiOH	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIHP_1	Lithium Hydroxide 1 Packaging				-	LiOH	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LISPR_1	Lithium Sulfide 1 Production				-	Li_2S	24	620		*(LNC 2019a)*								0.27	lb/hr	*20 ppmv H2S (LNC 2019a)*	Caustic Scrubber	
LISP_1	Lithium Sulfide 1 Packaging				-	Li_2S	24	620		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LIME_1	Lime 1 unloading and transfer to Silos (silo unloading through sealed transfers)				-	Lime	24	2,525		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
SDA_1	Soda Ash 1 unloading and transfer to Silos (silo unloading through sealed transfers)				-	Lime	24	1,570		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
LMSU_1	Limestone 1 unloading and transfer to Stockpile (Limestone				-	Limestone	24	2,525		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
LMSCR_1	Limestone Crushing 1				-	Limestone	24	6,240		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
LMSL_1	Limestone Silos 1 loading				-	Limestone	24	6,240		*(LNC 2019a)*	0.014	0.014	0.014						gr/dscf	*40 CFR 60, Subpart OOO, Table 2*	Baghouse	
BATC_1	Battery Production 1 Complex				-	Batteries	24	7,446		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
BATS_1	Battery Production 1 Solvent				-	Solvent	24	7,446		*(LNC 2019a)*							4.6		lb/hr	*(LNC 2019a)*	Scrubber	
	Sodium Hypochlorite Tank 1				-	NaClO	24	4,380		*(LNC 2019a)*										*Cl2 emissions only, see HAPs*	Scrubber	
LICLM_1	Lithium Chloride 1 Material Handling				-	LiCl	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
KCLM_1	Potassium Chloride 1 Material Handling				-	KCl	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
ALM_1	Aluminum Powder 1 Material Handling				-	Al	24	4,380		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
S2T_1	Sulfur Storage Tanks 1				-	Sulfur	24	8,760		*(LNC 2019a)*						0.075		0.080	lb/hr	*10 ppmv SO2, 20 ppmv H2S (LNC 2019a)*	Caustic Scrubber	
BOIL_1	Package Boiler 1	67.4	1,618	19,411	MMBtu	Diesel	24	288		*(LNC 2019a), MMBtu - (Whitehead 2019)*	0.020	0.020	0.020	0.037	0.100	0.0015	0.004		lb/MMBtu	*(LNC 2019a); SO2: mass balance w/ 15 ppm S (ULSD)*	Industry standard controls	
BURN_1	Start-Up Burner 1	89.3	2,143	25,718	MMBtu	Diesel	24	288		*(LNC 2019a), MMBtu - (Whitehead 2019)*	0.0236	0.0164	0.0111	0.0357	0.1429	0.0015	0.0014		lb/MMBtu	*AP-42 Tables 1.3-1, 1.3-2, 1.3-3 & 1.3-6 (05/10) Industrial Boilers, distillate oil; SO2: mass balance w/ 15 ppm S (ULSD)*	None	
SAP_1	Sulfuric Acid Plant	39.7	952	337,895	ton	Sulfur	24	8,520		*(LNC 2019a), (Chemetics 2018)*	6.4	6.4	6.4		17.7	17.7			lb/hr	*(LNC 2019a), (Chemetics 2018), (Rabe 2019)*	Tail Gas Scrubber	
COOL_1	Cooling Tower 1	760,860			Gal	Water	24	8,760		*(LNC 2019a)*	0.1586	0.1586	0.1586						lb/hr	*(LNC 2019a), 500 ppm TDS - (Whitehead 2019), 0.005% drift loss estimated from similar CT*	None	
FIRE1_1	Fire Pump 1 (Mine)	175	4,200	17,500	hp	Diesel	24	100	*9.3 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	2.6E-04	2.6E-04	2.6E-04	1.8E-03	6.1E-03	1.1E-05	2.2E-04		lb/hp-hr	*(Clarke 2019); SO2: mass balance w/ 15 ppm S (ULSD) (NDEP 2019)*	None	
FIRE2_1	Fire Pump 2 (Process)	175	4,200	17,500	hp	Diesel	24	100	*9.3 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	2.6E-04	2.6E-04	2.6E-04	1.8E-03	6.1E-03	1.1E-05	2.2E-04		lb/hp-hr	*(Clarke 2019); SO2: mass balance w/ 15 ppm S (ULSD) (NDEP 2019)*	None	
GEN1_1	Emergency Generator 1 (Mine)	134	3,216	13,400	hp	Propane	24	100	*13.9 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	0.0005	0.0005	0.0005	0.0088	0.0044	3.6E-05	0.0022		lb/hp-hr	*CO, NOX, VOC: 40 CFR 60 Subpart JJJJ, Table 1; PM, SO2: (CARB 1991)*	None	

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
MGF_1	Magnesium Precipitation 1 Filter System	0.020	0.020	0.020						0.480	0.480	0.480						0.074	0.074	0.074					
MGV_1	Magnesium Precipitation 1 Filter Vent	0.200	0.200	0.200						4.800	4.800	4.800						0.012	0.012	0.012					
LICM_1	Lithium Carbonate 1 Material Handling	0.329	0.329	0.329						7.899	7.899	7.899						0.102	0.102	0.102					
LICV_1	Lithium Carbonate 1 Filter Vent	0.200	0.200	0.200						4.800	4.800	4.800						0.012	0.012	0.012					
LICD_1	Lithium Carbonate 1 Dryer	0.429	0.429	0.429						10.286	10.286	10.286						1.596	1.596	1.596					
LICP_1	Lithium Carbonate 1 Packaging	0.069	0.069	0.069						1.646	1.646	1.646						0.255	0.255	0.255					
LIHD_1	Lithium Hydroxide 1 Dryer	0.429	0.429	0.429						10.286	10.286	10.286						1.596	1.596	1.596					
LIHP_1	Lithium Hydroxide 1 Packaging	0.165	0.165	0.165						3.950	3.950	3.950						0.613	0.613	0.613					
LISPR_1	Lithium Sulfide 1 Production								0.270								6.480								0.084
LISP_1	Lithium Sulfide 1 Packaging	0.165	0.165	0.165						3.950	3.950	3.950						0.051	0.051	0.051					
LIME_1	Lime 1 unloading and transfer to Silos (silo unloading through sealed transfers)	0.165	0.165	0.165						3.950	3.950	3.950						0.208	0.208	0.208					
SDA_1	Soda Ash 1 unloading and transfer to Silos (silo unloading through sealed transfers)	0.165	0.165	0.165						3.950	3.950	3.950						0.129	0.129	0.129					
LMSU_1	Limestone 1 unloading and transfer to Stockpile (Limestone	2.400	2.400	2.400						57.600	57.600	57.600						3.030	3.030	3.030					
LMSCR_1	Limestone Crushing 1	2.400	2.400	2.400						57.600	57.600	57.600						7.488	7.488	7.488					
LMSL_1	Limestone Silos 1 loading	2.400	2.400	2.400						57.600	57.600	57.600						7.488	7.488	7.488					
BATC_1	Battery Production 1 Complex	0.857	0.857	0.857						20.571	20.571	20.571						3.191	3.191	3.191					
BATS_1	Battery Production 1 Solvent							4.600								110.400								17.126	
	Sodium Hypochlorite Tank 1																								
LICLM_1	Lithium Chloride 1 Material Handling	0.069	0.069	0.069						1.646	1.646	1.646						0.150	0.150	0.150					
KCLM_1	Potassium Chloride 1 Material Handling	0.165	0.165	0.165						3.950	3.950	3.950						0.360	0.360	0.360					
ALM_1	Aluminum Powder 1 Material Handling	0.069	0.069	0.069						1.646	1.646	1.646						0.150	0.150	0.150					
S2T_1	Sulfur Storage Tanks 1						0.075		0.080						1.796		1.911						0.328		0.349
BOIL_1	Package Boiler 1	1.348	1.348	1.348	2.494	6.740	0.100	0.270		32.352	32.352	32.352	59.851	161.760	2.404	6.470		0.194	0.194	0.194	0.359	0.971	0.014	0.039	
BURN_1	Start-Up Burner 1	2.105	1.467	0.989	3.189	12.757	0.133	0.128		50.518	35.210	23.728	76.543	306.171	3.185	3.062		0.303	0.211	0.142	0.459	1.837	0.019	0.018	
SAP_1	Sulfuric Acid Plant	6.400	6.400	6.400		17.700	17.700			153.600	153.600	153.600		424.800	424.800			27.264	27.264	27.264		75.402	75.402		
COOL_1	Cooling Tower 1	0.159	0.159	0.159						3.807	3.807	3.807						0.695	0.695	0.695					
FIRE1_1	Fire Pump 1 (Mine)	0.046	0.046	0.046	0.309	1.061	0.002	0.039		1.111	1.111	1.111	7.408	25.463	0.046	0.926		0.002	0.002	0.002	0.015	0.053	0.000	0.002	
FIRE2_1	Fire Pump 2 (Process)	0.046	0.046	0.046	0.309	1.061	0.002	0.039		1.111	1.111	1.111	7.408	25.463	0.046	0.926		0.002	0.002	0.002	0.015	0.053	0.000	0.002	
GEN1_1	Emergency Generator 1 (Mine)	0.070	0.070	0.070	1.182	0.591	0.005	0.295		1.668	1.668	1.668	28.360	14.180	0.117	7.090		0.003	0.003	0.003	0.059	0.030	0.000	0.015	

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
MGF_1	Magnesium Precipitation 1 Filter System	414,446	4,617,138	1,439.8	POINT	110	Ambient	952	952	1.0	0.0025	0.0025						0.0021			33.5280	0.00	6.1576	0.3048	
MGV_1	Magnesium Precipitation 1 Filter Vent	414,445	4,617,115	1,439.8	POINT	110	Ambient	2,000	2,000	1.0	0.0252	0.0252						0.0004			33.5280	0.00	12.9361	0.3048	
LICM_1	Lithium Carbonate 1 Material Handling	414,426	4,617,236	1,441.4	POINT	30	Ambient	1,920	1,920	1.0	0.0415	0.0415						0.0029			9.1440	0.00	12.4187	0.3048	
LICV_1	Lithium Carbonate 1 Filter Vent	414,387	4,617,138	1,439.8	POINT	110	Ambient	2,000	2,000	1.0	0.0252	0.0252						0.0004			33.5280	0.00	12.9361	0.3048	
LICD_1	Lithium Carbonate 1 Dryer	414,380	4,617,160	1,439.8	POINT	110	150	2,500	2,500	1.0	0.0540	0.0540						0.0459			33.5280	338.71	16.1701	0.3048	
LICP_1	Lithium Carbonate 1 Packaging	414,392	4,617,160	1,439.8	POINT	110	Ambient	400	400	0.5	0.0086	0.0086						0.0073			33.5280	0.00	10.3489	0.1524	
LIHD_1	Lithium Hydroxide 1 Dryer	414,363	4,617,201	1,441.4	POINT	110	150	2,500	2,500	1.0	0.0540	0.0540						0.0459			33.5280	338.71	16.1701	0.3048	
LIHP_1	Lithium Hydroxide 1 Packaging	414,365	4,617,189	1,441.4	POINT	110	Ambient	960	960	0.7	0.0207	0.0207						0.0176			33.5280	0.00	13.9710	0.2032	
LISPR_1	Lithium Sulfide 1 Production	414,419	4,617,197	1,441.4	POINT	110	100	2,506	3,185	1.0							0.0340				33.5280	310.93	20.6008	0.3048	
LISP_1	Lithium Sulfide 1 Packaging	414,419	4,617,186	1,441.4	POINT	110	Ambient	960	960	0.7	0.0207	0.0207						0.0015			33.5280	0.00	13.9710	0.2032	
LIME_1	Lime 1 unloading and transfer to Silos (silo unloading through sealed transfers)	414,457	4,616,969	1,436.5	POINT	80	Ambient	960	960	0.7	0.0207	0.0207						0.0060			24.3840	0.00	13.9710	0.2032	
SDA_1	Soda Ash 1 unloading and transfer to Silos (silo unloading through sealed transfers)	414,395	4,616,969	1,436.5	POINT	80	Ambient	960	960	0.7	0.0207	0.0207						0.0037			24.3840	0.00	13.9710	0.2032	
LMSU_1	Limestone 1 unloading and transfer to Stockpile (Limestone	414,359	4,616,988	1,436.5	POINT	80	Ambient	20,000	20,000	1.5	0.3024	0.3024						0.0872			24.3840	0.00	57.4938	0.4572	
LMSCR_1	Limestone Crushing 1	414,318	4,616,986	1,436.5	POINT	80	Ambient	20,000	20,000	1.5	0.3024	0.3024						0.2154			24.3840	0.00	57.4938	0.4572	
LMSL_1	Limestone Silos 1 loading	414,375	4,616,989	1,436.5	POINT	80	Ambient	20,000	20,000	1.5	0.3024	0.3024						0.2154			24.3840	0.00	57.4938	0.4572	
BATC_1	Battery Production 1 Complex	413,487	4,616,837	1,460.3	POINT	40	Ambient	5,000	5,000	1.0	0.1080	0.1080						0.0918			12.1920	0.00	32.3403	0.3048	
BATS_1	Battery Production 1 Solvent	413,528	4,616,794	1,460.3	POINT	40	Ambient	5,000	5,000	1.0											12.1920	0.00	32.3403	0.3048	
	Sodium Hypochlorite Tank 1	414,439	4,616,822	1,428.1	POINT	40	Ambient	17	17	0.3											12.1920	0.00	0.9896	0.1016	
LICLM_1	Lithium Chloride 1 Material Handling	414,457	4,616,822	1,428.1	POINT	40	Ambient	400	400	0.5	0.0086	0.0086						0.0043			12.1920	0.00	10.3489	0.1524	
KCLM_1	Potassium Chloride 1 Material Handling	414,449	4,616,793	1,428.1	POINT	40	Ambient	960	960	0.7	0.0207	0.0207						0.0104			12.1920	0.00	13.9710	0.2032	
ALM_1	Aluminum Powder 1 Material Handling	414,441	4,616,766	1,428.1	POINT	40	Ambient	400	400	0.5	0.0086	0.0086						0.0043			12.1920	0.00	10.3489	0.1524	
S2T_1	Sulfur Storage Tanks 1	414,428	4,616,932	1,436.9	POINT	60	500	750	1,635	1.0					0.0094	0.0094	0.0100			0.0094	18.2880	533.15	10.5753	0.3048	
BOIL_1	Package Boiler 1	414,287	4,616,907	1,436.9	POINT	60	350	18,131	36,240	2.5	0.1698	0.1698	0.3142	0.8492	0.0126	0.0126		0.0056	0.0279	0.0004	18.2880	449.82	37.5043	0.7620	0.0074
BURN_1	Start-Up Burner 1	414,265	4,616,929	1,436.9	POINT	60	350	24,022	48,015	3.0	0.1848	0.1246	0.4018	1.6074	0.0167	0.0167		0.0041	0.0528	0.0005	18.2880	449.82	34.5073	0.9144	0.5
SAP_1	Sulfuric Acid Plant	414,329	4,616,857	1,436.9	POINT	213	73	110,414	142,365	6.0	0.8064	0.8064		2.2302	2.2302	2.2302		0.7843	2.1691	2.1691	65.0000	296.15	25.5784	1.8288	0.5
COOL_1	Cooling Tower 1	414,453	4,617,226	1,441.4	POINT	30	Ambient		1,000,000	24.0	0.0200	0.0200						0.0200			9.1440	0.00	11.2293	7.3152	
FIRE1_1	Fire Pump 1 (Mine)	411,516	4,617,085	1,510.5	POINT	14	966	255	826	0.3	0.0058	0.0058	0.0389	0.0015	0.0000	0.0002		0.0001	0.0015	0.0000	4.2672	792.04	48.0835	0.1016	0.2
FIRE2_1	Fire Pump 2 (Process)	414,457	4,617,215	1,441.4	POINT	14	966	255	826	0.3	0.0058	0.0058	0.0389	0.0015	0.0000	0.0002		0.0001	0.0015	0.0000	4.2672	792.04	48.0835	0.1016	0.2
GEN1_1	Emergency Generator 1 (Mine)	410,940	4,617,336	1,533.8	POINT	5	960	275	888	0.3	0.0088	0.0088	0.1489	0.0008	0.0000	0.0006		0.0001	0.0008	0.0000	1.5240	788.71	51.6927	0.1016	0.1

SOURCE DESCRIPTION		OPERATING LIMITS									EMISSION FACTORS										EMISSION CONTROLS	
Model ID	Source Description	Design Throughput unit/hr	unit/day	unit/yr	units	Material	Operating Schedule hr/day	hr/yr	Other	reference	PM	PM10	PM2.5	CO	NOX	SO2	VOC	H2S	unit	reference	control system	eff.
GEN2_1	Emergency Generator 2 (Mine)	134	3,216	13,400	hp	Propane	24	100	*13.9 gal/hr*	*(LNC 2019a); 100 hr/yr of non-emergency*	0.0005	0.0005	0.0005	0.0088	0.0044	3.6E-05	0.0022		lb/hp-hr	*CO, NOX, VOC: 40 CFR 60 Subpart JJJJ, Table 1; PM, SO2: (CARB 1991)*	None	
LAB_1	Laboratory				-	Samples	24	2,190		*(LNC 2019a)*	0.02	0.02	0.02						gr/dscf	*NDEP Default (NDEP 2017)*	Baghouse	
PRILL_1	Ammonium Nitrate Prill Silo 1 Loading	80	80	29,200	ton	Prill	1	365	*80 ton capacity*	*(Whitehead 2019)*	0.02	0.007	0.0011						lb/ton	*AP-42 Table 8.3-2 (07/93) bulk load unctrl. (NDEP 2017)*	None	
PRILU_1	Ammonium Nitrate Prill Silo 1 Unloading	80	80	29,200	ton	Prill	1	365	*80 ton capacity*	*(Whitehead 2019)*	0.02	0.007	0.0011						lb/ton	*AP-42 Table 8.3-2 (07/93) bulk load unctrl. (NDEP 2017)*	None	
	Gasoline Tank (Mine)			69,000	Gal	Gasoline	24	8,760		*(LNC 2019a)*							1.0E-01		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Gasoline Tank (Process)			25,000	Gal	Gasoline	24	8,760		*(LNC 2019a)*							4.0E-02		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank, Off Road (Mine)			4,150,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							4.6E-03		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank, Highway (Mine)			32,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							2.1E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank (Process)			63,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							7.0E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank 1 (Acid Plant)			321,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							7.7E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Diesel Tank 2 (Acid Plant)			0	Gal	Diesel	24	8,760		*(LNC 2019a)*							0.0E+00		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Oil Tank			76,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							5.2E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Coolant Tank			15,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							8.0E-06		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Used Oil Tank			76,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							2.1E-04		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
	Bulk Used Coolant Tank			15,000	Gal	Diesel	24	8,760		*(LNC 2019a)*							8.0E-06		lb/hr	*EPA Tanks 4.0.9d (EPA 2005)*	None	
Total																						

SOURCE DESCRIPTION		HOURLY EMISSIONS								DAILY EMISSIONS								ANNUAL EMISSIONS							
Model ID	Source Description	PM lb/hr	PM10 lb/hr	PM2.5 lb/hr	CO lb/hr	NOX lb/hr	SO2 lb/hr	VOC lb/hr	H2S lb/hr	PM lb/day	PM10 lb/day	PM2.5 lb/day	CO lb/day	NOX lb/day	SO2 lb/day	VOC lb/day	H2S lb/day	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	H2S ton/yr
GEN2_1	Emergency Generator 2 (Mine)	0.070	0.070	0.070	1.182	0.591	0.005	0.295		1.668	1.668	1.668	28.360	14.180	0.117	7.090		0.003	0.003	0.003	0.059	0.030	0.000	0.015	
LAB_1	Laboratory	0.429	0.429	0.429						10.286	10.286	10.286						0.469	0.469	0.469					
PRILL_1	Ammonium Nitrate Prill Silo 1 Loading	1.600	0.560	0.085						1.600	0.560	0.085						0.292	0.102	0.015					
PRILU_1	Ammonium Nitrate Prill Silo 1 Unloading	1.600	0.560	0.085						1.600	0.560	0.085						0.292	0.102	0.015					
	Gasoline Tank (Mine)							0.100								2.407								0.439	
	Gasoline Tank (Process)							0.040								0.965								0.176	
	Diesel Tank, Off Road (Mine)							0.005								0.111								0.020	
	Diesel Tank, Highway (Mine)							0.000								0.005								0.001	
	Diesel Tank (Process)							0.001								0.017								0.003	
	Diesel Tank 1 (Acid Plant)							0.001								0.018								0.003	
	Diesel Tank 2 (Acid Plant)							0.000								0.000								0.000	
	Bulk Oil Tank							0.001								0.013								0.002	
	Bulk Coolant Tank							0.000								0.000								0.000	
	Bulk Used Oil Tank							0.000								0.005								0.001	
	Bulk Used Coolant Tank							0.000								0.000								0.000	
Total		**32.2**	**26.7**	**23.7**	**8.7**	**40.5**	**18.0**	**5.8**	**0.3**	**699.2**	**614.1**	**564.7**	**207.9**	**972.0**	**432.5**	**139.5**	**8.4**	**81.9**	**71.0**	**65.1**	**1.0**	**78.4**	**75.8**	**17.9**	**0.4**

SOURCE DESCRIPTION		NAD 83 LOCATION			RELEASE PARAMETERS INPUT						MODEL EMISSION RATES / RELEASE PARAMETERS														
Model ID	Source Description	UTM E m	UTM N m	elev m	POINT VOLUME	rel ht (ft) rel ht (ft)	temp (F) width (ft)	flow (dscfm) vert. ln (ft)	flow (acfm) grnd ht (ft)	dia (ft) σz type	PM_{10}-24 gps	$PM_{2.5}$-24 gps	CO-ALL gps	NO_X-1 gps	SO_2-1 gps	SO_2-ST gps	H_2S-1 gps	$PM_{2.5}$-AN gps	NO_X-AN gps	SO_2-AN gps	ht (m) ht (m)	temp (K) σy (m)	vel (m/s) σz (m)	dia (m)	NO_2/NO_X ISR
GEN2_1	Emergency Generator 2 (Mine)	410,940	4,617,336	1,533.8	POINT	5	960	275	888	0.3	0.0088	0.0088	0.1489	0.0008	0.0000	0.0006		0.0001	0.0008	0.0000	1.5240	788.71	51.6927	0.1016	0.1
LAB_1	Laboratory	414,333	4,617,098	1,439.8	POINT	40	Ambient	2,500	2,500	1.0	0.0540	0.0540						0.0135			12.1920	0.00	16.1701	0.3048	
PRILL_1	Ammonium Nitrate Prill Silo 1 Loading	412,191	4,618,139	1,535.7	POINT	30	Ambient	N/A	0.039	0.5	0.0706	0.0107						0.0004			9.1440	0.00	0.0010	0.1524	
PRILU_1	Ammonium Nitrate Prill Silo 1 Unloading	412,191	4,618,139	1,535.7	VOLUME	11	2	4	13	elev src w/o bldg	0.0706	0.0107						0.0004			3.3528	0.14	0.2835		
	Gasoline Tank (Mine)	410,885	4,617,431	1,538.8																					
	Gasoline Tank (Process)	414,219	4,616,997	1,436.5																					
	Diesel Tank, Off Road (Mine)	410,870	4,617,438	1,539.0																					
	Diesel Tank, Highway (Mine)	410,870	4,617,433	1,538.6																					
	Diesel Tank (Process)	414,232	4,616,998	1,436.5																					
	Diesel Tank 1 (Acid Plant)	414,256	4,616,921	1,436.9																					
	Diesel Tank 2 (Acid Plant)	414,256	4,616,921	1,436.9																					
	Bulk Oil Tank	410,867	4,617,432	1,538.4																					
	Bulk Coolant Tank	410,904	4,617,376	1,533.8																					
	Bulk Used Oil Tank	410,913	4,617,372	1,533.8																					
	Bulk Used Coolant Tank	410,900	4,617,368	1,533.8																					
Total											**4.9278**	**4.1792**	**1.8466**	**7.150**	**2.3077**	**2.3097**	**0.0881**	**2.4316**	**2.3369**	**2.1899**					

Phase 1 Fugitive Source Emissions

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
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Project Phase Phase 1

Mining Activity Emissions Summary

By Area/Model ID

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY	CO_PPH	CO_TPY	NOX_PPH	NOX_TPY	SO2_PPH	SO2_TPY	VOC_TPY
Area/	Location of	PM	PM10		PM2.5		CO		NOX		SO2		VOC
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
PIT	Pit	11.83	575.43	6.76	57.38	4.80	16.39	71.78	32.39	141.87	0.03	0.15	13.29
PIT_BL	Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.00	0
O_STOCK	Ore Stockpile	3.49	8.00	1.46	3.30	0.60	1.33	5.83	1.74	7.63	0.00	0.01	1.95
W_WRSF	West WRSF	3.68	8.43	1.54	3.48	0.64	1.40	6.14	1.83	8.04	0.00	0.01	2.05
E_WRSF	East WRSF	1.50	3.44	0.63	1.42	0.26	0.57	2.51	0.75	3.28	0.00	0.00	0.84
G_STOCK	Gangue Stockpile	1.84	4.25	0.78	1.66	0.30	0.65	2.84	0.85	3.72	0.00	0.00	0.95
CTFS	Clay Tailings Filter Stack	7.24	16.55	3.02	6.91	1.26	2.80	12.27	3.66	16.05	0.00	0.02	4.10
HR	Haul Roads	218.07	280.95	51.27	60.53	11.05	16.28	71.30	47.25	206.96	0.06	0.25	18.45
PROC	Process Plant	0.39	2.12	0.39	2.04	0.37	1.68	7.34	1.12	4.90	0.00	0.01	1.90
Total		249.53	1,158.28	66.62	151.67	19.33	3,079.28	189.12	171.22	392.70	0.32	0.47	43.53

By Activity

	PM_TPY chk	chk	chk	chk	chk	chk	chk	chk	chk	chk-16	chk	chk
	PM	PM10		PM2.5		CO		NOX		SO2		VOC
Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
Open Pit Drilling	3.16	547.39	1.64	31.58	0.09							
Open Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.00	
Onsite Hauling	82.93	94.10	17.17	9.41	1.72							
Material Load / Unload	1.13	2.93	0.53	0.44	0.08							
Mobile Equipment (Tailpipes)	12.10	66.29	12.10	65.50	11.95	41.10	180.01	89.60	392.45	0.11	0.47	43.53
Dozing	9.64	6.63	1.21	5.55	1.01							
Grading	98.88	120.66	22.02	16.80	3.07							
Water Truck Travel	30.50	34.61	6.32	3.46	0.63							
Wind Erosion	9.70	26.57	4.85	3.99	0.73							
Total	249.53	1,158.28	66.62	151.67	19.33	3,079.28	189.12	171.22	392.70	0.32	0.47	43.53

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
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Project Phase Phase 1

Mining Activity Source Parameters Summary

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M	SXINIT_M	SYINIT_M	PITVOL_M3	ANGL_DEG
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z	Pit X	Pit Y	Pit Vol.	Angle
Model ID	Activity	Type	E m	N m	m	m	m	m	m	m	m^3	deg
PIT	Pit	OPENPIT	409,625	4,617,550	1,564.5	4.36	-	-	2,720.00	1,649.11	2.5E+08	-
PIT_BL	Pit Blasting	VOLUME	410,560	4,618,577	1,597.3	75.00	20.93	34.88	-	-	-	-
O_STOCK	Ore Stockpile	VOLUME	411,254	4,617,174	1,525.8	4.36	47.45	4.05	-	-	-	-
W_WRSF	West WRSF	VOLUME	409,214	4,617,951	1,503.6	4.36	186.56	4.05	-	-	-	-
E_WRSF	East WRSF	VOLUME	412,839	4,618,603	1,548.9	4.36	171.15	4.05	-	-	-	-
G_STOCK	Gangue Stockpile	VOLUME	413,702	4,617,832	1,492.0	4.36	261.41	4.05	-	-	-	-
CTFS	Clay Tailings Filter Stack	VOLUME	415,659	4,617,957	1,471.2	3.49	355.22	3.24	-	-	-	-
HR	Haul Roads	VOLUME	See worksheet: ROADS			4.36	14.13	4.05	-	-	-	-
PROC	Process Plant	VOLUME	414,342	4,617,062	1,439.7	1.79	166.34	1.67	-	-	-	-

			PM10_PPD	PM2.5_PPD	PM2.5_TPY	CO_PPH	NOX_PPH	NOX_TPY	SO2_PPH	SO2_TPY	
	Source		PM10	PM2.5	PM2.5	CO	NOX	NOX	SO2	SO2	NO2/NOX
Model ID	Type	Units	24-hr	24-hr	Annual	1-hr & 8-hr	1-hr	Annual	1-hr & 3-hr	Annual	ISR
PIT	OPENPIT	g/s/m2	6.73E-07	6.72E-08	3.08E-08	4.60E-07	9.10E-07	9.10E-07	9.75E-10	9.75E-10	0.11
PIT_BL	VOLUME	g/s	1.3603	0.0785	0.0013	382.8039	10.2843	0.0070	0.0274	0.0000	0.0357
O_STOCK	VOLUME	g/s	0.0420	0.0173	0.0173	0.1677	0.2195	0.2195	0.0003	0.0003	0.11
W_WRSF	VOLUME	g/s	0.0443	0.0183	0.0183	0.1767	0.2312	0.2312	0.0003	0.0003	0.11
E_WRSF	VOLUME	g/s	0.0181	0.0075	0.0075	0.0722	0.0944	0.0944	0.0001	0.0001	0.11
G_STOCK	VOLUME	g/s	0.0223	0.0087	0.0087	0.0818	0.1070	0.1070	0.0001	0.0001	0.11
CTFS	VOLUME	g/s	0.0869	0.0363	0.0363	0.3529	0.4618	0.4618	0.0006	0.0006	0.11
HR	VOLUME	g/s	1.4750	0.3178	0.3178	2.0510	5.9536	5.9536	0.0073	0.0073	0.11
PROC	VOLUME	g/s	0.0111	0.0107	0.0107	0.2111	0.1409	0.1409	0.0003	0.0003	0.11
			chk	chk	chk	chk	chk	chk	Error	chk	

Conversions

3.28084	ft/m	8,760	hr/yr
453.592	g/lb	24	hr/day
2,000	lb/ton	3,600	sec/hr

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Open Pit Drilling

Activity Information

Blasting schedule	6	day/yr		*Based on blasts/yr, with 1 blast per day*
Annual blast holes drilled	4,858	hole/yr	hpy	*(Whitehead 2019a)*

Emission Factors

TSP (PM)	1.3	lb/hole	*AP-42, Table 11.9-4, 7/98 (overburden)*

PM Scaling Factors

PM_{10}	0.52	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*
$PM_{2.5}$	0.03	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*

Emissions

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
	Location of	PM	PM10		PM2.5	
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
PIT	Pit	3.16	547.39	1.64	31.58	0.09
Total	Open Pit Drilling	3.16	547.39	1.64	31.58	0.09

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	PITVOL_M3	SXINIT_M	SYINIT_M	ANGL_DEG
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	Pit Vol.	Pit X	Pit Y	Angle
Model ID	Activity	Type	E m	N m	m	m	m^3	m	m	deg
PIT	Pit	OPENPIT	409,625	4,617,550	1,565	4.36	2.5E+08	2,720	1,649	0

(LNC 2019)

Conversions
2,000 lb/ton

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Open Pit Blasting

Activity Information

Blast area	108,200 ft^2/blast	ft2	*(Whitehead 2019a)*
Blasts per year	6 blast/yr	bpy	*(Whitehead 2019b)*
ANFO consumption	272 ton/yr	AN_tpy	*(Whitehead 2019a)*
ANFO diesel content	8%		*AP-42, Table 13.3-1, 2/80 (ANFO max. FO content)*

Emission Factors

Emission factor equation	TSP (lb/blast) = 0.000014 x $A^{1.5}$	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*
A = Area per blast	108,200 ft^2	
TSP (PM)	498.27 lb/blast	
CO	67 lb CO/ton - ANFO	*AP-42, Table 13.3-1, 2/80 (ANFO)*
NOX	0.9 kg/t-ANFO	*(CSIRO 2008)*
	1.8 lb NOX/ton - ANFO	
SO2	4.8E-03 lb SO2/ton-ANFO	*Based on 15 ppm S in FO and a maximum of 8% FO in ANFO*

1.5E-05 ~~lb S~~	64.064 lb SO2	8% ~~lb FO~~	2,000 ~~lb ANFO~~	=	0.00480 lb SO2
~~lb FO~~	32.065 ~~lb S~~	~~lb ANFO~~	ton ANFO		ton ANFO

PM Scaling Factors

PM_{10}	0.52	*AP-42, Tab. 11.9-1, 7/98 (blasting, overburden)*
$PM_{2.5}$	0.03	*AP-42, Tab. 11.9-1, 7/98 (blasting, overburden)*

Emissions

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY	CO_PPH	CO_TPY	NOX_PPH	NOX_TPY	SO2_PPH	SO2_TPY
	Location of	PM	PM10		PM2.5		CO		NOX[1]		SO2	
Model ID	Activity	ton/yr	lb/day[2]	ton/yr	lb/day[2]	ton/yr	lb/hr[2]	ton/yr	lb/hr[2]	ton/yr	lb/hr[2]	ton/yr
PIT_BL	Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.001
Total	Open Pit Blasting	1.49	259.10	0.78	14.95	0.04	3,038.18	9.11	81.62	0.24	0.22	0.001

(1) *NO2 / NOX In-Stack Ratio (ISR):* 3.57% *(CSIRO 2008)*

(2) *Short-term emissions (lb/day and lb/hr) are based on the annual blasting emissions divided by the annual number of blasts.*

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
PIT_BL	Pit Blasting	VOLUME	410,560	4,618,577	1,597	75	20.93	34.88

(LNC 2019)

Blast height (BH)	150 m	*(CSIRO 2008)*	Sigma divider			
Blast width	90 m	*(CSIRO 2008)*	Rel. Ht.	2	of BH	*(EPA 2004b)*
Blast depth	90 m	*(CSIRO 2008)*	S-y	4.3	of SL	*(EPA 2004b)*
Equal area side length (SL)	90 m		S-z	4.3	of BH	*(EPA 2004b)*

Conversions

2,000 lb/ton	1.102 ton/t	64.0638 M.W. SO2
2.205 lb/kg	453.59 g/lb	32.065 M.W. S

Project Phase Phase 1

Onsite Hauling

Activity Information

Operating schedule 365 day/yr

Hauling Routes, Production Rates and Distances tpy

	Origin Model ID	Route Origin	Destination Model ID	Route Destination	Material Type	Material Hauled [1] Rate ton/yr	Truck Loads load/yr	One-Way Hauling [2] mi	Total Travel [3] VMT/yr
	Unpaved Roads								
PIT-	*PIT*	Pit	*O_STOCK*	Ore Stockpile	Ore	3,100,000	19,746	1.41	55,620
PIT-	*PIT*	Pit	*W_WRSF*	West WRSF	Waste	3,266,000	20,803	2.09	86,851
PIT-	*PIT*	Pit	*E_WRSF*	East WRSF	Waste	1,334,000	8,497	2.55	43,400
G_S	*G_STOCK*	Gangue Stockpile	*PIT*	Pit	Gangue	1,511,538	9,628	3.36	64,626
	Total					9,211,538			250,498

(1) *(LNC 2019)*

(2) *Estimated mileage based on Thacker Pass Site Layout (LNC 2019c)*

(3) *Total VMT distributed based on Material Hauled and One-Way Hauling distance.*

Truck Fleet

Truck	Payload Capacity ton	Empty Weight ton	Quantity of trucks	Average Weight ton		
CAT 785D	157	118	9	196.5	*Loaded trucks one way*	*(LNC 2019a)*

Emission Factors

Unpaved roads

Emission factor equation	$E = k(s/12)^a (W/3)^b [(365-P)/365]$				*AP-42, Sec. 13.2.2, Eq. 1a, 11/06*
s = Surface material silt content	1.7 %				*(EPA 2003)*
W = Mean vehicle weight	196.5 ton				
P = Days/year with ≥0.01 in precip.	70 day/yr				*AP-42 Fig. 13.2.2-1, 11/06*
	PM	PM10	PM2.5		
k = Size-specific empirical constant	4.9	1.5	0.15		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
a = Size-specific empirical constant	0.7	0.9	0.9		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
b = Size-specific empirical constant	0.45	0.45	0.45		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
E = Size-specific emission factor	6.62	1.37	0.14	lb/VMT	

Emission Controls

Unpaved roads - periodic application of water and chemical dust suppressant

Control efficiency: 90% *(Air Sciences 2018)*

Conversions

2,000 lb/ton

5,280 ft/mi

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Onsite Hauling - continued

Hauling Emissions by Route

		Material Hauled	PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
Route	Route	Material	PM	PM10		PM2.5	
Origin	Destination	Type	ton/yr	lb/day	ton/yr	lb/day	ton/yr
Unpaved Roads							
Pit	Ore Stockpile	Ore	18.41	20.89	3.81	2.09	0.38
Pit	West WRSF	Waste	28.75	32.63	5.95	3.26	0.60
Pit	East WRSF	Waste	14.37	16.30	2.98	1.63	0.30
Gangue Stockpile	Pit	Gangue	21.39	24.28	4.43	2.43	0.44
Total			82.93	94.10	17.17	9.41	1.72

Emissions by Area

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
		PM	PM10		PM2.5	
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
HR	Haul Roads	82.93	94.10	17.17	9.41	1.72

See worksheet ROADS for haul road (HR) emissions by Model ID.

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
HR	Haul Roads	VOLUME	See worksheet: ROADS			4.36	14.13	4.05

Truck Specs	m	
Vehicle height (VH) CAT 785D	5.1	*(Caterpillar 2019)*
Road width (RW)	24.4	*(LNC 2019)*

Plume Parameter	Calculation	Const.	Value (m)	
Plume top (PT) - unpaved	1.7 x VH	1.7	8.71	*(EPA 2012)*
Release height - unpaved	0.5 x PT	0.5	4.36	*(EPA 2012)*
Plume width (PW)	RW + 6 m	6	30.38	*(EPA 2012)*
Sigma-z - unpaved	PT / 2.15	2.15	4.05	*(EPA 2012)*
Sigma-y	PW / 2.15	2.15	14.13	*(EPA 2012)*

Conversions

2,000 lb/ton

3.28 ft/m

12 in/ft

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Material Load / Unload

Activity Information

Operating schedule 365 day/yr

Throughput Rates chk

Model ID	Location of Activity	No. of Xfers	Rate ton/yr	Total Rate ton/yr	Xfer Description
PIT	Pit	1	7,700,000	7,700,000	Load
G_STOCK	Gangue Stockpile	1	1,511,538	1,511,538	Load
O_STOCK	Ore Stockpile	1	3,100,000	3,100,000	Unload
W_WRSF	West WRSF	1	3,266,000	3,266,000	Unload
E_WRSF	East WRSF	1	1,334,000	1,334,000	Unload
PIT	Pit	1	1,511,538	1,511,538	Unload

Emission Factors

		PM	PM10	PM2.5		
k = Particle size multiplier		0.74	0.35	0.053		*AP-42, Sec. 13.2.4, Pg. 4, 11/06*
E = Emission factor	Load	0.00021	0.0001	0.000015	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck loading - crushed stone)*
	Unload	0.00003	0.000016	0.0000024	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck unloading - fragmented stone)*

Emissions by Model ID

			chk	PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
	Location of		Total Rate	PM	PM10		PM2.5	
Model ID	Activity		ton/yr	ton/yr	lb/day	ton/yr	lb/day	ton/yr
PIT	Pit	Load	7,700,000	0.81	2.11	0.39	0.32	0.058
G_STOCK	Gangue Stockpile	Load	1,511,538	0.16	0.41	0.08	0.06	0.011
O_STOCK	Ore Stockpile	Unload	3,100,000	0.05	0.14	0.02	0.02	0.004
W_WRSF	West WRSF	Unload	3,266,000	0.06	0.14	0.03	0.02	0.004
E_WRSF	East WRSF	Unload	1,334,000	0.02	0.06	0.01	0.01	0.002
PIT	Pit	Unload	1,511,538	0.03	0.07	0.01	0.01	0.002
Total	Material Load / Unload		18,423,076	1.13	2.93	0.53	0.44	0.08

Conversions

2,000 lb/ton

Project Phase Phase 1

Material Load / Unload - continued

Source Parameters

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
O_STOCK	Ore Stockpile	VOLUME	411,254	4,617,174	1,526	4.36	47	4.05
W_WRSF	West WRSF	VOLUME	409,214	4,617,951	1,504	4.36	187	4.05
E_WRSF	East WRSF	VOLUME	412,839	4,618,603	1,549	4.36	171	4.05
G_STOCK	Gangue Stockpile	VOLUME	413,702	4,617,832	1,492	4.36	261	4.05

Vehicle height (VH) CAT 785D 5.1 m

Plume Parameter	Calculation	Const.	Value (m)
Plume top (PT)	1.7 x VH	1.7	8.71
Release height	0.5 x PT	0.5	4.36
Sigma-z	PT / 2.15	2.15	4.05

(EPA 2012)

S-y = length of side / 4.3 *(EPA 2004b)*

Location of Activity	Area[1] m^2	Length of side m	S-y
Ore Stockpile	41,623	204	47
West WRSF	643,544	802	187
East WRSF	541,645	736	171
Gangue Stockpile	1,263,489	1,124	261

[1] *(LNC 2019)*

Project Phase Phase 1

Mobile Equipment (Tailpipes)
Activity Information
Operating schedule 24 hr/day 365 day/yr

On-Road Mobile Equipment [(1)]

Equipment	Total Units	Use	Fuel	EPA Tier	Rating hp	Oper. hr/yr	Avg Load Factor[(2)]	Output hp-hr/yr	Speed mi/hr[(3)]	VMT/yr	MOVES Class[(4)]
Ford F250 XLT Superduty	4	Mine	Diesel	4	450	8,760	51%	8,015,400	35	623,420	LHD<=10K
Ford F350 XLT Superduty	1	Mine	Diesel	4	450	8,760	51%	2,003,850	35	155,855	LHD<=14K
Ford F150 XLT Supercrew	2	Mine	Gasoline	n/a	395	8,760	51%	3,517,870	35	311,710	LDT
Water Truck (Process)	1	Process	Diesel	4	450	1,140	51%	260,775	20	11,590	LHD<=14K
Maintenance Service Truck	2	Process	Gasoline	n/a	385	1,040	51%	407,073	20	21,147	LHD45
1/2 Ton Pickups	5	Process	Gasoline	n/a	395	1,040	51%	1,044,117	20	52,867	LDT
Ambulance	1	Process	Gasoline	n/a	385	100	51%	19,571	20	1,017	LHD45
Fire Truck	1	Process	Gasoline	n/a	385	100	51%	19,571	20	1,017	LHD45

[(1)] *(LNC 2019a)* [(2)] *Average load factor for mining equipment* [(3)] *Estimate* [(4)] *(EPA 2015)*

EPA MOVES 2014b Emission Factors

Class	Description	PM	PM10	PM2.5	CO	NOX	SO2	VOC
		Emission Factor (lb/VMT)[(1)]						
LDT	Gasoline - Passenger Truck	2.2E-04	2.2E-04	3.9E-05	7.1E-03	5.4E-04	2.2E-05	2.1E-04
LHD<=10K	Diesel - Light Commercial Truck	3.6E-04	3.6E-04	1.6E-04	2.6E-03	3.7E-03	1.4E-05	4.5E-04
LHD<=14K	Diesel - Light Commercial Truck	1.0E-03	1.0E-03	4.8E-04	3.1E-03	6.8E-03	2.4E-05	1.1E-03
LHD45	Gasoline - Single Unit Short-haul Truck	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03

[(1)] *(MOVES 2019)*

On-Road Equipment	MOVES Class	PM	PM10	PM2.5	CO	NOX	SO2	VOC
		Emission Factor (lb/VMT)						
Ford F250 XLT Superduty	LHD<=10K	3.6E-04	3.6E-04	1.6E-04	2.6E-03	3.7E-03	1.4E-05	4.5E-04
Ford F350 XLT Superduty	LHD<=14K	1.0E-03	1.0E-03	4.8E-04	3.1E-03	6.8E-03	2.4E-05	1.1E-03
Ford F150 XLT Supercrew	LDT	2.2E-04	2.2E-04	3.9E-05	7.1E-03	5.4E-04	2.2E-05	2.1E-04
Water Truck (Process)	LHD<=14K	1.0E-03	1.0E-03	4.8E-04	3.1E-03	6.8E-03	2.4E-05	1.1E-03
Maintenance Service Truck	LHD45	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03
1/2 Ton Pickups	LDT	2.2E-04	2.2E-04	3.9E-05	7.1E-03	5.4E-04	2.2E-05	2.1E-04
Ambulance	LHD45	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03
Fire Truck	LHD45	7.2E-04	7.2E-04	1.1E-04	2.9E-02	4.3E-03	6.3E-05	1.7E-03

On-Road Equipment Emissions by Area

		PM	PM10		PM2.5		CO		NOX		SO2		VOC
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
HR	Ford F250 XLT Super	0.11	0.62	0.11	0.28	0.05	0.18	0.80	0.27	1.16	0.0010	0.004	0.14
HR	Ford F350 XLT Super	0.08	0.43	0.08	0.20	0.04	0.05	0.24	0.12	0.53	0.0004	0.002	0.08
HR	Ford F150 XLT Super	0.03	0.19	0.03	0.03	0.01	0.25	1.11	0.02	0.08	0.0008	0.003	0.03
PROC	Water Truck (Process	0.01	0.03	0.01	0.02	0.00	0.00	0.02	0.01	0.04	0.0000	0.000	0.01
PROC	Maintenance Service '	0.01	0.04	0.01	0.01	0.00	0.07	0.31	0.01	0.05	0.0002	0.001	0.02
PROC	1/2 Ton Pickups	0.01	0.03	0.01	0.01	0.00	0.04	0.19	0.00	0.01	0.0001	0.001	0.01
PROC	Ambulance	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.0000	0.000	0.00
PROC	Fire Truck	0.0004	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.0000	0.000	0.00
Total	On-Road Equipment	0.25	1.34	0.25	0.54	0.10	0.62	2.70	0.43	1.88	0.00	0.01	0.29

Conversions
2,000 lb/ton

Project Phase Phase 1

Mobile Equipment (Tailpipes) - continued

Off-Road Vehicles

Final emission factor options:

EPA Engine Certification Data

EPA Non-Road Standards

EPA AP-42 - Diesel

AP-42 Emission Factors

	Emission Factor (lb/hp-hr)					
Engine Description	PM	CO	NOX	VOC	Reference	0
Diesel industrial engines ≤600 hp	0.0022	0.0067	0.0310	0.0025	*AP-42, Table 3.3-1, 10-96*	1
Large stationary diesel engines >600 hp	0.0007	0.0055	0.0240	0.00064	*AP-42, Table 3.4-1, 10-96*	600

EPA Engine Certification Data [(1)]

			Emission Factor (lb/hp-hr)[(3)]					
Vehicle Descriptio	Engine Description	EPA Family No.	PM	PM10	PM2.5	CO	NOX	VOC
Surface Miner	2006 Cummins QST 30, 1050 hp	6CEXL030.AAB[(2)]	0.00014	0.00014	0.00014	0.0014	0.0092	0.00064
Haul Truck	2006 CAT 3512C HD, 1450 hp	6CPXL58.6T2E[(2)]	0.00022	0.00022	0.00022	0.0026	0.0087	0.00064
Service Truck	2003 Cummins C8.3-215, 215 hp	3CEXL0505ABD[(2)]	0.00028	0.00028	0.00028	0.0012	0.0097	0.0025

(1) *(LNC 2019a)*

(2) *No EPA Certification VOC emission factor was provided, so AP-42, Table 3.4-1 was used.*

(3) *(EPA 2019)*

SO2 emission factor:

Diesel Sulfur Content 0.0015% *40 CFR 80.510 sulfur content of non-road diesel*

$$\frac{0.0015\%\ \text{lb S}}{\text{lb Fuel}} \times \frac{6.943\ \text{lb Fuel}}{\text{gal Fuel}} \times \frac{64.064\ \text{lb SO2}}{32.065\ \text{lb S}} = \frac{0.000208\ \text{lb SO2}}{\text{gal Fuel}}$$

Conversions

292.9 kW-hr/MMBtu	32.065 lb S
1.341 hp/kW	64.064 lb SO2
453.592 g/lb	6.943 lb/gal distillate oil

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Mobile Equipment (Tailpipes) - continued

Mobile Equipment Specifications and Activity [1]

Equipment	Category	Total Units	Model Year[2],[3]	Rating hp	Oper. hr/yr	Avg Load Factor[4]	Output hp-hr/yr	Diesel gal/yr	Rating kW	Power Category	
Hydraulic Excavator	Shovel	2	2006	1,530	8,760	65%	17,423,640	871,182	1,141	kW>560	chk
Surface Miner	Shovel	1	2006	1,050	8,760	65%	5,978,700	298,935	783	kW>560	chk
Haul Truck	Mining Truck	9	2006	1,450	8,760	35%	40,011,300	2,000,565	1,081	kW>560	chk
Dozer	Dozer	3	2006	600	8,760	58%	9,066,600	453,330	447	225≤kW<450, ≤2010	chk
Water Truck	Mining Truck	1	2006	1,025	8,760	35%	3,142,650	157,133	764	kW>560	chk
Grader	Grader	1	2006	304	8,760	40%	1,065,216	53,261	227	225≤kW<450, ≤2010	chk
Fuel/Lube Truck	Mining Truck	1	2006	375	8,760	35%	1,149,750	57,488	280	225≤kW<450, ≤2010	chk
Crane	Telehandler	1	2007	160	8,760	35%	490,560	24,528	119	75≤kW<130, ≤2011	chk
Telehandler	Telehandler	1	2007	142	8,760	35%	435,372	21,769	106	75≤kW<130, ≤2011	chk
Front End Loader	Loader	1	2006	973	8,760	58%	4,901,001	245,050	726	kW>560	chk
Service Truck	Mining Truck	2	2003	215	8,760	35%	1,318,380	65,919	160	130≤kW<225, ≤2010	chk
Skid Steer	Skid Steer	1	2008	74	8,760	58%	374,249	18,712	55	37≤kW<56, Opt2	chk
Manlift	Skid Steer	1	2015	67	8,760	58%	337,479	16,874	50	37≤kW<56, Opt2	chk
Drill Rigs [5],[6]	Shovel	1	2015	560	144	65%	52,416	2,621	418	130≤kW<560, Ph-out	chk
Forklift	Skid Steer	6	2015	75	1,139	58%	294,716	14,736	56	56≤kW<75, Ph-out	chk
Carry Deck Crane	Telehandler	1	2015	50	1,139	35%	19,933	997	37	37≤kW<56, Opt2	chk
Skid Steer	Skid Steer	2	2015	74	8,760	58%	748,498	37,425	55	37≤kW<56, Opt2	chk
Manlift - 340AJ	Skid Steer	1	2015	25	1,139	58%	16,242	812	18	8≤kW<19	chk
Manlift - 740AJ	Skid Steer	1	2015	67	1,139	58%	43,880	2,194	50	37≤kW<56, Opt2	chk
Telehandler	Telehandler	1	2015	142	8,760	35%	435,372	21,769	106	75≤kW<130, Ph-out	chk
Backhoe	Backhoe	1	2015	102	1,139	53%	60,993	3,050	76	75≤kW<130, Ph-out	chk
Mobile Crane	Telehandler	1	2015	164	475	35%	27,265	1,363	122	75≤kW<130, Ph-out	chk

[1] *(LNC 2019a)*

[2] *Oldest model year listed based on tier rating*

[3] *(Whitehead 2019c)*

[4] *Average medium application load factor by equipment category (Caterpillar 2016), pages 25-9 to 25-40.*

[5] *(LNC 2019)*

[6] *(Sandvik 2019)*

Conversions

1.341 hp/kW

7,000 Btu/hp-hr

140,000 Btu/gal diesel

Project Phase Phase 1

Mobile Equipment (Tailpipes) - continued

EPA Non-Road Standards

	Model		EPA	EPA Non-Road Standards (g/kW-hr)				
Equipment	Year	Power Category	Tier	PM	CO	NOX	VOC	Lookup ID
Hydraulic Excavator	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Surface Miner	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Haul Truck	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Dozer	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Water Truck	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Grader	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Fuel/Lube Truck	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Crane	2007	75≤kW<130, ≤2011	3	0.3	5	4	-	§89-75≤kW<130 2007
Telehandler	2007	75≤kW<130, ≤2011	3	0.3	5	4	-	§89-75≤kW<130 2007
Front End Loader	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Service Truck	2003	130≤kW<225, ≤2010	2	0.2	3.5	6.6	-	§89-130≤kW<225 2003
Skid Steer	2008	37≤kW<56, Opt2	3	0.4	5	4.7	-	§89-37≤kW<75 2008
Manlift	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Drill Rigs	2015	130≤kW<560, Ph-out	4	0.02	3.5	0.4	0.19	T4-130≤kW≤560 2015
Forklift	2015	56≤kW<75, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015
Carry Deck Crane	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Skid Steer	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Manlift - 340AJ	2015	8≤kW<19	4	0.4	6.6	7.5	7.5	T4-8≤kW<19 2015
Manlift - 740AJ	2015	37≤kW<56, Opt2	4	0.03	5	4.7	4.7	T4-37≤kW<56 2015
Telehandler	2015	75≤kW<130, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015
Backhoe	2015	75≤kW<130, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015
Mobile Crane	2015	75≤kW<130, Ph-out	4	0.02	5	0.4	0.19	T4-56≤kW<130 2015

Project Phase Phase 1

Mobile Equipment (Tailpipes) - continued

Final Emission Factors

Equipment	PM lb/hp-hr	CO lb/hp-hr	NOX lb/hp-hr[1]	VOC lb/hp-hr[1]	SO2 lb/gal	Final Emission Factor
Hydraulic Excavator	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Surface Miner	0.00014	0.00140	0.00921	0.00064	0.00021	*EPA Engine Certification Data*
Haul Truck	0.00022	0.00265	0.00875	0.00064	0.00021	*EPA Engine Certification Data*
Dozer	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Water Truck	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Grader	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Fuel/Lube Truck	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Crane	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Telehandler	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Front End Loader	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Service Truck	0.00028	0.00118	0.00970	0.00247	0.00021	*EPA Engine Certification Data*
Skid Steer	0.00066	0.00822	0.00773	0.00247	0.00021	*EPA Non-Road Standards*
Manlift	0.00005	0.00822	0.00773	0.00773	0.00021	*EPA Non-Road Standards*
Drill Rigs	0.00003	0.00575	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Forklift	0.00003	0.00822	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Carry Deck Crane	0.00005	0.00822	0.00773	0.00773	0.00021	*EPA Non-Road Standards*
Skid Steer	0.00066	0.00822	0.00773	0.00247	0.00021	*EPA Non-Road Standards*
Manlift - 340AJ	0.00066	0.01085	0.01233	0.01233	0.00021	*EPA Non-Road Standards*
Manlift - 740AJ	0.00005	0.00822	0.00773	0.00773	0.00021	*EPA Non-Road Standards*
Telehandler	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Backhoe	0.00003	0.00822	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Mobile Crane	0.00003	0.00822	0.00066	0.00031	0.00021	*EPA Non-Road Standards*

[1] *If the EPA Non-Road Standard is a combined NOX+VOC limit, then NOX = NOX+VOC and VOC is taken from AP-42.*

Conversions

453.592 g/lb

1.341 hp/kW

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Mobile Equipment (Tailpipes) - continued

Emissions by Area		chk	chk-14	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk
		PM	PM10		PM2.5		CO		NOX		SO2		VOC
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
PIT	Hydraulic Excavator	2.86	15.70	2.86	15.70	2.86	11.44	50.13	20.93	91.66	0.021	0.091	5.58
PIT	Surface Miner	0.43	2.34	0.43	2.34	0.43	0.95	4.18	6.28	27.52	0.007	0.031	1.92
HR	Haul Truck	4.47	24.51	4.47	24.51	4.47	12.09	52.95	39.95	174.97	0.048	0.208	12.82
MINE	Dozer	1.49	8.17	1.49	8.17	1.49	5.96	26.08	6.81	29.81	0.011	0.047	11.20
HR	Water Truck	0.52	2.83	0.52	2.83	0.52	2.06	9.04	3.77	16.53	0.004	0.016	1.01
HR	Grader	0.18	0.96	0.18	0.96	0.18	0.70	3.06	0.80	3.50	0.001	0.006	1.32
HR	Fuel/Lube Truck	0.19	1.04	0.19	1.04	0.19	0.76	3.31	0.86	3.78	0.001	0.006	1.42
MINE	Crane	0.12	0.66	0.12	0.66	0.12	0.46	2.02	0.37	1.61	0.001	0.003	0.61
MINE	Telehandler	0.11	0.59	0.11	0.59	0.11	0.41	1.79	0.33	1.43	0.001	0.002	0.54
MINE	Front End Loader	0.81	4.41	0.81	4.41	0.81	3.22	14.10	5.89	25.78	0.00582	0.02549	1.57
HR	Service Truck	0.18	1.01	0.18	1.01	0.18	0.18	0.78	1.46	6.39	0.002	0.007	1.63
MINE	Skid Steer	0.12	0.67	0.12	0.67	0.12	0.35	1.54	0.33	1.45	0.0004	0.002	0.46
MINE	Manlift	0.01	0.05	0.01	0.05	0.01	0.32	1.39	0.30	1.30	0.000	0.002	1.30
PIT	Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.00	0.02	0.000	0.000	0.01
PROC	Forklift	0.00	0.03	0.00	0.03	0.00	0.28	1.21	0.02	0.10	0.000	0.002	0.05
PROC	Carry Deck Crane	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.02	0.08	0.000	0.000	0.08
PROC	Skid Steer	0.25	1.35	0.25	1.35	0.25	0.70	3.08	0.66	2.89	0.001	0.004	0.92
PROC	Manlift - 340AJ	0.01	0.03	0.01	0.03	0.01	0.02	0.09	0.02	0.10	0.000	0.000	0.10
PROC	Manlift - 740AJ	0.00	0.01	0.00	0.01	0.00	0.04	0.18	0.04	0.17	0.000	0.000	0.17
PROC	Telehandler	0.11	0.59	0.11	0.59	0.11	0.41	1.79	0.33	1.43	0.001	0.002	0.54
PROC	Backhoe	0.00	0.01	0.00	0.01	0.00	0.06	0.25	0.00	0.02	0.000	0.000	0.01
PROC	Mobile Crane	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.00	0.01	0.000	0.000	0.00
	Total Non-Road Emissions	11.85	64.95	11.85	64.95	11.85	40.48	177.31	89.17	390.57	0.10	0.45	43.24
	Total On-Road Emissions	0.25	1.34	0.25	0.54	0.10	0.62	2.70	0.43	1.88	0.003	0.011	0.29
	Total Tailpipe Emissions	12.10	66.29	12.10	65.50	11.95	41.10	180.01	89.60	392.45	0.11	0.47	43.53

Conversions

2,000	lb/ton
453.59	g/lb

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Mobile Equipment (Tailpipes) - continued

Subtotals by Area

		PM	PM10		PM2.5		CO		NOX		SO2		VOC
		chk	chk-14	chk	chk	chk	chk	chk	chk	chk	chk	chk	chk
Area		ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
HR	Haul Roads	5.76	31.58	5.76	30.86	5.63	16.28	71.30	47.25	206.96	0.06	0.25	18.45
PIT	Pit	3.29	18.04	3.29	18.04	3.29	12.43	54.46	27.22	119.20	0.03	0.12	7.50
MINE	Mine	2.66	14.55	2.66	14.55	2.66	10.71	46.92	14.02	61.39	0.02	0.08	15.68
PROC	Process Plant	0.39	2.12	0.39	2.04	0.37	1.68	7.34	1.12	4.90	0.00	0.01	1.90
Total	Mobile Tailpipes	12.10	66.29	12.10	65.50	11.95	41.10	180.01	89.60	392.45	0.11	0.47	43.53

MINE = Pits, dumps, and stockpiles

Short-term emissions are based on annual emissions divided by 365 day/yr and 24 hr/day.

Emission Allocation by Model ID

		Area ID			Location of		Total Rate				
Model ID	*HR*	*PIT*	*MINE*	*PROC*	Activity		ton/yr	HR	PIT	MINE	PROC
PIT		*PIT*	*MINE*		Pit		9,211,538	-	100.0%	36.9%	-
O_STOCK			*MINE*		Ore Stockpile		3,100,000	-	-	12.4%	-
W_WRSF			*MINE*		West WRSF		3,266,000	-	-	13.1%	-
E_WRSF			*MINE*		East WRSF		1,334,000	-	-	5.3%	-
G_STOCK			*MINE*		Gangue Stockpile		1,511,538	-	-	6.1%	-
CTFS			*MINE*		Clay Tailings Filter Stack	Clay_tpy	6,522,696	-	-	26.1%	-
HR	*HR*				Haul Roads			100.0%	-	-	-
PROC				*PROC*	Process Plant			-	-	-	100.0%

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Mobile Equipment (Tailpipes) - continued

Emissions by Model ID		chk PM_TPY	chk-14 PM10_PPD	chk PM10_TPY	chk PM2.5_PPD	chk PM2.5_TPY	chk CO_PPH	chk CO_TPY	chk NOX_PPH	chk NOX_TPY	chk SO2_PPH	chk SO2_TPY	chk VOC_TPY
		PM	PM10		PM2.5		CO		NOX[1]		SO2		VOC
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr
PIT	Mobile Tailpipes	4.27	23.42	4.27	23.42	4.27	16.39	71.78	32.39	141.87	0.03	0.15	13.29
O_STOCK	Mobile Tailpipes	0.33	1.81	0.33	1.81	0.33	1.33	5.83	1.74	7.63	0.00	0.01	1.95
W_WRSF	Mobile Tailpipes	0.35	1.91	0.35	1.91	0.35	1.40	6.14	1.83	8.04	0.0024	0.0106	2.05
E_WRSF	Mobile Tailpipes	0.14	0.78	0.14	0.78	0.14	0.57	2.51	0.75	3.28	0.001	0.004	0.84
G_STOCK	Mobile Tailpipes	0.16	0.88	0.16	0.88	0.16	0.65	2.84	0.85	3.72	0.0011	0.0049	0.95
CTFS	Mobile Tailpipes	0.69	3.81	0.69	3.81	0.69	2.80	12.27	3.66	16.05	0.00	0.02	4.10
HR	Mobile Tailpipes	5.76	31.58	5.76	30.86	5.63	16.28	71.30	47.25	206.96	0.058	0.252	18.45
PROC	Mobile Tailpipes	0.39	2.12	0.39	2.04	0.37	1.68	7.34	1.12	4.90	0.00	0.01	1.90

[1] *NO2 / NOX In-Stack Ratio (ISR):* 11% *(CAPCOA 2011)*

		TYPE	UTM_E	UTM_N	ELEV_M	RELHT_M	SIG_Y_M	SIG_Z_M
	Location of	Source	UTM NAD 83		Elev.	Rel. Ht.	S-y	S-z
Model ID	Activity	Type	E m	N m	m	m	m	m
CTFS	Clay Tailings Filter Stack	VOLUME	415,659	4,617,957	1,471	3.49	355	3.24
PROC	Process Plant	VOLUME	414,342	4,617,062	1,440	1.79	166	1.67

Vehicle height (VH):
CAT D10 Dozer 4.10 m *(Caterpillar 2016)*

Plume Parameter	Calculation	Const.	Value (m)
Plume top (PT)	1.7 x VH	1.7	6.97
Release height	0.5 x PT	0.5	3.49
Sigma-z	PT / 2.15	2.15	3.24

(EPA 2012)

Vehicle height (VH):
CAT 246D Skid Stee 2.11 m *(Caterpillar 2016)*

Plume Parameter	Calculation	Const.	Value (m)
Plume top (PT)	1.7 x VH	1.7	3.59
Release height	0.5 x PT	0.5	1.79
Sigma-z	PT / 2.15	2.15	1.67

(EPA 2012)

S-y = length of side / 4.3 *(EPA 2004b)*

Location of Activity	Area[1] m^2	Length of side m	S-y
Clay Tailings Filter Stack	2,333,086	1,527	355
Process Plant	511,599	715	166

[1] *(LNC 2019)*

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Project Phase Phase 1

Dozing and Grading

Activity Information

Operating schedule	365	day/yr	
Average Grader Speed	11.8	mile/hr	*(LNC 2019a)*

Dozer and Grader Fleet

Equipment	Activity	
Dozer	26,280	hr/yr
Grader	8,760	hr/yr
	103,368	VMT/yr

Dozing Emission Factors

Emission Factor Equation	TSP (lb/hr) = 5.7 $(s)^{1.2}/(M)^{1.3}$	*AP-42, Tab. 11.9-1, 07/98, (bulldozing, overburden)*
	PM15 (lb/hr) = 1.0 $(s)^{1.5}/(M)^{1.4}$	*AP-42, Tab. 11.9-1, 07/98, (bulldozing, overburden)*
s = Surface material silt content	1.7 %	*(EPA 2003)*
M = Material moisture content	7.9 %	*AP-42, Table 11.9-3, 07/98, (bulldozers, overburden)*
TSP(PM)	0.734 lb/hr	
PM15	0.123 lb/hr	

Dozing PM Scaling Factors

PM10	0.75	*AP-42, Tab. 11.9-1, 07/98, (applies to PM15 EF, footnote d)*
PM2.5	0.105	*AP-42, Tab. 11.9-1, 07/98, (applies to TSP EF, footnote e)*

Grading Emission Factors

Emission Factor Equation	TSP (lb/VMT) = 0.04 $(S)^{2.5}$	*AP-42, Tab. 11.9-1, 07/98, (grading)*
	PM15 (lb/VMT) = 0.051 $(S)^{2}$	*AP-42, Tab. 11.9-1, 07/98, (grading)*
S - Grader average speed	11.8 mile/hr	
TSP(PM)	19.132 lb/VMT	
PM15	7.101 lb/VMT	

Grading PM Scaling Factors

PM10	0.6	*AP-42, Tab. 11.9-1, 07/98, (applies to PM15 EF, footnote d)*
PM2.5	0.031	*AP-42, Tab. 11.9-1, 07/98, (applies to TSP EF, footnote e)*

Emission Controls

Unpaved roads - periodic application of water and chemical dust suppressant

Control efficiency: 90% *(Air Sciences 2018)*

Emissions by Area

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
		PM	PM10		PM2.5	
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
MINE	Dozing	9.64	6.63	1.21	5.55	1.01
HR	Grading	98.88	120.66	22.02	16.80	3.07

Conversions

2,000 lb/ton

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Dozing and Grading - continued

Emissions by Model ID

		chk PM_TPY	chk PM10_PPD	chk PM10_TPY	chk PM2.5_PPD	chk PM2.5_TPY
		PM	PM10		PM2.5	
Model ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
PIT	Dozing	3.56	2.45	0.45	2.05	0.37
O_STOCK	Dozing	1.20	0.82	0.15	0.69	0.13
W_WRSF	Dozing	1.26	0.87	0.16	0.73	0.13
E_WRSF	Dozing	0.52	0.35	0.06	0.30	0.05
G_STOCK	Dozing	0.58	0.40	0.07	0.34	0.06
CTFS	Dozing	2.52	1.73	0.32	1.45	0.26
HR	Grading	98.88	120.66	22.02	16.80	3.07

Project Phase Phase 1

Water Truck Travel

Activity Information

Operating schedule 365 day/yr

Average truck speed 12 mph *(LNC 2019a)*

Truck Fleet

Water Truck	Payload Capacity ton	Empty Weight ton	Gross Weight ton	Oper. hr/yr	Average Weight ton	
CAT 777G	83.4	105	188	8,760	147	*(LNC 2019a)*

Total vehicle miles traveled (VMT) 105,120 VMT/yr

Emission Factors

Emission factor equation	$E = k(s/12)^a (W/3)^b [(365-P)/365]$				*AP-42, Sec. 13.2.2, Eq. 1a, 11/06*
s = Surface material silt content	1.7 %				*(EPA 2003)*
W = Mean vehicle weight	147 ton				
P = Days/year with ≥0.01 in precip.	70 day/yr				*AP-42 Fig. 13.2.2-1, 11/06*
	PM	PM10	PM2.5		
k = Size-specific empirical constant	4.9	1.5	0.15		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
a = Size-specific empirical constant	0.7	0.9	0.9		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
b = Size-specific empirical constant	0.45	0.45	0.45		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
E = Size-specific emission factor	5.80	1.20	0.12	lb/VMT	

Emission Controls

Periodic application of water and chemical dust suppressant

Control efficiency: 90% *(Air Sciences 2018)*

Emissions by Area

		PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
		PM	PM10		PM2.5	
Area ID	Activity	ton/yr	lb/day	ton/yr	lb/day	ton/yr
HR	Water Truck Travel	30.50	34.61	6.32	3.46	0.63

Conversions

2,000 lb/ton

8.34 lb H_2O/gal

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Project Phase Phase 1

Wind Erosion

Activity Information

Operating schedule 365 day/yr

Erodible Area

Model ID	Location of Activity		Surface Type	Total Rate ton/yr	Erodible Area (acre/yr)[(1),(2)] Flat	Pile
O_STOCK	Ore Stockpile		Pile	3,100,000		368
W_WRSF	West WRSF		Pile	3,266,000		388
E_WRSF	East WRSF		Pile	1,334,000		158
G_STOCK	Gangue Stockpile	Gangue_tpy	Pile	1,511,538		179
CTFS	Clay Tailings Filter Stack	Clay_tpy	Pile	6,522,696		774
HR	Haul Roads		Flat		91	

(1) *Based on total haul road length of* 15,137 *m* *and width of* 24.4 *m*

(2) *Pile surface area calculations:*

Truck dump (TD) size	157.0	ton	
Material density	132.2	lb/ft^3	*AP-42, Table 11.9-6, average of overburden density, 10/98*
	0.066	ton/ft^3	
Material specific volume	15.1	ft^3/ton	
TD volume (V)	2,376	ft^3	
Conical surface calculations			
Side slope	38	deg	*Typical value*
	0.7	rad	

Conical surface area (SA) Π × r × (h^2 + r^2)^0.5

Conical volume (V) (Π × h × r^2) ÷ 3

Conical base radius r = s × cos(slope)

Conical height h = s × sin(slope)

Sloped side length s = (h^2 + r^2)^0.5

Solution of conical volume equation

Replacing h and r with s × sin(slope) and s × cos(slope), respectively:

s = [3 × V/(pi × sin(slope) × cos^2(slope)]^(1/3)	18.1	ft
r	14.3	ft
h	11.1	ft
SA	811	ft^2
	0.019	acre
	1.2E-4	acre/ton-TD

Scaling Factors

PM10	0.5	*AP-42, Pg. 13.2.5-3, 11/06*
PM2.5	0.075	*AP-42, Pg. 13.2.5-3, 11/06*

Conversions

4,046.86 m^2/acre

43,560 ft^2/acre

1,609.34 m/mi

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Project Phase Phase 1

Wind Erosion - continued ***Wind erosion calculations based on 4/18/2012 through 4/17/2013 Thacker Pass on-site meteorological data. (Air Sciences 2019)***

chk

Wind erosion subtotals by surface type

	PM	PM10	PM2.5
	lb	lb	lb
Pile Subtotal	10.388	5.194	0.779
Flat Surface Subtotal (1)	0.000	0.000	0.000

(1) *The threshold wind speed to disturb flat surfaces of 16.04 m/s was never exceeded.*

Final Emission Factors (lb/acre-yr)

Surface Type	PM	PM10	PM2.5
Pile	10.39	5.19	0.78
Flat	--	--	--

Emissions by Model ID

				PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY
	Location of	Control(1)		PM	PM10		PM2.5	
Model ID	Activity		Type	ton/yr	lb/day	ton/yr	lb/day	ton/yr
O_STOCK	Ore Stockpile	--	Pile	1.91	5.23	0.96	0.785	0.143
W_WRSF	West WRSF	--	Pile	2.01	5.51	1.01	0.827	0.151
E_WRSF	East WRSF	--	Pile	0.82	2.25	0.41	0.338	0.062
G_STOCK	Gangue Stockpile	--	Pile	0.93	2.55	0.47	0.383	0.070
CTFS	Clay Tailings Filter Stacl	--	Pile	4.02	11.01	2.01	1.652	0.302
HR	Haul Roads	90%	Flat	0	0	0	0	0
Total	Wind Erosion			9.70	26.57	4.85	3.99	0.73

Conversions

2,000 lb/ton

Project Phase Phase 1

Wind Erosion - continued

Dump Surface Wind Erosion Event Emission Calculations - Notes

(1) u10 = wind speed at 10 meters reference height, m/s

(2) u10+ = fastest-mile wind speed, m/s

Based on hourly to fastest-mile wind speed conversion factor of 1.2 *(EPA 1994)*

(3) Pile: u* = friction velocity, m/s = (us/ur) × 0.1 × u10+ *AP-42, Sec. 13.2.5, Eqs. 6 & 7, 11/06*

Area ID	A	B	C	
(us/ur)	0.9	0.6	0.2	*AP-42, Page 13.2.5-10, 11/06*

Flat surface:

u* = friction velocity, m/s = 0.053 × u10+ *AP-42, Sec. 13.2.5, Eq. 4, 11/06*

(4) Hours elapsed since previous wind erosion event

(5) Erodible surface area = hours elapsed since previous erosion event × hourly erodible surface area (acre) × surface regime area fraction Surface regime area fractions:

Area ID	A	B	C	
% Surface	0.12	0.48	0.4	*AP-42, Page 13.2.5-10, 11/06*

(6) Erosion potential, g/m^2, = P = 58(u* - ut*)^2 + 25(u* - ut*); P = 0 for u* ≤ ut*

where, ut* = threshold friction velocity = 1.02 m/s *AP-42, Page 13.2.5-5 (overburden), 11/06*

P converted to lb/acre by multiplying with: 0.0022046 lb/g and 4,046.86 m^2/acre

Solving u* = (us/ur) × 0.1 × u10+ for u10, when u* = ut* = 1.02 m/s and u10+ = u* × 1.2

yields the following minimum wind speeds to disturb the each stockpile surface regime:

ID-A	9.44 m/s
ID-B	14.17 m/s
ID-C	42.50 m/s

The threshold wind speed to disturb flat surfaces is 1.02/0.053/1.2

Flat surface 16.04 m/s

The maximum hourly wind speed in the onsite data is 15.1 m/s, which is less than the threshold wind speeds to cause a disturbance of stockpile regime ID-C and flat surfaces.

(7) PM emissions, lb = P (lb/acre) × erodible surface area (acre)

(8) Total PM emissions, lb = PM (ID-A), lb + PM (ID-B), lb + PM(ID-C), lb

(9) Total PM10 emissions, lb = total PM emissions, lb × PM10 scaling factors of 0.5 *AP-42, Page 13.2.5-3, 11/06*

(10) Total PM2.5 emissions, lb = total PM emissions, lb × PM2.5 scaling factors of 0.075 *AP-42, Page 13.2.5-3, 11/06*

Phase 1 HAP, GHG, & Other Pollutant Emissions

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Hazardous Air Pollutants and Greenhouse Gas Emissions - Stationary Sources **Project Phase** Phase 1

HAP Emissions Summary - Stationary Sources

Pollutant/Group		Emissions ton/yr
1,1,1-Trichloroethane		7.46E-07
1,1,2,2-Tetrachloroethane		5.09E-06
1,1,2-Trichloroethane		4.04E-06
1,3-Butadiene		3.90E-05
1,3-Dichloropropene		3.36E-06
2-Methylnaphthalene	POM	4.22E-06
2,2,4-Trimethylpentane		3.18E-05
Acenaphthene	POM	3.44E-07
Acenaphthylene	POM	1.36E-06
Acetaldehyde		1.16E-03
Acrolein		6.66E-04
Anthracene	POM	2.47E-07
Benz(a)anthracene	POM	2.19E-07
Benzene		1.78E-04
Benzo(a)pyrene	POM	2.45E-08
Benzo(e)pyrene		5.28E-08
Benzo(b)fluoranthene	POM	3.40E-08
Benzo(g,h,i)perylene	POM	1.23E-07
Benzo(k)fluoranthene	POM	2.02E-08
Biphenyl		2.70E-05
Carbon Tetrachloride		4.67E-06
Chlorine		**2.85E-01**
Chlorobenzene		3.87E-06
Chloroform		3.62E-06
Chrysene	POM	1.34E-07
Dibenz(a,h)anthracene	POM	7.62E-08
Ethylbenzene		5.25E-06
Ethylene Dibromide		5.63E-06
Fluoranthene	POM	1.13E-06
Fluorene	POM	4.52E-06
Formaldehyde		6.97E-03
Hexane		1.41E-04
Indeno(1,2,3-cd)pyrene	POM	4.88E-08
Methanol		3.18E-04
Methylene Chloride		2.54E-06
Naphthalene	POM	2.41E-05
OCDD		9.79E-12
o-Xylene		3.44E-07
PAH		3.42E-06
Phenanthrene	POM	5.18E-06
Phenol		3.05E-06
Pyrene	POM	7.95E-07
Styrene		3.00E-06
Tetrachloroethane		3.15E-07
Toluene		1.25E-04
Vinyl Chloride		1.90E-06
Xylenes		6.05E-05

Pollutant/Group	Emissions ton/yr
Antimony	3.27E-03
Arsenic	3.13E-02
Beryllium	1.40E-03
Cadmium	1.57E-04
Chromium	2.35E-03
Cobalt	1.82E-03
Lead	3.41E-03
Manganese	1.73E-01
Mercury	6.77E-05
Nickel	3.79E-03
Phosphorus	5.85E-02
Selenium	7.00E-04
POM Subtotal	*4.26E-05*
Highest Single HAP: Chlorine	0.28
Total HAP	0.57

Chlorine 22 #N/A chk

GHG Emissions Summary - Stationary Sources

Source Category	CO2e *(ton/yr)*
Diesel Combustion	3,713
Natural Gas/Propane Combustion	17
Lithium Processing Sources	17,612
Total GHGs	**21,342**

chk

Conversions

2,000	lb/ton	1.341	hp/kW
907.184	kg/ton	1,000,000	Btu/MMBtu
		1,000	gal/10^3 gal

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Hazardous Air Pollutants and Greenhouse Gas Emissions - Mobile Sources **Project Phase** Phase 1

HAP Emissions Summary - Mobile Sources

Pollutant/Group		Emissions ton/yr
1,1,1-Trichloroethane		0.00E+00
1,1,2,2-Tetrachloroethane		0.00E+00
1,1,2-Trichloroethane		0.00E+00
1,3-Butadiene		4.27E-03
1,3-Dichloropropene		0.00E+00
2-Methylnaphthalene	POM	0.00E+00
2,2,4-Trimethylpentane		0.00E+00
Acenaphthene	POM	1.33E-03
Acenaphthylene	POM	2.86E-03
Acetaldehyde		9.01E-02
Acrolein		1.21E-02
Anthracene	POM	5.12E-04
Benz(a)anthracene	POM	3.39E-04
Benzene		2.96E-01
Benzo(a)pyrene	POM	8.48E-05
Benzo(e)pyrene		0.00E+00
Benzo(b)fluoranthene	POM	2.88E-04
Benzo(g,h,i)perylene	POM	1.92E-04
Benzo(k)fluoranthene	POM	7.15E-05
Biphenyl		0.00E+00
Carbon Tetrachloride		0.00E+00
Chlorine		0.00E+00
Chlorobenzene		0.00E+00
Chloroform		0.00E+00
Chrysene	POM	4.21E-04
Dibenz(a,h)anthracene	POM	1.50E-04
Ethylbenzene		0.00E+00
Ethylene Dibromide		0.00E+00
Fluoranthene	POM	1.84E-03
Fluorene	POM	6.39E-03
Formaldehyde		1.49E-01
Hexane		0.00E+00
Indeno(1,2,3-cd)pyrene	POM	1.45E-04
Methanol		0.00E+00
Methylene Chloride		0.00E+00
Naphthalene	POM	4.18E-02
OCDD		0.00E+00
o-Xylene		0.00E+00
PAH		0.00E+00
Phenanthrene	POM	1.34E-02
Phenol		0.00E+00
Pyrene	POM	1.45E-03
Styrene		0.00E+00
Tetrachloroethane		0.00E+00
Toluene		1.15E-01
Vinyl Chloride		0.00E+00
Xylenes		7.94E-02

Pollutant/Group	Emissions ton/yr
Antimony	0.00E+00
Arsenic	0.00E+00
Beryllium	0.00E+00
Cadmium	0.00E+00
Chromium	0.00E+00
Cobalt	0.00E+00
Lead	0.00E+00
Manganese	0.00E+00
Mercury	0.00E+00
Nickel	0.00E+00
Phosphorus	0.00E+00
Selenium	0.00E+00
POM Subtotal	*7.13E-02*
Total HAP	0.82

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GHG Emissions Summary - Mobile Sources

Source Category	CO2e *(ton/yr)*
Gasoline & Diesel Mobile Machinery	58,656
Total GHGs	**58,656**

chk

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AIR EMISSION CALCULATIONS	SUBJECT: HAP and GHG Emissions	DATE: December 13, 2019

Hazardous Air Pollutants and Greenhouse Gas Emissions - Summary **Project Phase** Phase 1

Stationary Sources

Phase	Description		HAP ton/yr	CO2e ton/yr
Phase 1	Package Boiler 1	SAP	5.3E-04	1,588
Phase 2	Package Boiler 2	SAP	0.0E+00	0
Phase 1	Start-Up Burner 1	SAP	7.0E-04	2,104
Phase 2	Start-Up Burner 2	SAP	0.0E+00	0
Phase 1	Fire Pump 1 (Mine)		2.5E-04	11
Phase 1	Fire Pump 2 (Process)		2.5E-04	11
Phase 2	Fire Pump 3 (Process)		0.0E+00	0
Phase 1	Emergency Generator 1 (Mine)		4.6E-03	9
Phase 1	Emergency Generator 2 (Mine)		4.6E-03	9
Phase 1	Tail Gas Scrubber (Sulfuric Acid Plant	SAP	N/A	579
Phase 1	Carbonate Destruction	SAP	N/A	11,138
Phase 1	Neutralization		N/A	2,735
Phase 1	Lithium Sulfide Production		N/A	3,160
Phase 1	Sodium Hypochlorite Tank 1		0.28	N/A
Phase 2	Sodium Hypochlorite Tank 2		0.00	N/A
Total			0.30	21,342
			chk	chk

Fugitive Sources

Phase	Description	HAP ton/yr	CO2e ton/yr
Phase 1	Fugitive Dust Sources - HAP Emissions	0.28	N/A
Total		0.28	N/A

Mobile Sources

Description	HAP ton/yr	CO2e ton/yr	
Total Mobile Gasoline Engines	0.07	2,723	Gasoline
Total Mobile Diesel Engines	0.75	55,933	Diesel
Total	0.82	58,656	
	chk	chk	

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Stationary Source - Diesel External Combustion **Project Phase** Phase 1

Thru_unit

Source Data hr/yr Thru_hr

		Operation	Fuel Consumption		HAP	CO2e
Phase	**Description**	hr/yr	MMBtu/hr	MMBtu/yr	ton/yr	ton/yr
Phase 1	Package Boiler 1	288	67.4	19,411	5.31E-04	1,588
Phase 2	Package Boiler 2	0	0.0	0	0.00E+00	0
Phase 1	Start-Up Burner 1	288	89.3	25,718	7.04E-04	2,104
Phase 2	Start-Up Burner 2	0	0.0	0	0.00E+00	0
Total			157	45,130		
					chk	chk

Diesel HAP Emission Factors and Emissions

Pollutant	**POM**	**Emission Factor***		**Emissions**	
		$lb/10^3$ gal	lb/MMBtu**	lb/hr	ton/yr
Benzene		2.14E-04	3.00E-08	4.69E-06	6.76E-07
Ethylbenzene		6.36E-05	8.90E-09	1.40E-06	2.01E-07
Formaldehyde		3.30E-02	4.62E-06	7.24E-04	1.04E-04
Naphthalene	POM	1.13E-03	1.58E-07	2.48E-05	3.57E-06
1,1,1-Trichloroethane		2.36E-04	3.30E-08	5.18E-06	7.46E-07
Toluene		6.20E-03	8.68E-07	1.36E-04	1.96E-05
o-Xylene		1.09E-04	1.53E-08	2.39E-06	3.44E-07
Anthracene	POM	1.22E-06	1.71E-10	2.68E-08	3.85E-09
Benzo(g,h,i)perylene	POM	2.26E-06	3.16E-10	4.96E-08	7.14E-09
Phenanthrene	POM	1.05E-05	1.47E-09	2.30E-07	3.32E-08
OCDD		3.10E-09	4.34E-13	6.80E-11	9.79E-12
Antimony			0.00E+00	0.00E+00	0.00E+00
Arsenic			4.00E-06	6.27E-04	9.03E-05
Beryllium			3.00E-06	4.70E-04	6.77E-05
Cadmium			3.00E-06	4.70E-04	6.77E-05
Chromium			3.00E-06	4.70E-04	6.77E-05
Cobalt			0.00E+00	0.00E+00	0.00E+00
Lead			9.00E-06	1.41E-03	2.03E-04
Manganese			6.00E-06	9.40E-04	1.35E-04
Mercury			3.00E-06	4.70E-04	6.77E-05
Nickel			3.00E-06	4.70E-04	6.77E-05
Phosphorus			0.00E+00	0.00E+00	0.00E+00
Selenium			1.50E-05	2.35E-03	3.38E-04
POM Subtotal				*2.51E-05*	*3.61E-06*
Total HAP				8.58E-03	1.24E-03

* *AP-42, Table 1.3-9, (5/10), Fuel Oil Combustion*

** *Heat Content of* 0.14 MMBtu/gal diesel

Diesel GHG Emission Factors:

73.96	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
3.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
6.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Diesel GHG Emissions

Greenhouse Gas	**Emissions** ton/yr	**Global Warming Potential***	**CO2e** ton/yr
CO2	3,679	1	3,679
CH4	0.15	25	3.73
N2O	0.03	298	8.89
Total GHG			3,692

* *40 CFR 98, Table A-1*

Stationary Source - Diesel Engines **Project Phase** Phase 1

Thru_unit

Source Data Thru_hr hr/yr

		Power Rating		Operation	Output	Fuel Consumption*		HAP	CO2e
Phase	**Description**	kW	hp	hr/yr	hp-hr/yr	MMBtu/hr	MMBtu/yr	ton/yr	ton/yr
Phase 1	Fire Pump 1 (Mine)	130	175	100	17,500	1.3	130	2.5E-04	10.7
Phase 1	Fire Pump 2 (Process)	130	175	100	17,500	1.3	130	2.5E-04	10.7
Phase 2	Fire Pump 3 (Process)	130	175	0	0	0.0	0	0.0E+00	0.0
Total Small Diesel Engines (<=600 hp)					35,000	2.6	260		
Total Large Diesel Engines (>600 hp)					0	0.0	0		

** Estimated brake specific fuel consumption for Clarke diesel fire pumps* 7,440 *Btu/hp-hr* *(Clarke 2019)* chk chk

Diesel HAP Emission Factors and Emissions

Pollutant	**POM**	**Emission Factor***		**Emissions**	
		Small Diesel Engines <=600 hp	Large Diesel Engines >600 hp		
		lb/MMBtu	lb/MMBtu	lb/hr	ton/yr
Benzene		9.33E-04	7.76E-04	2.43E-03	1.21E-04
Toluene		4.09E-04	2.81E-4	1.07E-03	5.33E-05
Xylenes		2.85E-04	1.93E-4	7.42E-04	3.71E-05
1,3-Butadiene		3.91E-05	0.00E+0	1.02E-04	5.09E-06
Formaldehyde		1.18E-03	7.89E-5	3.07E-03	1.54E-04
Acetaldehyde		7.67E-04	2.52E-5	2.00E-03	9.99E-05
Acrolein		9.25E-05	7.88E-6	2.41E-04	1.20E-05
Naphthalene	POM	8.48E-05	1.30E-4	2.21E-04	1.10E-05
Acenaphthylene	POM	5.06E-06	9.23E-6	1.32E-05	6.59E-07
Acenaphthene	POM	1.42E-06	4.68E-6	3.70E-06	1.85E-07
Fluorene	POM	2.92E-05	1.28E-5	7.60E-05	3.80E-06
Phenanthrene	POM	2.94E-05	4.08E-05	7.66E-05	3.83E-06
Anthracene	POM	1.87E-06	1.23E-06	4.87E-06	2.43E-07
Fluoranthene	POM	7.61E-06	4.03E-06	1.98E-05	9.91E-07
Pyrene	POM	4.78E-06	3.71E-06	1.24E-05	6.22E-07
Benz(a)anthracene	POM	1.68E-06	6.22E-07	4.37E-06	2.19E-07
Chrysene	POM	3.53E-07	1.53E-06	9.19E-07	4.60E-08
Benzo(b)fluoranthene	POM	9.91E-08	1.11E-06	2.58E-07	1.29E-08
Benzo(k)fluoranthene	POM	1.55E-07	2.18E-07	4.04E-07	2.02E-08
Benzo(a)pyrene	POM	1.88E-07	2.57E-07	4.90E-07	2.45E-08
Indeno(1,2,3-cd)pyrene	POM	3.75E-07	4.14E-07	9.77E-07	4.88E-08
Dibenz(a,h)anthracene	POM	5.85E-07	3.46E-07	1.52E-06	7.62E-08
Benzo(g,h,i)perylene	POM	4.89E-07	5.56E-07	1.27E-06	6.37E-08
POM Subtotal				*4.38E-04*	*2.19E-05*
Total HAP				1.01E-02	5.04E-04

** AP-42, Table 3.3-2, (10/96), Diesel Industrial Engines; Tables 3.4-3 & 3.4-4, (10/96), Large Stationary Diesel Engines*

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Stationary Source - Diesel Engines - Continued **Project Phase** Phase 1

Diesel GHG Emission Factors:	73.96	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Diesel Combustion 260 *MMBtu/yr*

Diesel GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	21.2	1	21.2
CH4	8.6E-04	25	2.2E-02
N2O	1.7E-04	298	5.1E-02
Total GHG			21.3

** 40 CFR 98, Table A-1*

Mobile Source - Diesel & Gasoline Engines **Project Phase** Phase 1

Source Data

Description	Fuel	Output hp-hr/yr	Fuel Consumptior MMBtu/yr*	HAP ton/yr	CO2e ton/yr
Total Mobile Gasoline Engines	Gasoline	5,008,202	35,057	6.8E-02	2,723
Total Mobile Small Diesel Engines (<=600 hp)	Diesel	26,216,947	183,519	3.6E-01	15,013
Total Mobile Large Diesel Engines (>600 hp)	Diesel	71,457,291	500,201	3.9E-01	40,920

** Based on brake specific fuel consumption of* 7,000 *Btu/hp-hr* *AP-42, Table 3.3-1* chk-15 chk

Diesel and Gasoline HAP Emission Factors and Emissions

Pollutant	POM	Emission Factor* Gasoline Engines & Small Diesel Engines <=600 hp lb/MMBtu	Emission Factor* Large Diesel Engines >600 hp lb/MMBtu	Emissions ton/yr
Benzene		9.33E-04	7.76E-04	2.96E-01
Toluene		4.09E-04	2.81E-4	1.15E-01
Xylenes		2.85E-04	1.93E-4	7.94E-02
1,3-Butadiene		3.91E-05	0.00E+0	4.27E-03
Formaldehyde		1.18E-03	7.89E-5	1.49E-01
Acetaldehyde		7.67E-04	2.52E-5	9.01E-02
Acrolein		9.25E-05	7.88E-6	1.21E-02
Naphthalene	POM	8.48E-05	1.30E-4	4.18E-02
Acenaphthylene	POM	5.06E-06	9.23E-6	2.86E-03
Acenaphthene	POM	1.42E-06	4.68E-6	1.33E-03
Fluorene	POM	2.92E-05	1.28E-5	6.39E-03
Phenanthrene	POM	2.94E-05	4.08E-05	1.34E-02
Anthracene	POM	1.87E-06	1.23E-06	5.12E-04
Fluoranthene	POM	7.61E-06	4.03E-06	1.84E-03
Pyrene	POM	4.78E-06	3.71E-06	1.45E-03
Benz(a)anthracene	POM	1.68E-06	6.22E-07	3.39E-04
Chrysene	POM	3.53E-07	1.53E-06	4.21E-04
Benzo(b)fluoranthene	POM	9.91E-08	1.11E-06	2.88E-04
Benzo(k)fluoranthene	POM	1.55E-07	2.18E-07	7.15E-05
Benzo(a)pyrene	POM	1.88E-07	2.57E-07	8.48E-05
Indeno(1,2,3-cd)pyrene	POM	3.75E-07	4.14E-07	1.45E-04
Dibenz(a,h)anthracene	POM	5.85E-07	3.46E-07	1.50E-04
Benzo(g,h,i)perylene	POM	4.89E-07	5.56E-07	1.92E-04
POM Subtotal				*7.13E-02*
Total HAP				8.17E-01

** AP-42, Table 3.3-2, (10/96), Gasoline and Diesel Industrial Engines; Tables 3.4-3 & 3.4-4, (10/96), Large Stationary Diesel and all Stationary Dual-fuel Engines*

Mobile Source - Diesel & Gasoline Engines - Continued **Project Phase** Phase 1

Diesel GHG Emission Factors:	73.96	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Diesel Combustion 683,720 *MMBtu/yr*

Diesel GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	55,742	1	55,742
CH4	2.3	25	57
N2O	0.5	298	135
Total GHG			55,933

** 40 CFR 98, Table A-1*

Gasoline GHG Emission Factors:	70.22	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) Motor Gasoline*
	3.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum Products*
	6.0E-04	*kg N_2O/MMBtu*	*41 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum Products*

Total Gasoline Combustion 35,057 *MMBtu/yr*

Gasoline GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	2,713.6	1	2,713.6
CH4	0.1	25	2.9
N2O	0.0	298	6.9
Total GHG			2,723.4

** 40 CFR 98, Table A-1*

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Stationary Source - Natural Gas/Propane Engines **Project Phase** Phase 1

Source Data Thru_Mat hr/yr Other

Phase	Description	Fuel	Operation hr/yr	gal/hr	Fuel Consumption MMBtu/hr*	MMBtu/yr	HAP ton/yr	CO2e ton/yr
Phase 1	Emergency Generator 1 (Mine)	Propane	100	13.9	1.3	127	4.6E-03	8.7
Phase 1	Emergency Generator 2 (Mine)	Propane	100	13.9	1.3	127	4.6E-03	8.7
Total					2.5	254	9.2E-03	17.4

* *Heat Content of* 0.0915 MMBtu/gal Propane chk chk

Propane GHG Emission Factors:

61.71	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) LPG*
3.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
6.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Propane Combustion 254 *MMBtu/yr*

Propane GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	17.3	1	17.3
CH4	8.4E-04	25	2.1E-02
N2O	1.7E-04	298	5.0E-02
Total GHG			17.4

* *40 CFR 98, Table A-1 (12/2014)*

Natural Gas GHG Emission Factors:

53.06	*kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) Natural Gas*
1.0E-03	*kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Natural Gas*
1.0E-04	*kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Natural Gas*

Total Natural Gas Combustion 0 *MMBtu/yr*

Natural Gas GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	0.00	1	0.0
CH4	0.0E+00	25	0.0E+00
N2O	0.0E+00	298	0.0E+00
Total GHG			0.0

* *40 CFR 98, Table A-1 (12/2014)*

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Stationary Source - Natural Gas/Propane Engines - Continued **Project Phase** Phase 1

Natural Gas/Propane HAP Emission Factors and Emissions

		Emission Factor*	Emissions	
Pollutant	**POM**	lb/MMBtu**	lb/hr	ton/yr
1,1,2,2-Tetrachloroethane		4.00E-05	1.02E-04	5.09E-06
1,1,2-Trichloroethane		3.18E-05	8.09E-05	4.04E-06
1,3-Butadiene		2.67E-04	6.79E-04	3.40E-05
1,3-Dichloropropene		2.64E-05	6.72E-05	3.36E-06
2-Methylnaphthalene		3.32E-05	8.45E-05	4.22E-06
2,2,4-Trimethylpentane		2.50E-04	6.36E-04	3.18E-05
Acenaphthene	POM	1.25E-06	3.18E-06	1.59E-07
Acenaphthylene	POM	5.53E-06	1.41E-05	7.03E-07
Acetaldehyde		8.36E-03	2.13E-02	1.06E-03
Acrolein		5.14E-03	1.31E-02	6.54E-04
Benzene		4.40E-04	1.12E-03	5.60E-05
Benzo(b)fluoranthene	POM	1.66E-07	4.22E-07	2.11E-08
Benzo(e)pyrene		4.15E-07	1.06E-06	5.28E-08
Benzo(g,h,i)perylene		4.14E-07	1.05E-06	5.27E-08
Biphenyl	POM	2.12E-04	5.39E-04	2.70E-05
Carbon Tetrachloride		3.67E-05	9.34E-05	4.67E-06
Chlorobenzene		3.04E-05	7.73E-05	3.87E-06
Chloroform		2.85E-05	7.25E-05	3.62E-06
Chrysene	POM	6.93E-07	1.76E-06	8.81E-08
Ethylbenzene		3.97E-05	1.01E-04	5.05E-06
Ethylene Dibromide		4.43E-05	1.13E-04	5.63E-06
Fluoranthene	POM	1.11E-06	2.82E-06	1.41E-07
Fluorene	POM	5.67E-06	1.44E-05	7.21E-07
Formaldehyde		5.28E-02	1.34E-01	6.72E-03
Methanol		2.50E-03	6.36E-03	3.18E-04
Methylene Chloride		2.00E-05	5.09E-05	2.54E-06
Hexane		1.11E-03	2.82E-03	1.41E-04
Naphthalene	POM	7.44E-05	1.89E-04	9.46E-06
PAH		2.69E-05	6.84E-05	3.42E-06
Phenanthrene	POM	1.04E-05	2.65E-05	1.32E-06
Phenol		2.40E-05	6.10E-05	3.05E-06
Pyrene	POM	1.36E-06	3.46E-06	1.73E-07
Styrene		2.36E-05	6.00E-05	3.00E-06
Tetrachloroethane		2.48E-06	6.31E-06	3.15E-07
Toluene		4.08E-04	1.04E-03	5.19E-05
Vinyl Chloride		1.49E-05	3.79E-05	1.90E-06
Xylenes		1.84E-04	4.68E-04	2.34E-05
POM Subtotal			*7.95E-04*	*3.98E-05*
Total HAP			1.84E-01	9.18E-03

AP-42, Table 3.2-2 (7/00) Natural Gas-fired 4-Stroke Lean-Burn Engines

**Natural Gas HAPs assumed for propane*

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Fugitive Dust Sources - HAP Emissions **Project Phase** Phase 1

Activity Information

Activity			PM_TPY PM ton/yr	
Open Pit Drilling			3.16	*See Mine Sheet*
Open Pit Blasting			1.49	*See Mine Sheet*
Onsite Hauling			82.93	*See Mine Sheet*
Material Load / Unload			1.13	*See Mine Sheet*
Mobile Equipment (Tailpipes)			N/A	*Combustion HAP. See page 7*
Dozing			9.64	*See Mine Sheet*
Grading			98.88	*See Mine Sheet*
Water Truck Travel			30.50	*See Mine Sheet*
Wind Erosion			9.70	*See Mine Sheet*
Process Sources	Gangue	Ore	24.83	*See Process Sheet for Ore and Gangue Processes*
Ore/Waste Subtotal			262.26	
			chk	

*Ore and Waste Dust HAP Concentrations * and Emissions*

Pollutant	Ore/Waste ppm	Emissions ton/yr
Antimony	12.46	3.27E-03
Arsenic	119.12	3.12E-02
Beryllium	5.10	1.34E-03
Cadmium	0.34	8.97E-05
Chromium	8.72	2.29E-03
Cobalt	6.95	1.82E-03
Lead	12.22	3.20E-03
Manganese	659.99	1.73E-01
Nickel	14.19	3.72E-03
Phosphorus	223.10	5.85E-02
Selenium	1.38	3.62E-04
Total HAP		2.79E-01

** (LNC 2019b)*

Lithium Processing Sources - GHG Emissions **Project Phase** Phase 1

Lithium Processing CO2 Emissions

	CO2 Emissions ton/yr	
Tail Gas Scrubber (Sulfuric Acid Plant)	579	*(LNC 2019a)*
Carbonate Destruction	11,138	*(Schonlau 2019)*
Neutralization	2,735	*(Schonlau 2019)*
Lithium Sulfide Production	3,160	*(Schonlau 2019)*
Total CO2	17,612	

Lithium Processing GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	17,612	1	17,612

** 40 CFR 98, Table A-1 (12/2014)*

Conversions
2,000 lb/ton

Lithium Processing Sources - HAP & Other Regulated Pollutant Emissions **Project Phase** Phase 1

Lithium Processing Sulfuric Acid Mist Emissions hr/yr

Phase	Description		Operation hr/yr	H2SO4 Emissions lb/hr	H2SO4 Emissions ton/yr	
Phase 1	Leach Tanks 1		7,446	0.3	1.12	*(LNC 2019a)*
Phase 1	Leach 1 Filter System		7,446	0.003	0.01	*(LNC 2019a)*
Phase 1	Leach 1 Filter Vent		496	0.067	0.02	*(LNC 2019a)*
Phase 2	Leach Tanks 2		0	0	0.00	*(LNC 2019a)*
Phase 2	Leach 2 Filter System		0	0	0.00	*(LNC 2019a)*
Phase 2	Leach 2 Filter Vent		0	0	0.00	*(LNC 2019a)*
Phase 1	Sulfuric Acid Plant	SAP	8,520	6.0	25.56	*(Rabe 2019)*
Total H2SO4				6.37	26.70	

Sodium Hypochlorite Tank Chlorine Emissions hr/yr

Phase	Description	Operation hr/yr	Cl2 Emissions lb/hr	Cl2 Emissions ton/yr	
Phase 1	Sodium Hypochlorite Tank 1	4,380	0.13	0.28	*(LNC 2019a)*
Phase 2	Sodium Hypochlorite Tank 2	0	0.13	0.00	*(LNC 2019a)*
Total Cl2			0.26	0.28	

Conversions

2,000 lb/ton

Mining Activity by Phase

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Mining Activity by Phase

Operating Schedule

	hr/day	day/yr	hr/yr	
Phase 1	24	365	8,760	*(LNC 2019)*
Phase 2	24	365	8,760	*(LNC 2019)*

Blasting

	hpy	bpy	ft2	AN_tpy	
	Drilling	Blasting		ANFO Use	
	hole/yr	blast/yr	ft2/blast	ton/yr	
Pre-Production*	15,971	11	108,200	894	*(Whitehead 2019a)*
Phase 1	4,858	6	108,200	272	*(Whitehead 2019a), (Whitehead 2019b)*
Phase 2	4,858	6	108,200	272	*(Whitehead 2019a), (Whitehead 2019b)*

**Assumes 1 blast per month*

Production

Material Mined

	Ore_tpy	Waste_tpy		
	Ore	Waste	Total	
	ton/yr	ton/yr	ton/yr	
Phase 1	3,100,000	4,600,000	7,700,000	*(LNC 2019)*
Phase 2	6,200,000	4,800,000	11,000,000	*(LNC 2019)*

Waste Placement

	Capacity		
	MM Yd^3	% of total	
West WRSF	32.7	71%	*(LNC 2019)*
East WRSF	13.2	29%	*(LNC 2019)*

Material Processed

	Gangue_tpy	Clay_tpy	
	Gangue	Clay Tailings	
	ton/yr	ton/yr	
Phase 1	1,511,538	6,522,696	*(LNC 2019a)*
Phase 2	3,023,076	13,045,392	*(LNC 2019a)*

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Mobile Equipment

Non-Road

Mine Equipment	Phase 1	Phase 2	
Hydraulic Excavator	2	3	*(LNC 2019a)*
Surface Miner	1	1	*(LNC 2019a)*
Haul Truck	9	14	*(LNC 2019a)*
Dozer	3	5	*(LNC 2019a)*
Water Truck	1	2	*(LNC 2019a)*
Grader	1	2	*(LNC 2019a)*
Fuel/Lube Truck	1	3	*(LNC 2019a)*
Crane	1	1	*(LNC 2019a)*
Telehandler	1	1	*(LNC 2019a)*
Front End Loader	1	1	*(LNC 2019a)*
Service Truck	2	2	*(LNC 2019a)*
Skid Steer	1	1	*(LNC 2019a)*
Manlift	1	1	*(LNC 2019a)*
Drill Rigs	1	1	*(LNC 2019)*

On-Road

Mine Equipment	Phase 1	Phase 2	
Diesel			
Ford F250 XLT Superduty	4	6	*(LNC 2019a)*
Ford F350 XLT Superduty	1	2	*(LNC 2019a)*
Gasoline			
Ford F150 XLT Supercrew	2	4	*(LNC 2019a)*

Non-Road

Process Plant Equipment	Phase 1	Phase 2	
Forklift	6	8	*(LNC 2019a)*
Carry Deck Crane	1	2	*(LNC 2019a)*
Skid Steer	2	3	*(LNC 2019a)*
Manlift - 340AJ	1	2	*(LNC 2019a)*
Manlift - 740AJ	1	2	*(LNC 2019a)*
Telehandler	1	2	*(LNC 2019a)*
Backhoe	1	1	*(LNC 2019a)*
Mobile Crane	1	1	*(LNC 2019a)*

On-Road Equipment

Process Plant Equipment	Phase 1	Phase 2	
Diesel			
Water Truck (Process)	1	1	*(LNC 2019a)*
Gasoline			
Maintenance Service Truck	2	4	*(LNC 2019a)*
1/2 Ton Pickups	5	7	*(LNC 2019a)*
Ambulance	1	1	*(LNC 2019a)*
Fire Truck	1	1	*(LNC 2019a)*

Storage Tank Emissions

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
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Storage Tanks[1]

			Dimensions		Throughput		VOC Emissions[2]				
					gpy1	gpy2	ppy1		ppy2		
	Type	Capacity	Dia	L or H	Phase 1	Phase 2	Phase 1		Phase 2		
Storage Tank		gal	ft	ft	gal/yr	gal/yr	lb/yr	ton/yr	lb/yr	ton/yr	
Gasoline Tank (Mine)	vert cyl	3,000	8	10	69,000	111,000	879	0.439	1,122	0.561	3760
Gasoline Tank (Process)	vert cyl	1,000	6	6	25,000	44,000	352	0.176	428	0.214	1269
Diesel Tank, Off Road (Mine)	vert cyl	50,000	20	22	4,150,000	6,050,000	40	0.020	45	0.023	51702
Diesel Tank, Highway (Mine)	vert cyl	8,000	10	14	32,000	40,000	1.8	0.001	1.9	0.001	8225
Diesel Tank (Process)	vert cyl	31,500	17	19	63,000	63,000	6.1	0.003	6.1	0.003	32261
Diesel Tank 1 (Acid Plant)	vert cyl	10,700	12	14	321,000	321,000	6.7	0.003	6.7	0.003	11844
Diesel Tank 2 (Acid Plant)	vert cyl	10,700	12	14	0	321,000		0.000	6.7	0.003	11844
Bulk Oil Tank	vert cyl	19,000	14	18	76,000	114,000	4.6	0.002	5.2	0.003	20728
Bulk Coolant Tank	vert cyl	3,000	8	10	15,000	24,000	0.07	0.00004	0.08	0.00004	3760
Bulk Used Oil Tank	vert cyl	3,000	8	10	76,000	114,000	1.8	0.001	2.3	0.001	3760
Bulk Used Coolant Tank	vert cyl	3,000	8	10	15,000	24,000	0.07	0.00004	0.08	0.00004	3760

(1) *(LNC 2019a)*

(2) *EPA Tanks 4.0.9d (EPA 2005)*

Additional Vertical Tank Parameters

Storage Tank	Roof Type	Max Liq. Height *(ft)*	Avg Liq. Height *(ft)*	Roof ht *(ft)*	Roof Radius *(ft)*
Gasoline Tank (Mine)	Dome	8.5	4.25	0.25	8
Gasoline Tank (Process)	Dome	5	2.5	0.19	6
Diesel Tank, Off Road (Mine)	Dome	21.5	10.75	0.63	20
Diesel Tank, Highway (Mine)	Dome	13.75	6.875	0.31	10
Diesel Tank (Process)	Dome	18.75	9.375	0.53	17
Diesel Tank 1 (Acid Plant)	Dome	13	6.5	0.38	12
Diesel Tank 2 (Acid Plant)	Dome	13.5	6.75	0.38	12
Bulk Oil Tank	Dome	17	8.5	0.44	14
Bulk Coolant Tank	Dome	8.5	4.25	0.25	8
Bulk Used Oil Tank	Dome	8.5	4.25	0.25	8
Bulk Used Coolant Tank	Dome	8.5	4.25	0.25	8

Ethylene Glycol TANKS Chemical Parameters

Vapor Pressure of Ethylene Glycol ($C_2H_6O_2$)[1]

C	mmHg	F	psia	psia[2]
53	1	127.4	0.019	0.019
79.7	5	175.46	0.097	0.098
92.1	10	197.78	0.193	0.192
105.8	20	222.44	0.387	0.386
120	40	248	0.773	0.755
129.5	60	265.1	1.160	1.152
141.8	100	287.24	1.934	1.937
158.5	200	317.3	3.867	3.742
178.5	400	353.3	7.735	7.730

(1) *(Perry's 1997) p. 2-68*

(2) *psia = y = 10^-(3167.6/(x+280) - 7.7968)*

Ethylene Glycol Pressures for TANKD 4.0.9d

F	C	psia[2]
40	4.4	0.0005
50	10.0	0.0007
60	15.6	0.0012
70	21.1	0.0019
80	26.7	0.0029
90	32.2	0.0045
100	37.8	0.0067

$C_2H_6O_2$ Conc.	100%	wt.
Density	1.1132	g/cc
	9.2901	lb/gal
$C_2H_6O_2$ MW	62.068	g/mol
H2O MW	18.01528	g/mol
$C_2H_6O_2$ Sol'n MW	62.068	g/mol

Conversions

2,000 lb/ton

7.481 gal/ft3

Roof Height (cone or dome)

roof slope 0.0625 default value for vertical fixed roof *(EPA 1999)*

radius shell diameter, default

dome ht. = 1/2D*roof slope

Gasoline Tank (Mine), Phase 1 878.6 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Gasoline 3k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	3,000 gal vertical gasoline tank, Phase 1

Tank Dimensions

Shell Height (ft):	10.00
Diameter (ft):	8.00
Liquid Height (ft) :	8.50
Avg. Liquid Height (ft):	4.25
Volume (gallons):	3,000.00
Turnovers:	23.00
Net Throughput(gal/yr):	69,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.25
Radius (ft) (Dome Roof)	8.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Gasoline 3k P1 - Vertical Fixed Roof Tank

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Gasoline (RVP 9)	All	51.10	43.23	58.97	49.10	3.8582	3.2784	4.5181	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Gasoline 3k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	424.68	453.93	878.60

Gasoline Tank (Mine), Phase 2 1,121.72 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Gasoline 3k P2
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	3,000 gal vertical gasoline tank, Phase 2

Tank Dimensions

Shell Height (ft):	10.00
Diameter (ft):	8.00
Liquid Height (ft) :	8.50
Avg. Liquid Height (ft):	4.25
Volume (gallons):	3,000.00
Turnovers:	37.00
Net Throughput(gal/yr):	111,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.25
Radius (ft) (Dome Roof)	8.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Gasoline 3k P2 - Vertical Fixed Roof Tank

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Gasoline (RVP 9)	All	51.10	43.23	58.97	49.10	3.8582	3.2784	4.5181	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Gasoline 3k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	667.79	453.93	1,121.72

Gasoline Tank (Process), Phase 1 352.1 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Gasoline 1k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	1,000 gal vertical gasoline tank, Phase 1

Tank Dimensions

Shell Height (ft):		6.00
Diameter (ft):		6.00
Liquid Height (ft) :		5.00
Avg. Liquid Height (ft):		2.50
Volume (gallons):		1,000.00
Turnovers:		25.00
Net Throughput(gal/yr):		25,000.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome	
Height (ft)		0.19
Radius (ft) (Dome Roof)		6.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Gasoline 1k P1 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 9)	All	51.10	43.23	58.97	49.10	3.8582	3.2784	4.5181	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Gasoline 1k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	153.87	198.23	352.10

Gasoline Tank (Process), Phase 2 428 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Gasoline 1k P2
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	1,000 gal vertical gasoline tank, Phase 2

Tank Dimensions

Shell Height (ft):	6.00
Diameter (ft):	6.00
Liquid Height (ft) :	5.00
Avg. Liquid Height (ft):	2.50
Volume (gallons):	1,000.00
Turnovers:	44.00
Net Throughput(gal/yr):	44,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.19
Radius (ft) (Dome Roof)	6.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Gasoline 1k P2 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 9)	All	51.10	43.23	58.97	49.10	3.8582	3.2784	4.5181	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Gasoline 1k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	229.78	198.23	428.00

Diesel Tank, Off Road (Mine), Phase 1 40.46 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Diesel 50k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	50,000 gal vertical diesel tank, Phase 1

Tank Dimensions

Shell Height (ft):	22.00
Diameter (ft):	20.00
Liquid Height (ft) :	21.50
Avg. Liquid Height (ft):	10.75
Volume (gallons):	50,000.00
Turnovers:	83.00
Net Throughput(gal/yr):	4,150,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.63
Radius (ft) (Dome Roof)	20.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Diesel 50k P1 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Diesel 50k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	32.01	8.45	40.46

Diesel Tank, Off Road (Mine), Phase 2 45.09 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Diesel 50k P2
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	50,000 gal vertical diesel tank, Phase 2

Tank Dimensions

Shell Height (ft):	22.00
Diameter (ft):	20.00
Liquid Height (ft) :	21.50
Avg. Liquid Height (ft):	10.75
Volume (gallons):	50,000.00
Turnovers:	121.00
Net Throughput(gal/yr):	6,050,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.63
Radius (ft) (Dome Roof)	20.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Diesel 50k P2 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Diesel 50k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	36.64	8.45	45.09

Diesel Tank, Highway (Mine), Phase 1 1.8 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Diesel 8k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	8,000 gal vertical diesel tank, Phase 1

Tank Dimensions

Shell Height (ft):	14.00
Diameter (ft):	10.00
Liquid Height (ft) :	13.75
Avg. Liquid Height (ft):	6.88
Volume (gallons):	8,000.00
Turnovers:	4.00
Net Throughput(gal/yr):	32,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.31
Radius (ft) (Dome Roof)	10.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Diesel 8k P1 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Diesel 8k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.47	1.33	1.80

Diesel Tank, Highway (Mine), Phase 2 1.92 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Diesel 8k P2
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	8,000 gal vertical diesel tank, Phase 2

Tank Dimensions

Shell Height (ft):	14.00
Diameter (ft):	10.00
Liquid Height (ft) :	13.75
Avg. Liquid Height (ft):	6.88
Volume (gallons):	8,000.00
Turnovers:	5.00
Net Throughput(gal/yr):	40,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.31
Radius (ft) (Dome Roof)	10.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Diesel 8k P2 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Diesel 8k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.58	1.33	1.92

Diesel Tank (Process), Phase 1 6.14 lb/yr

Diesel Tank (Process), Phase 2 6.14 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Diesel 31.5k
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	31,500 gal vertical diesel tank, Phase 1&2

Tank Dimensions

Shell Height (ft):	19.00
Diameter (ft):	17.00
Liquid Height (ft) :	18.75
Avg. Liquid Height (ft):	9.38
Volume (gallons):	31,500.00
Turnovers:	2.00
Net Throughput(gal/yr):	63,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.53
Radius (ft) (Dome Roof)	17.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Diesel 31.5k - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Diesel 31.5k - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.92	5.22	6.14

Diesel Tank 1 (Acid Plant), Phase 1 6.71 lb/yr

Diesel Tank 1 (Acid Plant), Phase 2 6.71 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Diesel 10.7k
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	10,700 gal vertical diesel tank, Phase 1&2

Tank Dimensions

Shell Height (ft):	14.00
Diameter (ft):	12.00
Liquid Height (ft) :	13.00
Avg. Liquid Height (ft):	6.50
Volume (gallons):	10,700.00
Turnovers:	30.00
Net Throughput(gal/yr):	321,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.38
Radius (ft) (Dome Roof)	12.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Diesel 10.7k - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Diesel 10.7k - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	4.69	2.02	6.71

Bulk Oil Tank, Phase 1 4.59 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Oil 19k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	19,000 gal vertical oil tank, Phase 1

Tank Dimensions

Shell Height (ft):	18.00
Diameter (ft):	14.00
Liquid Height (ft) :	17.00
Avg. Liquid Height (ft):	8.50
Volume (gallons):	19,000.00
Turnovers:	4.00
Net Throughput(gal/yr):	76,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.44
Radius (ft) (Dome Roof)	14.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Oil 19k P1 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Oil 19k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.11	3.48	4.59

Bulk Oil Tank, Phase 2 5.15 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Oil 19k P2
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	19,000 gal vertical oil tank, Phase 2

Tank Dimensions

Shell Height (ft):	18.00
Diameter (ft):	14.00
Liquid Height (ft) :	17.00
Avg. Liquid Height (ft):	8.50
Volume (gallons):	19,000.00
Turnovers:	6.00
Net Throughput(gal/yr):	114,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.44
Radius (ft) (Dome Roof)	14.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Oil 19k P2 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Oil 19k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.67	3.48	5.15

Bulk Coolant Tank, Phase 1 0.07 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Coolant 3k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	3,000 gal vertical coolant tank, Phase 1

Tank Dimensions

Shell Height (ft):	10.00
Diameter (ft):	8.00
Liquid Height (ft) :	8.50
Avg. Liquid Height (ft):	4.25
Volume (gallons):	3,000.00
Turnovers:	5.00
Net Throughput(gal/yr):	15,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.25
Radius (ft) (Dome Roof)	8.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Coolant 3k P1 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Ethylene Glycol	All	51.10	43.23	58.97	49.10	0.0008	0.0006	0.0011	62.0680			62.07	Option 1: VP50 = .0007 VP60 = .0012

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Coolant 3k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Ethylene Glycol	0.02	0.05	0.07

Bulk Coolant Tank, Phase 2 0.08 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Coolant 3k P2
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	3,000 gal vertical coolant tank, Phase 2

Tank Dimensions

Shell Height (ft):	10.00
Diameter (ft):	8.00
Liquid Height (ft) :	8.50
Avg. Liquid Height (ft):	4.25
Volume (gallons):	3,000.00
Turnovers:	8.00
Net Throughput(gal/yr):	24,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.25
Radius (ft) (Dome Roof)	8.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Coolant 3k P2 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Ethylene Glycol	All	51.10	43.23	58.97	49.10	0.0008	0.0006	0.0011	62.0680			62.07	Option 1: VP50 = .0007 VP60 = .0012

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Coolant 3k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Ethylene Glycol	0.03	0.05	0.08

Bulk Used Oil Tank, Phase 1 1.8 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	LNC Oil 3k P1
City:	
State:	Nevada
Company:	Lithium Nevada Corp
Type of Tank:	Vertical Fixed Roof Tank
Description:	3,000 gal vertical oil tank, Phase 1

Tank Dimensions

Shell Height (ft):	10.00
Diameter (ft):	8.00
Liquid Height (ft) :	8.50
Avg. Liquid Height (ft):	4.25
Volume (gallons):	3,000.00
Turnovers:	25.33
Net Throughput(gal/yr):	76,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.25
Radius (ft) (Dome Roof)	8.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Oil 3k P1 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Oil 3k P1 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.11	0.69	1.80

Bulk Used Oil Tank, Phase 2 2.28 lb/yr

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification		
User Identification:	LNC Oil 3k P2	
City:		
State:	Nevada	
Company:	Lithium Nevada Corp	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	3,000 gal vertical oil tank, Phase 2	
Tank Dimensions		
Shell Height (ft):		10.00
Diameter (ft):		8.00
Liquid Height (ft) :		8.50
Avg. Liquid Height (ft):		4.25
Volume (gallons):		3,000.00
Turnovers:		38.00
Net Throughput(gal/yr):		114,000.00
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	White/White	
Shell Condition	Good	
Roof Color/Shade:	White/White	
Roof Condition:	Good	
Roof Characteristics		
Type:	Dome	
Height (ft)		0.25
Radius (ft) (Dome Roof)		8.00
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Winnemucca, Nevada (Avg Atmospheric Pressure = 12.6 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

LNC Oil 3k P2 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	51.10	43.23	58.97	49.10	0.0047	0.0036	0.0063	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

LNC Oil 3k P2 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.59	0.69	2.28

Wind Erosion Event Emission Calculations

Dump Surface Wind Erosion Event Emission Calculations

Based on 1 acre/yr 8,760 hr/yr 0.00011 acre/hr

Threshold Wind Event	Date / Hour	u10 (m/s) (1)	u10+ (m/s) (2)	u* (m/s) ID-A (3)	u* (m/s) ID-B (3)	u* (m/s) ID-C (3)	Hours Elapsed ID-A (4)	Hours Elapsed ID-B (4)	Hours Elapsed ID-C (4)	Erodible Surface Area (acre) ID-A (5)	Erodible Surface Area (acre) ID-B (5)	Erodible Surface Area (acre) ID-C (5)	Erosion Potential (lb/acre) ID-A (6)	Erosion Potential (lb/acre) ID-B (6)	Erosion Potential (lb/acre) ID-C (6)	PM Emissions (lb) ID-A (7)	PM Emissions (lb) ID-B (7)	PM Emissions (lb) ID-C (7)	PM Emissions (lb) Total (8)	PM10 (lb) Total (9)	PM2.5 (lb) Total (10)
0	4/18/2012 00:00																				
1	4/23/2012 17:00	9.7	11.640	1.048	0.698	0.233	137	137	137	0.00188	0.0075	0.0063	6.55	--	--	0.012	--	--	0.012	0.006	0.001
2	4/26/2012 11:00	10.4	12.480	1.123	0.749	0.250	66	203	203	0.00090	0.0111	0.0093	28.53	--	--	0.026	--	--	0.026	0.013	0.002
3	4/26/2012 14:00	12.8	15.360	1.382	0.922	0.307	3	206	206	0.00004	0.0113	0.0094	148.79	--	--	0.006	--	--	0.006	0.003	0.000
4	4/26/2012 15:00	10.1	12.120	1.091	0.727	0.242	1	207	207	0.00001	0.0113	0.0095	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
5	4/26/2012 16:00	10.6	12.720	1.145	0.763	0.254	1	208	208	0.00001	0.0114	0.0095	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
6	4/26/2012 17:00	12.2	14.640	1.318	0.878	0.293	1	209	209	0.00001	0.0115	0.0095	112.21	--	--	0.002	--	--	0.002	0.001	0.000
7	4/26/2012 18:00	11.7	14.040	1.264	0.842	0.281	1	210	210	0.00001	0.0115	0.0096	85.04	--	--	0.001	--	--	0.001	0.001	8.74E-5
8	4/30/2012 10:00	9.7	11.640	1.048	0.698	0.233	88	298	298	0.00121	0.0163	0.0136	6.55	--	--	0.008	--	--	0.008	0.004	0.001
9	4/30/2012 11:00	9.7	11.640	1.048	0.698	0.233	1	299	299	0.00001	0.0164	0.0137	6.55	--	--	8.97E-5	--	--	8.97E-5	4.49E-5	6.73E-6
10	4/30/2012 12:00	9.7	11.640	1.048	0.698	0.233	1	300	300	0.00001	0.0164	0.0137	6.55	--	--	8.97E-5	--	--	8.97E-5	4.49E-5	6.73E-6
11	5/1/2012 21:00	9.6	11.520	1.037	0.691	0.230	33	333	333	0.00045	0.0182	0.0152	3.89	--	--	0.002	--	--	0.002	0.001	0.000
12	5/1/2012 22:00	10.3	12.360	1.112	0.742	0.247	1	334	334	0.00001	0.0183	0.0153	25.03	--	--	0.000	--	--	0.000	0.000	2.57E-5
13	5/3/2012 10:00	10.4	12.480	1.123	0.749	0.250	36	370	370	0.00049	0.0203	0.0169	28.53	--	--	0.014	--	--	0.014	0.007	0.001
14	5/3/2012 11:00	10.6	12.720	1.145	0.763	0.254	1	371	371	0.00001	0.0203	0.0169	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
15	5/3/2012 12:00	12.6	15.120	1.361	0.907	0.302	1	372	372	0.00001	0.0204	0.0170	136.11	--	--	0.002	--	--	0.002	0.001	0.000
16	5/3/2012 13:00	11.5	13.800	1.242	0.828	0.276	1	373	373	0.00001	0.0204	0.0170	75.02	--	--	0.001	--	--	0.001	0.001	7.71E-5
17	5/3/2012 14:00	11.1	13.320	1.199	0.799	0.266	1	374	374	0.00001	0.0205	0.0171	56.42	--	--	0.001	--	--	0.001	0.000	5.80E-5
18	5/3/2012 15:00	11.7	14.040	1.264	0.842	0.281	1	375	375	0.00001	0.0205	0.0171	85.04	--	--	0.001	--	--	0.001	0.001	8.74E-5
19	5/3/2012 16:00	10.2	12.240	1.102	0.734	0.245	1	376	376	0.00001	0.0206	0.0172	21.65	--	--	0.000	--	--	0.000	0.000	2.22E-5
20	5/3/2012 18:00	9.6	11.520	1.037	0.691	0.230	2	378	378	0.00003	0.0207	0.0173	3.89	--	--	0.000	--	--	0.000	5.33E-5	8.00E-6
21	5/4/2012 14:00	9.5	11.400	1.026	0.684	0.228	20	398	398	0.00027	0.0218	0.0182	1.36	--	--	0.000	--	--	0.000	0.000	2.79E-5
22	5/4/2012 15:00	10.5	12.600	1.134	0.756	0.252	1	399	399	0.00001	0.0219	0.0182	32.15	--	--	0.000	--	--	0.000	0.000	3.30E-5
23	5/10/2012 00:00	10.1	12.120	1.091	0.727	0.242	129	528	528	0.00177	0.0289	0.0241	18.39	--	--	0.032	--	--	0.032	0.016	0.002
24	5/14/2012 20:00	10.3	12.360	1.112	0.742	0.247	116	644	644	0.00159	0.0353	0.0294	25.03	--	--	0.040	--	--	0.040	0.020	0.003
25	5/14/2012 21:00	11.3	13.560	1.220	0.814	0.271	1	645	645	0.00001	0.0353	0.0295	65.48	--	--	0.001	--	--	0.001	0.000	6.73E-5
26	5/14/2012 22:00	10.9	13.080	1.177	0.785	0.262	1	646	646	0.00001	0.0354	0.0295	47.85	--	--	0.001	--	--	0.001	0.000	4.92E-5
27	5/14/2012 23:00	11.6	13.920	1.253	0.835	0.278	1	647	647	0.00001	0.0355	0.0295	79.97	--	--	0.001	--	--	0.001	0.001	8.22E-5
28	5/15/2012 00:00	10.5	12.600	1.134	0.756	0.252	1	648	648	0.00001	0.0355	0.0296	32.15	--	--	0.000	--	--	0.000	0.000	3.30E-5
29	5/17/2012 17:00	10.9	13.080	1.177	0.785	0.262	65	713	713	0.00089	0.0391	0.0326	47.85	--	--	0.043	--	--	0.043	0.021	0.003
30	5/17/2012 18:00	12.5	15.000	1.350	0.900	0.300	1	714	714	0.00001	0.0391	0.0326	129.96	--	--	0.002	--	--	0.002	0.001	0.000
31	5/17/2012 19:00	10.7	12.840	1.156	0.770	0.257	1	715	715	0.00001	0.0392	0.0326	39.76	--	--	0.001	--	--	0.001	0.000	4.08E-5
32	5/21/2012 13:00	9.7	11.640	1.048	0.698	0.233	90	805	805	0.00123	0.0441	0.0368	6.55	--	--	0.008	--	--	0.008	0.004	0.001
33	5/21/2012 14:00	10.2	12.240	1.102	0.734	0.245	1	806	806	0.00001	0.0442	0.0368	21.65	--	--	0.000	--	--	0.000	0.000	2.22E-5
34	5/22/2012 02:00	10.1	12.120	1.091	0.727	0.242	12	818	818	0.00016	0.0448	0.0374	18.39	--	--	0.003	--	--	0.003	0.002	0.000
35	5/22/2012 14:00	9.7	11.640	1.048	0.698	0.233	12	830	830	0.00016	0.0455	0.0379	6.55	--	--	0.001	--	--	0.001	0.001	8.08E-5
36	5/22/2012 16:00	10.6	12.720	1.145	0.763	0.254	2	832	832	0.00003	0.0456	0.0380	35.90	--	--	0.001	--	--	0.001	0.000	7.38E-5
37	5/22/2012 18:00	9.8	11.760	1.058	0.706	0.235	2	834	834	0.00003	0.0457	0.0381	9.33	--	--	0.000	--	--	0.000	0.000	1.92E-5
38	5/26/2012 16:00	10.8	12.960	1.166	0.778	0.259	94	928	928	0.00129	0.0508	0.0424	43.74	--	--	0.056	--	--	0.056	0.028	0.004
39	5/26/2012 17:00	10.7	12.840	1.156	0.770	0.257	1	929	929	0.00001	0.0509	0.0424	39.76	--	--	0.001	--	--	0.001	0.000	4.08E-5
40	6/3/2012 14:00	9.8	11.760	1.058	0.706	0.235	189	1,118	1,118	0.00259	0.0613	0.0511	9.33	--	--	0.024	--	--	0.024	0.012	0.002
41	6/3/2012 15:00	10.1	12.120	1.091	0.727	0.242	1	1,119	1,119	0.00001	0.0613	0.0511	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
42	6/3/2012 16:00	10.1	12.120	1.091	0.727	0.242	1	1,120	1,120	0.00001	0.0614	0.0511	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
43	6/3/2012 17:00	9.5	11.400	1.026	0.684	0.228	1	1,121	1,121	0.00001	0.0614	0.0512	1.36	--	--	1.86E-5	--	--	1.86E-5	9.29E-6	1.39E-6
44	6/4/2012 15:00	13.4	16.080	1.447	0.965	0.322	22	1,143	1,143	0.00030	0.0626	0.0522	189.72	--	--	0.057	--	--	0.057	0.029	0.004
45	6/4/2012 16:00	14.9	17.880	1.609	1.073	0.358	1	1,144	1,144	0.00001	0.0627	0.0522	311.06	13	--	0.004	0.829	--	0.833	0.416	0.062

Threshold Wind Event	Date / Hour	u10 (m/s) (1)	u10+ (m/s) (2)	u* (m/s) ID-A (3)	ID-B (3)	ID-C (3)	Hours Elapsed ID-A (4)	ID-B (4)	ID-C (4)	Erodible Surface Area (acre) ID-A (5)	ID-B (5)	ID-C (5)	Erosion Potential (lb/acre)(ID-A (6)	ID-B (6)	ID-C (6)	PM Emissions (lb) ID-A (7)	ID-B (7)	ID-C (7)	Total (8)	PM10 (lb) Total (9)	PM2.5 (lb) Total (10)
46	6/4/2012 17:00	12.7	15.240	1.372	0.914	0.305	1	1	1,145	0.00001	0.0001	0.0523	142.39	--	--	0.002	--	--	0.002	0.001	0.000
47	6/15/2012 03:00	10.4	12.480	1.123	0.749	0.250	250	251	1,395	0.00342	0.0138	0.0637	28.53	--	--	0.098	--	--	0.098	0.049	0.007
48	6/17/2012 16:00	11.5	13.800	1.242	0.828	0.276	61	312	1,456	0.00084	0.0171	0.0665	75.02	--	--	0.063	--	--	0.063	0.031	0.005
49	6/17/2012 17:00	10.6	12.720	1.145	0.763	0.254	1	313	1,457	0.00001	0.0172	0.0665	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
50	6/17/2012 18:00	10.3	12.360	1.112	0.742	0.247	1	314	1,458	0.00001	0.0172	0.0666	25.03	--	--	0.000	--	--	0.000	0.000	2.57E-5
51	6/17/2012 19:00	10.3	12.360	1.112	0.742	0.247	1	315	1,459	0.00001	0.0173	0.0666	25.03	--	--	0.000	--	--	0.000	0.000	2.57E-5
52	6/18/2012 08:00	10.4	12.480	1.123	0.749	0.250	13	328	1,472	0.00018	0.0180	0.0672	28.53	--	--	0.005	--	--	0.005	0.003	0.000
53	6/18/2012 12:00	12.5	15.000	1.350	0.900	0.300	4	332	1,476	0.00005	0.0182	0.0674	129.96	--	--	0.007	--	--	0.007	0.004	0.001
54	6/18/2012 13:00	10.9	13.080	1.177	0.785	0.262	1	333	1,477	0.00001	0.0182	0.0674	47.85	--	--	0.001	--	--	0.001	0.000	4.92E-5
55	6/18/2012 14:00	11.5	13.800	1.242	0.828	0.276	1	334	1,478	0.00001	0.0183	0.0675	75.02	--	--	0.001	--	--	0.001	0.001	7.71E-5
56	6/18/2012 15:00	11.3	13.560	1.220	0.814	0.271	1	335	1,479	0.00001	0.0184	0.0675	65.48	--	--	0.001	--	--	0.001	0.000	6.73E-5
57	6/18/2012 16:00	10	12.000	1.080	0.720	0.240	1	336	1,480	0.00001	0.0184	0.0676	15.25	--	--	0.000	--	--	0.000	0.000	1.57E-5
58	6/18/2012 17:00	10.6	12.720	1.145	0.763	0.254	1	337	1,481	0.00001	0.0185	0.0676	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
59	6/21/2012 22:00	10.5	12.600	1.134	0.756	0.252	77	414	1,558	0.00105	0.0227	0.0711	32.15	--	--	0.034	--	--	0.034	0.017	0.003
60	6/22/2012 18:00	11.7	14.040	1.264	0.842	0.281	20	434	1,578	0.00027	0.0238	0.0721	85.04	--	--	0.023	--	--	0.023	0.012	0.002
61	6/22/2012 19:00	11.3	13.560	1.220	0.814	0.271	1	435	1,579	0.00001	0.0238	0.0721	65.48	--	--	0.001	--	--	0.001	0.000	6.73E-5
62	6/22/2012 20:00	10.3	12.360	1.112	0.742	0.247	1	436	1,580	0.00001	0.0239	0.0721	25.03	--	--	0.000	--	--	0.000	0.000	2.57E-5
63	6/30/2012 22:00	10	12.000	1.080	0.720	0.240	194	630	1,774	0.00266	0.0345	0.0810	15.25	--	--	0.041	--	--	0.041	0.020	0.003
64	6/30/2012 23:00	10.3	12.360	1.112	0.742	0.247	1	631	1,775	0.00001	0.0346	0.0811	25.03	--	--	0.000	--	--	0.000	0.000	2.57E-5
65	7/1/2012 00:00	9.5	11.400	1.026	0.684	0.228	1	632	1,776	0.00001	0.0346	0.0811	1.36	--	--	1.86E-5	--	--	1.86E-5	9.29E-6	1.39E-6
66	7/3/2012 22:00	9.5	11.400	1.026	0.684	0.228	70	702	1,846	0.00096	0.0385	0.0843	1.36	--	--	0.001	--	--	0.001	0.001	9.76E-5
67	7/14/2012 22:00	11.2	13.440	1.210	0.806	0.269	264	966	2,110	0.00362	0.0529	0.0963	60.89	--	--	0.220	--	--	0.220	0.110	0.017
68	8/5/2012 15:00	9.6	11.520	1.037	0.691	0.230	521	1,487	2,631	0.00714	0.0815	0.1201	3.89	--	--	0.028	--	--	0.028	0.014	0.002
69	9/9/2012 12:00	9.6	11.520	1.037	0.691	0.230	837	2,324	3,468	0.01147	0.1273	0.1584	3.89	--	--	0.045	--	--	0.045	0.022	0.003
70	9/9/2012 13:00	10	12.000	1.080	0.720	0.240	1	2,325	3,469	0.00001	0.1274	0.1584	15.25	--	--	0.000	--	--	0.000	0.000	1.57E-5
71	9/9/2012 14:00	10.3	12.360	1.112	0.742	0.247	1	2,326	3,470	0.00001	0.1275	0.1584	25.03	--	--	0.000	--	--	0.000	0.000	2.57E-5
72	9/10/2012 20:00	9.5	11.400	1.026	0.684	0.228	30	2,356	3,500	0.00041	0.1291	0.1598	1.36	--	--	0.001	--	--	0.001	0.000	4.18E-5
73	10/10/2012 02:00	9.9	11.880	1.069	0.713	0.238	702	3,058	4,202	0.00962	0.1676	0.1919	12.23	--	--	0.118	--	--	0.118	0.059	0.009
74	10/12/2012 22:00	10.1	12.120	1.091	0.727	0.242	68	3,126	4,270	0.00093	0.1713	0.1950	18.39	--	--	0.017	--	--	0.017	0.009	0.001
75	10/16/2012 12:00	11.1	13.320	1.199	0.799	0.266	86	3,212	4,356	0.00118	0.1760	0.1989	56.42	--	--	0.066	--	--	0.066	0.033	0.005
76	10/16/2012 13:00	10.2	12.240	1.102	0.734	0.245	1	3,213	4,357	0.00001	0.1761	0.1989	21.65	--	--	0.000	--	--	0.000	0.000	2.22E-5
77	10/22/2012 14:00	9.5	11.400	1.026	0.684	0.228	145	3,358	4,502	0.00199	0.1840	0.2056	1.36	--	--	0.003	--	--	0.003	0.001	0.000
78	10/22/2012 15:00	11.9	14.280	1.285	0.857	0.286	1	3,359	4,503	0.00001	0.1841	0.2056	95.55	--	--	0.001	--	--	0.001	0.001	9.82E-5
79	10/31/2012 22:00	10.5	12.600	1.134	0.756	0.252	223	3,582	4,726	0.00305	0.1963	0.2158	32.15	--	--	0.098	--	--	0.098	0.049	0.007
80	11/8/2012 09:00	10.3	12.360	1.112	0.742	0.247	179	3,761	4,905	0.00245	0.2061	0.2240	25.03	--	--	0.061	--	--	0.061	0.031	0.005
81	11/8/2012 10:00	12.1	14.520	1.307	0.871	0.290	1	3,762	4,906	0.00001	0.2061	0.2240	106.53	--	--	0.001	--	--	0.001	0.001	0.000
82	11/8/2012 11:00	12.7	15.240	1.372	0.914	0.305	1	3,763	4,907	0.00001	0.2062	0.2241	142.39	--	--	0.002	--	--	0.002	0.001	0.000
83	11/8/2012 12:00	12.2	14.640	1.318	0.878	0.293	1	3,764	4,908	0.00001	0.2062	0.2241	112.21	--	--	0.002	--	--	0.002	0.001	0.000
84	11/8/2012 13:00	12.2	14.640	1.318	0.878	0.293	1	3,765	4,909	0.00001	0.2063	0.2242	112.21	--	--	0.002	--	--	0.002	0.001	0.000
85	11/8/2012 14:00	12	14.400	1.296	0.864	0.288	1	3,766	4,910	0.00001	0.2064	0.2242	100.98	--	--	0.001	--	--	0.001	0.001	0.000
86	11/18/2012 00:00	10.5	12.600	1.134	0.756	0.252	226	3,992	5,136	0.00310	0.2187	0.2345	32.15	--	--	0.100	--	--	0.100	0.050	0.007
87	11/20/2012 13:00	9.5	11.400	1.026	0.684	0.228	61	4,053	5,197	0.00084	0.2221	0.2373	1.36	--	--	0.001	--	--	0.001	0.001	8.50E-5
88	11/21/2012 09:00	11.7	14.040	1.264	0.842	0.281	20	4,073	5,217	0.00027	0.2232	0.2382	85.04	--	--	0.023	--	--	0.023	0.012	0.002
89	11/21/2012 10:00	12.1	14.520	1.307	0.871	0.290	1	4,074	5,218	0.00001	0.2232	0.2383	106.53	--	--	0.001	--	--	0.001	0.001	0.000
90	11/21/2012 11:00	11.2	13.440	1.210	0.806	0.269	1	4,075	5,219	0.00001	0.2233	0.2383	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
91	11/21/2012 12:00	12.1	14.520	1.307	0.871	0.290	1	4,076	5,220	0.00001	0.2233	0.2384	106.53	--	--	0.001	--	--	0.001	0.001	0.000
92	11/21/2012 13:00	11.9	14.280	1.285	0.857	0.286	1	4,077	5,221	0.00001	0.2234	0.2384	95.55	--	--	0.001	--	--	0.001	0.001	9.82E-5
93	11/21/2012 15:00	9.5	11.400	1.026	0.684	0.228	2	4,079	5,223	0.00003	0.2235	0.2385	1.36	--	--	3.72E-5	--	--	3.72E-5	1.86E-5	2.79E-6
94	11/21/2012 16:00	9.5	11.400	1.026	0.684	0.228	1	4,080	5,224	0.00001	0.2236	0.2385	1.36	--	--	1.86E-5	--	--	1.86E-5	9.29E-6	1.39E-6

Threshold Wind Event	Date / Hour	u10 (m/s) (1)	u10+ (m/s) (2)	u* (m/s) ID-A (3)	ID-B (3)	ID-C (3)	Hours Elapsed ID-A (4)	ID-B (4)	ID-C (4)	Erodible Surface Area (acre) ID-A (5)	ID-B (5)	ID-C (5)	Erosion Potential (lb/acre)(ID-A (6)	ID-B (6)	ID-C (6)	PM Emissions (lb) ID-A (7)	ID-B (7)	ID-C (7)	Total (8)	PM10 (lb) Total (9)	PM2.5 (lb) Total (10)
95	11/21/2012 17:00	10.1	12.120	1.091	0.727	0.242	1	4,081	5,225	0.00001	0.2236	0.2386	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
96	11/21/2012 18:00	11.1	13.320	1.199	0.799	0.266	1	4,082	5,226	0.00001	0.2237	0.2386	56.42	--	--	0.001	--	--	0.001	0.000	5.80E-5
97	11/30/2012 04:00	9.7	11.640	1.048	0.698	0.233	202	4,284	5,428	0.00277	0.2347	0.2479	6.55	--	--	0.018	--	--	0.018	0.009	0.001
98	12/2/2012 04:00	10.3	12.360	1.112	0.742	0.247	48	4,332	5,476	0.00066	0.2374	0.2500	25.03	--	--	0.016	--	--	0.016	0.008	0.001
99	12/2/2012 05:00	10.7	12.840	1.156	0.770	0.257	1	4,333	5,477	0.00001	0.2374	0.2501	39.76	--	--	0.001	--	--	0.001	0.000	4.08E-5
100	12/2/2012 06:00	10.8	12.960	1.166	0.778	0.259	1	4,334	5,478	0.00001	0.2375	0.2501	43.74	--	--	0.001	--	--	0.001	0.000	4.49E-5
101	12/2/2012 07:00	11.5	13.800	1.242	0.828	0.276	1	4,335	5,479	0.00001	0.2375	0.2502	75.02	--	--	0.001	--	--	0.001	0.001	7.71E-5
102	12/2/2012 08:00	11.9	14.280	1.285	0.857	0.286	1	4,336	5,480	0.00001	0.2376	0.2502	95.55	--	--	0.001	--	--	0.001	0.001	9.82E-5
103	12/2/2012 09:00	10.8	12.960	1.166	0.778	0.259	1	4,337	5,481	0.00001	0.2376	0.2503	43.74	--	--	0.001	--	--	0.001	0.000	4.49E-5
104	12/2/2012 10:00	12.3	14.760	1.328	0.886	0.295	1	4,338	5,482	0.00001	0.2377	0.2503	118.00	--	--	0.002	--	--	0.002	0.001	0.000
105	12/2/2012 12:00	9.9	11.880	1.069	0.713	0.238	2	4,340	5,484	0.00003	0.2378	0.2504	12.23	--	--	0.000	--	--	0.000	0.000	2.51E-5
106	12/12/2012 00:00	9.7	11.640	1.048	0.698	0.233	228	4,568	5,712	0.00312	0.2503	0.2608	6.55	--	--	0.020	--	--	0.020	0.010	0.002
107	12/17/2012 01:00	10.9	13.080	1.177	0.785	0.262	121	4,689	5,833	0.00166	0.2569	0.2663	47.85	--	--	0.079	--	--	0.079	0.040	0.006
108	12/17/2012 02:00	11.7	14.040	1.264	0.842	0.281	1	4,690	5,834	0.00001	0.2570	0.2664	85.04	--	--	0.001	--	--	0.001	0.001	8.74E-5
109	12/17/2012 03:00	12.8	15.360	1.382	0.922	0.307	1	4,691	5,835	0.00001	0.2570	0.2664	148.79	--	--	0.002	--	--	0.002	0.001	0.000
110	12/17/2012 04:00	13.7	16.440	1.480	0.986	0.329	1	4,692	5,836	0.00001	0.2571	0.2665	211.82	--	--	0.003	--	--	0.003	0.001	0.000
111	12/17/2012 05:00	12.6	15.120	1.361	0.907	0.302	1	4,693	5,837	0.00001	0.2572	0.2665	136.11	--	--	0.002	--	--	0.002	0.001	0.000
112	12/17/2012 06:00	10.1	12.120	1.091	0.727	0.242	1	4,694	5,838	0.00001	0.2572	0.2666	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
113	12/17/2012 08:00	10	12.000	1.080	0.720	0.240	2	4,696	5,840	0.00003	0.2573	0.2667	15.25	--	--	0.000	--	--	0.000	0.000	3.13E-5
114	12/17/2012 09:00	10.1	12.120	1.091	0.727	0.242	1	4,697	5,841	0.00001	0.2574	0.2667	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
115	12/17/2012 11:00	11	13.200	1.188	0.792	0.264	2	4,699	5,843	0.00003	0.2575	0.2668	52.08	--	--	0.001	--	--	0.001	0.001	0.000
116	12/17/2012 12:00	9.9	11.880	1.069	0.713	0.238	1	4,700	5,844	0.00001	0.2575	0.2668	12.23	--	--	0.000	--	--	0.000	8.37E-5	1.26E-5
117	12/17/2012 13:00	10.8	12.960	1.166	0.778	0.259	1	4,701	5,845	0.00001	0.2576	0.2669	43.74	--	--	0.001	--	--	0.001	0.000	4.49E-5
118	12/17/2012 14:00	9.9	11.880	1.069	0.713	0.238	1	4,702	5,846	0.00001	0.2576	0.2669	12.23	--	--	0.000	--	--	0.000	8.37E-5	1.26E-5
119	12/17/2012 15:00	10.1	12.120	1.091	0.727	0.242	1	4,703	5,847	0.00001	0.2577	0.2670	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
120	12/24/2012 10:00	10.3	12.360	1.112	0.742	0.247	163	4,866	6,010	0.00223	0.2666	0.2744	25.03	--	--	0.056	--	--	0.056	0.028	0.004
121	12/24/2012 11:00	11.2	13.440	1.210	0.806	0.269	1	4,867	6,011	0.00001	0.2667	0.2745	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
122	12/26/2012 19:00	9.9	11.880	1.069	0.713	0.238	56	4,923	6,067	0.00077	0.2698	0.2770	12.23	--	--	0.009	--	--	0.009	0.005	0.001
123	1/10/2013 07:00	10.3	12.360	1.112	0.742	0.247	348	5,271	6,415	0.00477	0.2888	0.2929	25.03	--	--	0.119	--	--	0.119	0.060	0.009
124	1/10/2013 08:00	10.1	12.120	1.091	0.727	0.242	1	5,272	6,416	0.00001	0.2889	0.2930	18.39	--	--	0.000	--	--	0.000	0.000	1.89E-5
125	1/10/2013 09:00	10.2	12.240	1.102	0.734	0.245	1	5,273	6,417	0.00001	0.2889	0.2930	21.65	--	--	0.000	--	--	0.000	0.000	2.22E-5
126	1/10/2013 10:00	11.7	14.040	1.264	0.842	0.281	1	5,274	6,418	0.00001	0.2890	0.2931	85.04	--	--	0.001	--	--	0.001	0.001	8.74E-5
127	1/10/2013 11:00	11.3	13.560	1.220	0.814	0.271	1	5,275	6,419	0.00001	0.2890	0.2931	65.48	--	--	0.001	--	--	0.001	0.000	6.73E-5
128	1/10/2013 12:00	11.4	13.680	1.231	0.821	0.274	1	5,276	6,420	0.00001	0.2891	0.2932	70.19	--	--	0.001	--	--	0.001	0.000	7.21E-5
129	1/10/2013 13:00	11.9	14.280	1.285	0.857	0.286	1	5,277	6,421	0.00001	0.2892	0.2932	95.55	--	--	0.001	--	--	0.001	0.001	9.82E-5
130	1/10/2013 14:00	11.6	13.920	1.253	0.835	0.278	1	5,278	6,422	0.00001	0.2892	0.2932	79.97	--	--	0.001	--	--	0.001	0.001	8.22E-5
131	1/10/2013 15:00	10.7	12.840	1.156	0.770	0.257	1	5,279	6,423	0.00001	0.2893	0.2933	39.76	--	--	0.001	--	--	0.001	0.000	4.08E-5
132	1/10/2013 16:00	9.9	11.880	1.069	0.713	0.238	1	5,280	6,424	0.00001	0.2893	0.2933	12.23	--	--	0.000	--	--	0.000	8.37E-5	1.26E-5
133	1/11/2013 05:00	11.1	13.320	1.199	0.799	0.266	13	5,293	6,437	0.00018	0.2900	0.2939	56.42	--	--	0.010	--	--	0.010	0.005	0.001
134	1/29/2013 02:00	10.7	12.840	1.156	0.770	0.257	429	5,722	6,866	0.00588	0.3135	0.3135	39.76	--	--	0.234	--	--	0.234	0.117	0.018
135	1/29/2013 05:00	10.1	12.120	1.091	0.727	0.242	3	5,725	6,869	0.00004	0.3137	0.3137	18.39	--	--	0.001	--	--	0.001	0.000	5.67E-5
136	1/29/2013 06:00	10.9	13.080	1.177	0.785	0.262	1	5,726	6,870	0.00001	0.3138	0.3137	47.85	--	--	0.001	--	--	0.001	0.000	4.92E-5
137	1/29/2013 07:00	11.4	13.680	1.231	0.821	0.274	1	5,727	6,871	0.00001	0.3138	0.3137	70.19	--	--	0.001	--	--	0.001	0.000	7.21E-5
138	1/29/2013 08:00	13.5	16.200	1.458	0.972	0.324	1	5,728	6,872	0.00001	0.3139	0.3138	196.97	--	--	0.003	--	--	0.003	0.001	0.000
139	1/29/2013 09:00	12.9	15.480	1.393	0.929	0.310	1	5,729	6,873	0.00001	0.3139	0.3138	155.31	--	--	0.002	--	--	0.002	0.001	0.000
140	1/29/2013 10:00	13.4	16.080	1.447	0.965	0.322	1	5,730	6,874	0.00001	0.3140	0.3139	189.72	--	--	0.003	--	--	0.003	0.001	0.000
141	1/29/2013 11:00	9.9	11.880	1.069	0.713	0.238	1	5,731	6,875	0.00001	0.3140	0.3139	12.23	--	--	0.000	--	--	0.000	8.37E-5	1.26E-5
142	2/6/2013 01:00	9.7	11.640	1.048	0.698	0.233	182	5,913	7,057	0.00249	0.3240	0.3222	6.55	--	--	0.016	--	--	0.016	0.008	0.001
143	2/8/2013 10:00	10	12.000	1.080	0.720	0.240	57	5,970	7,114	0.00078	0.3271	0.3248	15.25	--	--	0.012	--	--	0.012	0.006	0.001

Threshold Wind Event	Date / Hour	u10 (m/s) (1)	u10+ (m/s) (2)	u* (m/s) ID-A (3)	ID-B (3)	ID-C (3)	Hours Elapsed ID-A (4)	ID-B (4)	ID-C (4)	Erodible Surface Area (acre) ID-A (5)	ID-B (5)	ID-C (5)	Erosion Potential (lb/acre)(1 ID-A (6)	ID-B (6)	ID-C (6)	PM Emissions (lb) ID-A (7)	ID-B (7)	ID-C (7)	Total (8)	PM10 (lb) Total (9)	PM2.5 (lb) Total (10)
144	2/8/2013 11:00	10.6	12.720	1.145	0.763	0.254	1	5,971	7,115	0.00001	0.3272	0.3249	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
145	2/8/2013 12:00	10.8	12.960	1.166	0.778	0.259	1	5,972	7,116	0.00001	0.3272	0.3249	43.74	--	--	0.001	--	--	0.001	0.000	4.49E-5
146	2/8/2013 13:00	11.2	13.440	1.210	0.806	0.269	1	5,973	7,117	0.00001	0.3273	0.3250	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
147	2/8/2013 14:00	10	12.000	1.080	0.720	0.240	1	5,974	7,118	0.00001	0.3273	0.3250	15.25	--	--	0.000	--	--	0.000	0.000	1.57E-5
148	2/8/2013 15:00	10.6	12.720	1.145	0.763	0.254	1	5,975	7,119	0.00001	0.3274	0.3251	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
149	2/23/2013 02:00	9.6	11.520	1.037	0.691	0.230	347	6,322	7,466	0.00475	0.3464	0.3409	3.89	--	--	0.019	--	--	0.019	0.009	0.001
150	2/23/2013 03:00	15.1	18.120	1.631	1.087	0.362	1	6,323	7,467	0.00001	0.3465	0.3410	329.29	17	--	0.005	6.003	--	6.007	3.004	0.451
151	2/23/2013 04:00	13.4	16.080	1.447	0.965	0.322	1	1	7,468	0.00001	0.0001	0.3410	189.72	--	--	0.003	--	--	0.003	0.001	0.000
152	2/23/2013 14:00	10.3	12.360	1.112	0.742	0.247	10	11	7,478	0.00014	0.0006	0.3415	25.03	--	--	0.003	--	--	0.003	0.002	0.000
153	3/6/2013 09:00	11.4	13.680	1.231	0.821	0.274	259	270	7,737	0.00355	0.0148	0.3533	70.19	--	--	0.249	--	--	0.249	0.125	0.019
154	3/6/2013 10:00	10.6	12.720	1.145	0.763	0.254	1	271	7,738	0.00001	0.0148	0.3533	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
155	3/6/2013 11:00	13.1	15.720	1.415	0.943	0.314	1	272	7,739	0.00001	0.0149	0.3534	168.71	--	--	0.002	--	--	0.002	0.001	0.000
156	3/6/2013 12:00	11.8	14.160	1.274	0.850	0.283	1	273	7,740	0.00001	0.0150	0.3534	90.23	--	--	0.001	--	--	0.001	0.001	9.27E-5
157	3/6/2013 13:00	12.2	14.640	1.318	0.878	0.293	1	274	7,741	0.00001	0.0150	0.3535	112.21	--	--	0.002	--	--	0.002	0.001	0.000
158	3/6/2013 14:00	13	15.600	1.404	0.936	0.312	1	275	7,742	0.00001	0.0151	0.3535	161.95	--	--	0.002	--	--	0.002	0.001	0.000
159	3/6/2013 15:00	12.6	15.120	1.361	0.907	0.302	1	276	7,743	0.00001	0.0151	0.3536	136.11	--	--	0.002	--	--	0.002	0.001	0.000
160	3/6/2013 16:00	11.2	13.440	1.210	0.806	0.269	1	277	7,744	0.00001	0.0152	0.3536	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
161	3/6/2013 17:00	10.7	12.840	1.156	0.770	0.257	1	278	7,745	0.00001	0.0152	0.3537	39.76	--	--	0.001	--	--	0.001	0.000	4.08E-5
162	3/16/2013 22:00	10.1	12.120	1.091	0.727	0.242	245	523	7,990	0.00336	0.0287	0.3648	18.39	--	--	0.062	--	--	0.062	0.031	0.005
163	3/16/2013 23:00	10.4	12.480	1.123	0.749	0.250	1	524	7,991	0.00001	0.0287	0.3649	28.53	--	--	0.000	--	--	0.000	0.000	2.93E-5
164	3/17/2013 00:00	11.2	13.440	1.210	0.806	0.269	1	525	7,992	0.00001	0.0288	0.3649	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
165	3/17/2013 01:00	12.6	15.120	1.361	0.907	0.302	1	526	7,993	0.00001	0.0288	0.3650	136.11	--	--	0.002	--	--	0.002	0.001	0.000
166	3/17/2013 02:00	11.2	13.440	1.210	0.806	0.269	1	527	7,994	0.00001	0.0289	0.3650	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
167	3/20/2013 13:00	10.3	12.360	1.112	0.742	0.247	83	610	8,077	0.00114	0.0334	0.3688	25.03	--	--	0.028	--	--	0.028	0.014	0.002
168	3/20/2013 14:00	10.5	12.600	1.134	0.756	0.252	1	611	8,078	0.00001	0.0335	0.3689	32.15	--	--	0.000	--	--	0.000	0.000	3.30E-5
169	3/20/2013 15:00	12	14.400	1.296	0.864	0.288	1	612	8,079	0.00001	0.0335	0.3689	100.98	--	--	0.001	--	--	0.001	0.001	0.000
170	3/20/2013 16:00	12.4	14.880	1.339	0.893	0.298	1	613	8,080	0.00001	0.0336	0.3689	123.92	--	--	0.002	--	--	0.002	0.001	0.000
171	3/20/2013 17:00	11.7	14.040	1.264	0.842	0.281	1	614	8,081	0.00001	0.0336	0.3690	85.04	--	--	0.001	--	--	0.001	0.001	8.74E-5
172	3/20/2013 21:00	11.6	13.920	1.253	0.835	0.278	4	618	8,085	0.00005	0.0339	0.3692	79.97	--	--	0.004	--	--	0.004	0.002	0.000
173	3/20/2013 22:00	11.2	13.440	1.210	0.806	0.269	1	619	8,086	0.00001	0.0339	0.3692	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
174	4/4/2013 16:00	11.2	13.440	1.210	0.806	0.269	354	973	8,440	0.00485	0.0533	0.3854	60.89	--	--	0.295	--	--	0.295	0.148	0.022
175	4/4/2013 17:00	10.6	12.720	1.145	0.763	0.254	1	974	8,441	0.00001	0.0534	0.3854	35.90	--	--	0.000	--	--	0.000	0.000	3.69E-5
176	4/4/2013 18:00	10.5	12.600	1.134	0.756	0.252	1	975	8,442	0.00001	0.0534	0.3855	32.15	--	--	0.000	--	--	0.000	0.000	3.30E-5
177	4/4/2013 23:00	10.3	12.360	1.112	0.742	0.247	5	980	8,447	0.00007	0.0537	0.3857	25.03	--	--	0.002	--	--	0.002	0.001	0.000
178	4/5/2013 00:00	10	12.000	1.080	0.720	0.240	1	981	8,448	0.00001	0.0538	0.3858	15.25	--	--	0.000	--	--	0.000	0.000	1.57E-5
179	4/7/2013 12:00	10.5	12.600	1.134	0.756	0.252	60	1,041	8,508	0.00082	0.0570	0.3885	32.15	--	--	0.026	--	--	0.026	0.013	0.002
180	4/7/2013 13:00	10.4	12.480	1.123	0.749	0.250	1	1,042	8,509	0.00001	0.0571	0.3885	28.53	--	--	0.000	--	--	0.000	0.000	2.93E-5
181	4/7/2013 14:00	11.2	13.440	1.210	0.806	0.269	1	1,043	8,510	0.00001	0.0572	0.3886	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
182	4/7/2013 15:00	12.6	15.120	1.361	0.907	0.302	1	1,044	8,511	0.00001	0.0572	0.3886	136.11	--	--	0.002	--	--	0.002	0.001	0.000
183	4/7/2013 16:00	11.6	13.920	1.253	0.835	0.278	1	1,045	8,512	0.00001	0.0573	0.3887	79.97	--	--	0.001	--	--	0.001	0.001	8.22E-5
184	4/7/2013 17:00	12.8	15.360	1.382	0.922	0.307	1	1,046	8,513	0.00001	0.0573	0.3887	148.79	--	--	0.002	--	--	0.002	0.001	0.000
185	4/7/2013 18:00	12.4	14.880	1.339	0.893	0.298	1	1,047	8,514	0.00001	0.0574	0.3888	123.92	--	--	0.002	--	--	0.002	0.001	0.000
186	4/8/2013 04:00	10.6	12.720	1.145	0.763	0.254	10	1,057	8,524	0.00014	0.0579	0.3892	35.90	--	--	0.005	--	--	0.005	0.002	0.000
187	4/8/2013 05:00	12.7	15.240	1.372	0.914	0.305	1	1,058	8,525	0.00001	0.0580	0.3893	142.39	--	--	0.002	--	--	0.002	0.001	0.000
188	4/8/2013 06:00	13.1	15.720	1.415	0.943	0.314	1	1,059	8,526	0.00001	0.0580	0.3893	168.71	--	--	0.002	--	--	0.002	0.001	0.000
189	4/8/2013 07:00	13.9	16.680	1.501	1.001	0.334	1	1,060	8,527	0.00001	0.0581	0.3894	227.15	--	--	0.003	--	--	0.003	0.002	0.000
190	4/8/2013 08:00	13.6	16.320	1.469	0.979	0.326	1	1,061	8,528	0.00001	0.0581	0.3894	204.33	--	--	0.003	--	--	0.003	0.001	0.000
191	4/8/2013 16:00	9.7	11.640	1.048	0.698	0.233	8	1,069	8,536	0.00011	0.0586	0.3898	6.55	--	--	0.001	--	--	0.001	0.000	5.38E-5
192	4/8/2013 22:00	10.3	12.360	1.112	0.742	0.247	6	1,075	8,542	0.00008	0.0589	0.3900	25.03	--	--	0.002	--	--	0.002	0.001	0.000

Threshold	Date / Hour	u10	u10+	u* (m/s)			Hours Elapsed			Erodible Surface Area (acre)			Erosion Potential (lb/acre)[1]			PM Emissions (lb)				PM10 (lb)	PM2.5 (lb)
Wind		(m/s)	(m/s)	ID-A	ID-B	ID-C	ID-A	ID-B	ID-C	ID-A	ID-B	ID-C	ID-A	ID-B	ID-C	ID-A	ID-B	ID-C	Total	Total	Total
Event		(1)	(2)	(3)	(3)	(3)	(4)	(4)	(4)	(5)	(5)	(5)	(6)	(6)	(6)	(7)	(7)	(7)	(8)	(9)	(10)
193	4/8/2013 23:00	11.5	13.800	1.242	0.828	0.276	1	1,076	8,543	0.00001	0.0590	0.3901	75.02	--	--	0.001	--	--	0.001	0.001	7.71E-5
194	4/9/2013 00:00	10.7	12.840	1.156	0.770	0.257	1	1,077	8,544	0.00001	0.0590	0.3901	39.76	--	--	0.001	--	--	0.001	0.000	4.08E-5
195	4/9/2013 04:00	11.1	13.320	1.199	0.799	0.266	4	1,081	8,548	0.00005	0.0592	0.3903	56.42	--	--	0.003	--	--	0.003	0.002	0.000
196	4/9/2013 05:00	9.5	11.400	1.026	0.684	0.228	1	1,082	8,549	0.00001	0.0593	0.3904	1.36	--	--	1.86E-5	--	--	1.86E-5	9.29E-6	1.39E-6
197	4/10/2013 17:00	9.8	11.760	1.058	0.706	0.235	36	1,118	8,585	0.00049	0.0613	0.3920	9.33	--	--	0.005	--	--	0.005	0.002	0.000
198	4/10/2013 18:00	11.2	13.440	1.210	0.806	0.269	1	1,119	8,586	0.00001	0.0613	0.3921	60.89	--	--	0.001	--	--	0.001	0.000	6.26E-5
199	4/10/2013 19:00	11.3	13.560	1.220	0.814	0.271	1	1,120	8,587	0.00001	0.0614	0.3921	65.48	--	--	0.001	--	--	0.001	0.000	6.73E-5
200	4/13/2013 02:00	9.6	11.520	1.037	0.691	0.230	55	1,175	8,642	0.00075	0.0644	0.3946	3.89	--	--	0.003	--	--	0.003	0.001	0.000
201	4/13/2013 05:00	10.7	12.840	1.156	0.770	0.257	3	1,178	8,645	0.00004	0.0645	0.3947	39.76	--	--	0.002	--	--	0.002	0.001	0.000
202	4/13/2013 06:00	14.1	16.920	1.523	1.015	0.338	1	1,179	8,646	0.00001	0.0646	0.3948	242.97	--	--	0.003	--	--	0.003	0.002	0.000
203	4/13/2013 07:00	14.8	17.760	1.598	1.066	0.355	1	1,180	8,647	0.00001	0.0647	0.3948	302.13	11	--	0.004	0.727	--	0.731	0.366	0.055
204	4/13/2013 08:00	12.4	14.880	1.339	0.893	0.298	1	1	8,648	0.00001	0.0001	0.3949	123.92	--	--	0.002	--	--	0.002	0.001	0.000
205	4/13/2013 09:00	11.6	13.920	1.253	0.835	0.278	1	2	8,649	0.00001	0.0001	0.3949	79.97	--	--	0.001	--	--	0.001	0.001	8.22E-5
206	4/13/2013 10:00	10.2	12.240	1.102	0.734	0.245	1	3	8,650	0.00001	0.0002	0.3950	21.65	--	--	0.000	--	--	0.000	0.000	2.22E-5
																		TOTAL	**10.388**	**5.194**	**0.779**

[1] *Zero denotes winds did not exceed the threshold for a surface regime.*

Off-Site Transport Emissions

Air Sciences Inc.	PROJECT TITLE: Thacker Pass			BY: E. Huelson
	PROJECT NO: 270-3-3	PAGE: 1	OF: 6	SHEET: Off-Site
AIR EMISSION CALCULATIONS	SUBJECT: Off-Site Sources			DATE: December 16, 2019

Off-Site Trucking Emission Summary

Phase 1

	PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY
	PM10	PM2.5	CO	NOX	SO2	VOC
Activity	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr
Reagent Trucking	35.47	8.99	3.17	13.09	3.0E-02	0.53
Product Trucking	2.36	0.60	0.21	0.87	2.0E-03	0.04
Total Off-Site Trucking	37.83	9.59	3.38	13.96	3.2E-02	0.57
	chk	chk	chk	chk	chk	chk

Phase 2

	PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY
	PM10	PM2.5	CO	NOX	SO2	VOC
Activity	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr
Reagent Trucking	70.93	17.98	6.34	26.18	6.1E-02	1.07
Product Trucking	4.73	1.20	0.42	1.75	4.0E-03	0.07
Total Off-Site Trucking	75.66	19.18	6.77	27.93	6.5E-02	1.14
	chk	chk	chk	chk	chk	chk

Off-Site GHG Emission Summary

Phase 1

	CO2e_TPY
	CO2e
Activity	ton/yr
Reagent Trucking	4,547
Product Trucking	303
Product Transport by Rail	312
Total Off-Site Transport	5,162

Phase 2

	CO2e_TPY
	CO2e
Activity	ton/yr
Reagent Trucking	9,095
Product Trucking	606
Product Transport by Rail	623
Total Off-Site Transport	10,325

Air Sciences Inc.	PROJECT TITLE: Thacker Pass	BY: E. Huelson
	PROJECT NO: 270-3-3	PAGE: 2 OF: 6 SHEET: Off-Site
AIR EMISSION CALCULATIONS	SUBJECT: Off-Site Sources	DATE: December 16, 2019

Off-Site Hauling Dust Emissions

Activity Information

Reagent Trucking

Origin	Winnemucca	*(Schonlau 2019a)*
Truck Type	Combination Short-haul Truck	*(Schonlau 2019a)*

Product Trucking

Destination	Winnemucca	*(Schonlau 2019a)*
Truck Type	Combination Short-haul Truck	*(Schonlau 2019a)*

	Phase 1		Phase 2		
Reagent Trucking	21,900	trips/yr	43,800	trips/yr	*(Schonlau 2019c)*
Product Trucking	1,460	trips/yr	2,920	trips/yr	*(Schonlau 2019a)*

Road Information

Route	Haul Length mi*	Road Type	Round Trip mi
Thacker Pass Access Road	0.75	Paved	1.5
SR-293	19.0	Paved	38
US-95	43.6	Paved	87.2

**Route length provided by Google Maps*

Road Dust Emission Factors

Paved roads

Emission factor equation	$E = k(sL)^{0.91} * (W)^{1.02}$		*AP-42, Sec. 13.2.1, Eq. 1, 1/11*
sL = Road surface silt loading:			
Thacker Pass Access Road	0.6	g/m^2	*AP-42, Tab. 13.2.1-2, 1/11 (ADT*** = <500); (NDOT 2018)*
SR-293	0.6	g/m^2	*AP-42, Tab. 13.2.1-2, 1/11 (ADT*** = <500); (NDOT 2018)*
US-95	0.2	g/m^2	*AP-42, Tab. 13.2.1-2, 1/11 (ADT*** = 500-5,000); (NDOT 2018)*
			**** ADT - Average daily traffic*
W = Mean vehicle weight	30	ton	*Estimated based on FHA Gross Weight Limit; Loaded truck one way*
P = Days/year with ≥0.01 in precip.	70	day/yr	*AP-42 Fig. 13.2.2-1, 11/06*

	PM	PM10	PM2.5		
k = Size-specific empirical constant	0.011	0.0022	0.00054	lb/VMT	*AP-42, Tab. 13.2.1-1, 1/11*
E = Size-specific emission factor					

Route	PM	PM10	PM2.5	Units
Thacker Pass Access Road	0.222	0.044	0.011	lb/VMT
SR-293	0.222	0.044	0.011	lb/VMT
US-95	0.082	0.016	0.004	lb/VMT

Off-Site Hauling Dust Emissions - continued

Reagent Trucking

Road Dust Emissions

			PM10_TPY	PM2.5_TPY			PM10_TPY	PM2.5_TPY
	Phase 1				Phase 2			
Location of Activity	Total VMT*/yr	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	Total VMT*/yr	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr
Thacker Pass Access Road	32,850	3.64	0.73	0.18	65,700	7.29	1.46	0.36
SR-293	832,200	92.34	18.47	4.53	1,664,400	184.67	36.93	9.07
US-95	1,909,680	77.97	15.59	3.83	3,819,360	155.94	31.19	7.66
Total	Phase 1	173.95	34.79	8.54	Phase 2	347.90	69.58	17.08

** VMT - Vehicle miles traveled*

Product Trucking

Road Dust Emissions

			PM10_TPY	PM2.5_TPY			PM10_TPY	PM2.5_TPY
	Phase 1				Phase 2			
Location of Activity	Total VMT*/yr	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	Total VMT*/yr	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr
Thacker Pass Access Road	2,190	0.24	0.05	0.01	4,380	0.49	0.10	0.02
SR-293	55,480	6.16	1.23	0.30	110,960	12.31	2.46	0.60
US-95	127,312	5.20	1.04	0.26	254,624	10.40	2.08	0.51
Total	Phase 1	11.60	2.32	0.57	Phase 2	23.19	4.64	1.14

** VMT - Vehicle miles traveled*

Conversions

2,000 lb/ton

Off-Site Hauling Tailpipe Emissions

Reagent Trucking

EPA MOVES 2014b Emission Factors

	Emission Factor (lb/VMT)*						
Route	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Thacker Pass Access Road	2.4E-03	9.8E-04	4.7E-03	1.6E-02	3.6E-05	9.0E-04	5.46
SR-293	4.6E-04	3.2E-04	2.3E-03	9.4E-03	2.2E-05	3.8E-04	3.25
US-95	4.6E-04	3.2E-04	2.3E-03	9.4E-03	2.2E-05	3.8E-04	3.25

** (MOVES 2019a)*

Vehicle Emissions - Phase 1

		PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY	CO2e_TPY
Location of	Total	Emissions (ton/yr)						
Activity	VMT*/yr	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Thacker Pass Access Road	32,850	0.04	0.02	0.08	0.26	6.0E-04	0.01	90
SR-293	832,200	0.19	0.13	0.94	3.90	9.0E-03	0.16	1,353
US-95	1,909,680	0.44	0.30	2.16	8.94	2.1E-02	0.36	3,105
Total		0.68	0.45	3.17	13.09	3.0E-02	0.53	4,547

Vehicle Emissions - Phase 2

		PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY	CO2e_TPY
Location of	Total	Emissions (ton/yr)						
Activity	VMT*/yr	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Thacker Pass Access Road	65,700	0.08	0.03	0.15	0.52	1.2E-03	0.03	179
SR-293	1,664,400	0.39	0.26	1.88	7.79	1.8E-02	0.32	2,706
US-95	3,819,360	0.89	0.61	4.31	17.88	4.1E-02	0.72	6,210
Total		1.35	0.90	6.34	26.18	6.1E-02	1.07	9,095

Conversions
2,000 lb/ton

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Off-Site Hauling Tailpipe Emissions - continued

Product Trucking

EPA MOVES 2014b Emission Factors

	Emission Factor (lb/VMT)*						
Route	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Thacker Pass Access Road	2.4E-03	9.8E-04	4.7E-03	1.6E-02	3.6E-05	9.0E-04	5.46
SR-293	4.6E-04	3.2E-04	2.3E-03	9.4E-03	2.2E-05	3.8E-04	3.25
US-95	4.6E-04	3.2E-04	2.3E-03	9.4E-03	2.2E-05	3.8E-04	3.25

** (MOVES 2019a)*

Vehicle Emissions - Phase 1

		PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY	CO2e_TPY
Location of	Total	Emissions (ton/yr)						
Activity	VMT*/yr	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Thacker Pass Access Road	2,190	0.003	0.001	0.01	0.02	4.0E-05	0.001	6
SR-293	55,480	0.013	0.009	0.06	0.26	6.0E-04	0.011	90
US-95	127,312	0.030	0.020	0.14	0.60	1.4E-03	0.024	207
Total		0.045	0.030	0.21	0.87	2.0E-03	0.036	303

Vehicle Emissions - Phase 2

		PM10_TPY	PM2.5_TPY	CO_TPY	NOX_TPY	SO2_TPY	VOC_TPY	CO2e_TPY
Location of	Total	Emissions (ton/yr)						
Activity	VMT*/yr	PM10	PM2.5	CO	NOX	SO2	VOC	CO2e
Thacker Pass Access Road	4,380	0.005	0.002	0.01	0.03	8.0E-05	0.002	12
SR-293	110,960	0.026	0.018	0.13	0.52	1.2E-03	0.021	180
US-95	254,624	0.059	0.040	0.29	1.19	2.8E-03	0.048	414
Total		0.090	0.060	0.42	1.75	4.0E-03	0.071	606

Conversions
2,000 lb/ton

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Off-Site Product Delivery GHG Emissions

Product Transport by Rail

Freight Rail Fuel Efficiency

473 ton-mile/gal diesel *(AAR 2019)*

Rail Distance from Winnemucca to San Francisco

390 miles *(USDOT 2019)*

Lithium Carbonate Equivalent (LCE) End-Products to be Shipped

Phase 1 33,000 ton/yr *(LNC 2019)*
Phase 2 66,000 ton/yr *(LNC 2019)*

Diesel Combusted for Product Shipment

Phase 1 27,209 gal/yr 3,809 MMBtu/yr
Phase 2 54,419 gal/yr 7,619 MMBtu/yr

Diesel GHG Emission Factors:

73.96	kg CO2/MMBtu	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
3.0E-03	kg CH4/MMBtu	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
6.0E-04	kg N2O/MMBtu	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Diesel GHG Emissions - Phase 1

Greenhouse Gas	**Emissions** ton/yr	**Global Warming Potential***	**CO2e** ton/yr
CO2	310.6	1	310.6
CH4	0.013	25	0.3
N2O	0.003	298	0.8
Total GHG			311.6

** 40 CFR 98, Table A-1*

Diesel GHG Emissions - Phase 2

Greenhouse Gas	**Emissions** ton/yr	**Global Warming Potential***	**CO2e** ton/yr
CO2	621.1	1	621.1
CH4	0.025	25	0.6
N2O	0.005	298	1.5
Total GHG			623.3

** 40 CFR 98, Table A-1*

Conversions
907.184 kg/ton
0.14 MMBtu/gal diesel

Construction Emissions

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Construction Emission Summary

Activity	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	Total HAP ton/yr	CO2e ton/yr
Facility and Infrastructure Constructior	95.2	34.5	7.5					0.10	
Mobile Equipment Tailpipe	8.6	8.6	8.6	137.4	269.9	0.31	29.9	0.42	34,109
Pre-Production Waste Rock Removal	41.3	12.8	1.0	30.0	0.8	0.002		0.04	
Total	145.2	55.9	17.2	167.4	270.7	0.31	29.9	0.57	34,109

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Facility and Infrastructure Construction

Activity Information

Construction Schedule 2 years *(LNC 2019)*

Construction Activity	acres	
Mine Facilities	48.3	*(LNC 2019)*
Processing Facilities	555.3	*(LNC 2019)*
Clay Tailings Filter Stack	1,166.1	*(LNC 2019)*
Power Lines	267.7	*(LNC 2019)*
Haul Roads	91.2	

Emission Factors (ton/acre)	PM	PM10	PM2.5		
Site Preparation/Construction	0.089	0.032	0.007	ton/acre	*See calculations below*

Site Preparation Activity[1]	Emission Factor				Emission Factor Reference	Scaling Factor	
	PM	PM10	PM2.5			PM10	PM2.5
Dozing	0.73	0.092	0.077	lb/hr	*AP-42, Tab. 11.9-1, 07/98, (bulldozing, overburden); See sheet: Mine, page 17*		
Scraper unloading	0.04	0.019	0.0029	lb/ton	*AP-42, Tab. 11.9-4, 07/98, (scraper unload); scaling from AP-42, Sec. 13.2.4, 11/06*	0.47	0.072
Scraper in travel	20.2	2.53	2.12	lb/VMT	*See scraping topsoil removal below*		
Scraping topsoil removal	20.2	2.53	2.12	lb/VMT	*AP-42, Tab. 13.2.3-1, 1/95; dozer scaling factors*	0.13	0.11
Material loading	2.1E-4	1.0E-4	1.5E-5	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck loading - crushed stone); See sheet: Mine, page 7*		
Material dumping	3.4E-5	1.6E-5	2.4E-6	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck unloading - fragmented stone); See sheet: Mine, page 7*		
Compacting	0.73	0.092	0.077	lb/hr	*AP-42, Tab. 11.9-1, 07/98, (bulldozing, overburden); See sheet: Mine, page 17*		
Grading	19.13	4.26	0.59	lb/VMT	*AP-42, Tab. 11.9-1, 07/98, (grading); See sheet: Mine, page 17*		

(1) *AP-42, Tab. 13.2.3-1, 1/95*

Construction Operation	Estimated Activity Rate			Estimated Emission Factor (ton/acre) PM	PM10	PM2.5
Dozing[1]	12	hr/ac		4.53E-3	5.68E-4	4.76E-4
Scraper unloading[2]	2,974	ton/ac		5.95E-2	2.81E-2	4.26E-3
Scraper in travel	0.8	VMT/ac	*See scraping topsoil removal below*	8.09E-3	1.02E-3	8.49E-4
Scraping topsoil removal[3]	0.8	VMT/ac		8.09E-3	1.02E-3	8.49E-4
Material loading	2,974	ton/ac	*See scraper unloading above*	3.14E-4	1.49E-4	2.25E-5
Material dumping	2,974	ton/ac	*See scraper unloading above*	5.03E-5	2.38E-5	3.60E-6
Compacting	12	hr/ac	*See dozing above*	4.53E-3	5.68E-4	4.76E-4
Grading[4]	0.5	VMT/ac		4.38E-3	9.76E-4	1.36E-4

(1) *Based on:* 26,280 *hr dozer usage and* 2,129 *acre disturbance* *Total (2-yr) construction activity*

(2) *Based on:* 12.4 *in., scraper cut depth (CAT 621K Scraper) (Caterpillar 2016) &*
132.2 *lb/ft^3, material density* *AP-42, Table 11.9-6, average of overburden density, 10/98*

(3) *Based on:* 10.3 *ft blade width (CAT 621K Scraper) (Caterpillar 2016)*

(4) *Based on:* 18.0 *ft blade width (CAT 18M3 Grader) (Caterpillar 2016)*

Emissions by Area

Area	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr
Mine Facilities	2.16	0.78	0.17
Processing Facilities	24.84	9.01	1.96
Clay Tailings Filter Stack	52.17	18.92	4.12
Power Lines	11.98	4.34	0.95
Haul Roads	4.08	1.48	0.32
Total	95.23	34.54	7.53

Conversions

2,000	lb/ton	43,560	ft2/acre
12	in/ft	5,280	ft/mi

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Mobile Equipment Tailpipes

Final emission factor options:
EPA Engine Certification Data
EPA Non-Road Standards
EPA AP-42 - Diesel

AP-42 Emission Factors

Engine Description	PM	CO	NOX	VOC	Reference	
	Emission Factor (lb/hp-hr)					0
Diesel industrial engines ≤600 hp	0.0022	0.0067	0.0310	0.0025	*AP-42, Table 3.3-1, 10-96*	1
Large stationary diesel engines >600 hp	0.0007	0.0055	0.0240	0.00064	*AP-42, Table 3.4-1, 10-96*	600

EPA Engine Certification Data [(1)]

Vehicle Description	Engine Description	EPA Family No.	PM	PM10	PM2.5	CO	NOX	VOC
			Emission Factor (lb/hp-hr)[(3)]					
Haul Truck	2006 CAT 3512C HD, 1450 hp	6CPXL58.6T2E[(2)]	0.00022	0.00022	0.00022	0.0026	0.0087	0.00064

(1) *(LNC 2019a)*
(2) *No EPA Certification VOC emission factor was provided, so AP-42, Table 3.4-1 was used.*
(3) *(EPA 2019)*

SO2 emission factor:

Diesel Sulfur Content 0.015% *40 CFR 80.510 sulfur content of non-road diesel*

$$\frac{0.0015\%\ \text{lb S}}{\text{lb Fuel}} \times \frac{6.943\ \text{lb Fuel}}{\text{gal Fuel}} \times \frac{64.064\ \text{lb SO2}}{32.065\ \text{lb S}} = \frac{0.000208\ \text{lb SO2}}{\text{gal Fuel}}$$

Mobile Equipment Specifications and Activity [(1)]

Equipment	Category	Total Units[(6)]	Model Year[(2),(3)]	Rating hp	Oper. hr/yr	Avg Load Factor[(4)]	Output hp-hr/yr	Diesel gal/yr	Rating kW	Power Category	
Hydraulic Excavator	Shovel	2	2006	1,530	8,760	65%	17,423,640	871,182	1,141	kW>560	chk
Haul Truck	Mining Truck	5	2006	1,450	8,760	35%	22,228,500	1,111,425	1,081	kW>560	chk
Dozer	Dozer	3	2006	600	8,760	58%	9,066,600	453,330	447	225≤kW<450, ≤2010	chk
Water Truck	Mining Truck	1	2006	1,025	8,760	35%	3,142,650	157,133	764	kW>560	chk
Grader	Grader	1	2006	304	8,760	40%	1,065,216	53,261	227	225≤kW<450, ≤2010	chk
Fuel/Lube Truck	Mining Truck	1	2006	375	8,760	35%	1,149,750	57,488	280	225≤kW<450, ≤2010	chk
Crane	Telehandler	1	2007	160	8,760	35%	490,560	24,528	119	75≤kW<130, ≤2011	chk
Front End Loader	Loader	1	2006	973	8,760	58%	4,901,001	245,050	726	kW>560	chk
Drill Rigs[(5)]	Shovel	1	2015	560	264	65%	96,096	4,805	418	130≤kW<560, Ph-out	chk

(1) *(LNC 2019a)*
(2) *Oldest model year listed based on tier rating*
(3) *(Whitehead 2019c)*
(4) *Average medium application load factor by equipment category (Caterpillar 2016), pages 25-9 to 25-40.*
(5) *(Sandvik 2019)*
(6) *Assume equal to Phase 1; Haul trucks scaled for waste loading only*

Conversions

1.341 hp/kW	32.065 lb S	6.943 lb/gal distillate oil
453.592 g/lb	64.064 lb SO2	

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Mobile Equipment Tailpipes - continued

EPA Non-Road Standards

	Model		EPA	EPA Non-Road Standards (g/kW-hr)				
Equipment	Year	Power Category	Tier	PM	CO	NOX	VOC	Lookup ID
Hydraulic Excavator	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Haul Truck	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Dozer	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Water Truck	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Grader	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Fuel/Lube Truck	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Crane	2007	75≤kW<130, ≤2011	3	0.3	5	4	-	§89-75≤kW<130 2007
Front End Loader	2006	kW>560	2	0.2	3.5	6.4	-	§89-kW>560 2006
Drill Rigs	2015	130≤kW<560, Ph-out	4	0.02	3.5	0.4	0.19	T4-130≤kW≤560 2015

Final Emission Factors

	PM	CO	NOX	VOC	SO2	
Equipment	lb/hp-hr	lb/hp-hr	lb/hp-hr[1]	lb/hp-hr[1]	lb/gal	Final Emission Factor
Hydraulic Excavator	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Haul Truck	0.00022	0.00265	0.00875	0.00064	0.00021	*EPA Engine Certification Data*
Dozer	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Water Truck	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Grader	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Fuel/Lube Truck	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Crane	0.00049	0.00822	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Front End Loader	0.00033	0.00575	0.01052	0.00064	0.00021	*EPA Non-Road Standards*
Drill Rigs	0.00003	0.00575	0.00066	0.00031	0.00021	*EPA Non-Road Standards*

[1] *If the EPA Non-Road Standard is a combined NOX+VOC limit, then NOX = NOX+VOC and VOC is taken from AP-42.*

Mobile Tailpipe Emissions	chk	chk	chk	chk	chk	chk	chk
	PM	PM10	PM2.5	CO	NOX	SO2	VOC
Activity	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr
Hydraulic Excavator	2.86	2.86	2.86	50.13	91.66	0.091	5.59
Haul Truck	2.48	2.48	2.48	29.42	97.21	0.116	7.13
Dozer	1.49	1.49	1.49	26.08	29.81	0.047	11.20
Water Truck	0.52	0.52	0.52	9.04	16.53	0.016	1.01
Grader	0.18	0.18	0.18	3.06	3.50	0.006	1.32
Fuel/Lube Truck	0.19	0.19	0.19	3.31	3.78	0.006	1.42
Crane	0.12	0.12	0.12	2.02	1.61	0.003	0.61
Front End Loader	0.81	0.81	0.81	14.10	25.78	0.025	1.57
Drill Rigs	0.00	0.00	0.00	0.28	0.03	0.000	0.02
Total Tailpipe Emissions	8.65	8.65	8.65	137.44	269.93	0.31	29.85

Conversions

1.341	hp/kW	140,000	Btu/gal diesel
7,000	Btu/hp-hr	453.592	g/lb

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Pre-Production Waste Rock Removal

Open Pit Drilling and Blasting

Activity Information

Annual blast holes drilled	15,971	hole/yr	*(Whitehead 2019a)*
Blasts per year	11	blast/yr	*(Whitehead 2019a)*
Blast area	108,200	ft^2/blast	*(Whitehead 2019a)*
ANFO consumption	894	ton/yr	*(Whitehead 2019a)*
ANFO diesel content	8%		*AP-42, Table 13.3-1, 2/80 (ANFO max. FO content)*

Drilling Emission Factors

TSP (PM)	1.3	lb/hole	*AP-42, Table 11.9-4, 7/98 (overburden)*

PM Scaling Factors

PM_{10}	0.52	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*
$PM_{2.5}$	0.03	*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*

Blasting Emission Factors

Emission factor equation	TSP (lb/blast) = 0.000014 x $A^{1.5}$		*AP-42, Table 11.9-1, 7/98 (blasting, overburden)*
A = Area per blast	108,200	ft^2	
TSP (PM)	498.27	lb/blast	
CO	67	lb CO/ton - ANFO	*AP-42, Table 13.3-1, 2/80 (ANFO)*
NOX	0.9	kg/t-ANFO	*(CSIRO 2008)*
	1.8	lb NOX/ton - ANFO	
SO2	4.8E-03	lb SO2/ton-ANFO	*Based on 15 ppm S in FO and a maximum of 8% FO in ANFO*

$$\frac{1.5\text{E-}05\ \text{lb S}}{\text{lb FO}} \times \frac{64.0638\ \text{lb SO2}}{32.065\ \text{lb S}} \times \frac{8\%\ \text{lb FO}}{\text{lb ANFO}} \times \frac{2{,}000\ \text{lb ANFO}}{\text{ton ANFO}} = \frac{0.00480\ \text{lb SO2}}{\text{ton ANFO}}$$

PM Scaling Factors

PM_{10}	0.52	*AP-42, Tab. 11.9-1, 7/98 (blasting, overburden)*
$PM_{2.5}$	0.03	*AP-42, Tab. 11.9-1, 7/98 (blasting, overburden)*

Open Pit Drilling and Blasting Emissions

Activity	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr
Drilling	10.38	5.40	0.31			
Blasting	2.74	1.43	0.08	29.96	0.80	0.002
Total	13.12	6.82	0.39	29.96	0.80	0.002

Conversions

2,000	lb/ton	1.102	ton/t	64.0638	M.W. SO2
2.205	lb/kg	453.592	g/lb	32.065	M.W. S

Pre-Production Waste Rock Removal - continued

Onsite Hauling

Hauling Routes, Production Rates and Distances tpy

Route Origin	Route Destination	Material Hauled [1] Material Type	Rate ton/yr	Truck Loads load/yr	One-Way Hauling [2] mi	Total Travel [3] VMT/yr
Unpaved Roads						
Pit	West WRSF	Waste	2,105,302	13,410	2.09	55,986
Pit	East WRSF	Waste	859,912	5,478	2.55	27,980
Total			2,965,214			83,966

(1) *(Schonlau 2019b)*
(2) *Estimated mileage based on Thacker Pass Site Layout (LNC 2019c)*
(3) *Total VMT distributed based on Material Hauled and One-Way Hauling distance.*

Truck Fleet

Truck	Payload Capacity ton	Empty Weight ton	Average Weight ton	
CAT 785D	157	118	196.5	*Loaded trucks one way* *(LNC 2019a)*

Emission Factors

Unpaved roads

Emission factor equation	$E = k(s/12)^a (W/3)^b [(365-P)/365]$				*AP-42, Sec. 13.2.2, Eq. 1a, 11/06*
s = Surface material silt content	1.7 %				*(EPA 2003)*
W = Mean vehicle weight	196.5 ton				
P = Days/year with ≥0.01 in precip.	70 day/yr				*AP-42 Fig. 13.2.2-1, 11/06*
	PM	PM10	PM2.5		
k = Size-specific empirical constant	4.9	1.5	0.15		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
a = Size-specific empirical constant	0.7	0.9	0.9		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
b = Size-specific empirical constant	0.45	0.45	0.45		*AP-42, Tab. 13.2.2-2, Eqs. 1a and 2, 11/06*
E = Size-specific emission factor	6.62	1.37	0.14	lb/VMT	

Emission Controls

Unpaved roads - periodic application of water and chemical dust suppressant

Control efficiency: 90% *(Air Sciences 2018)*

Hauling Emissions

Route Origin	Route Destination	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr
Unpaved Roads				
Pit	West WRSF	18.53	3.84	0.38
Pit	East WRSF	9.26	1.92	0.19
Total		27.80	5.76	0.58

Conversions

2,000 lb/ton

Pre-Production Waste Rock Removal - continued

Material Load / Unload

Throughput Rates chk

Location of Activity	No. of Xfers	Rate ton/yr	Total Rate ton/yr	Xfer Description
Pit	1	2,965,214	2,965,214	Load
West WRSF	1	2,105,302	2,105,302	Unload
East WRSF	1	859,912	859,912	Unload

Emission Factors

		PM	PM10	PM2.5		
k = Particle size multiplier		0.74	0.35	0.053		*AP-42, Sec. 13.2.4, Pg. 4, 11/06*
E = Emission factor	Load	0.00021	0.0001	0.000015	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck loading - crushed stone)*
	Unload	0.00003	0.000016	0.0000024	lb/ton	*AP-42, Table 11.19.2-2, 8/04 (truck unloading - fragmented stone)*

Material Load/Unload Emissions chk

Location of Activity		Total Rate ton/yr	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr
Pit	Load	2,965,214	0.31	0.15	0.02
West WRSF	Unload	2,105,302	0.04	0.02	0.003
East WRSF	Unload	859,912	0.01	0.01	0.001
Total		5,930,428	0.36	0.17	0.03

Conversions
2,000 lb/ton

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AIR EMISSION CALCULATIONS	SUBJECT: Construction Emissions	DATE: December 13, 2019

Hazardous Air Pollutants (HAP) and Greenhouse Gases (GHG)

Mobile Source - Diesel Engines

Source Data

Description	Fuel	Output hp-hr/yr	Fuel Consumption MMBtu/yr*	HAP ton/yr	CO2e ton/yr
Total Mobile Small Diesel Engines (<=600 hp)	Diesel	11,868,222	83,078	1.6E-01	6,796
Total Mobile Large Diesel Engines (>600 hp)	Diesel	47,695,791	333,871	2.6E-01	27,313
** Based on brake specific fuel consumption of*	7,000 *Btu/hp-hr*	*AP-42, Table 3.3-1*		chk	chk

Diesel HAP Emission Factors and Emissions

Pollutant	POM	Emission Factor* Small Diesel Engines <=600 hp lb/MMBtu	Emission Factor* Large Diesel Engines >600 hp lb/MMBtu	Emissions ton/yr
Benzene		9.33E-04	7.76E-04	1.68E-01
Toluene		4.09E-4	2.81E-4	6.39E-02
Xylenes		2.85E-4	1.93E-4	4.41E-02
1,3-Butadiene		3.91E-5	0.00E+0	1.62E-03
Formaldehyde		1.18E-3	7.89E-5	6.22E-02
Acetaldehyde		7.67E-4	2.52E-5	3.61E-02
Acrolein		9.25E-5	7.88E-6	5.16E-03
Naphthalene	POM	8.48E-5	1.30E-4	2.52E-02
Acenaphthylene	POM	5.06E-6	9.23E-6	1.75E-03
Acenaphthene	POM	1.42E-6	4.68E-6	8.40E-04
Fluorene	POM	2.92E-5	1.28E-5	3.35E-03
Phenanthrene	POM	2.94E-05	4.08E-05	8.03E-03
Anthracene	POM	1.87E-06	1.23E-06	2.83E-04
Fluoranthene	POM	7.61E-06	4.03E-06	9.89E-04
Pyrene	POM	4.78E-06	3.71E-06	8.18E-04
Benz(a)anthracene	POM	1.68E-06	6.22E-07	1.74E-04
Chrysene	POM	3.53E-07	1.53E-06	2.70E-04
Benzo(b)fluoranthene	POM	9.91E-08	1.11E-06	1.89E-04
Benzo(k)fluoranthene	POM	1.55E-07	2.18E-07	4.28E-05
Benzo(a)pyrene	POM	1.88E-07	2.57E-07	5.07E-05
Indeno(1,2,3-cd)pyrene	POM	3.75E-07	4.14E-07	8.47E-05
Dibenz(a,h)anthracene	POM	5.85E-07	3.46E-07	8.21E-05
Benzo(g,h,i)perylene	POM	4.89E-07	5.56E-07	1.13E-04
POM Subtotal				*4.23E-02*
Total HAP				4.24E-01

** AP-42, Table 3.3-2, (10/96), Gasoline and Diesel Industrial Engines; Tables 3.4-3 & 3.4-4, (10/96), Large Stationary Diesel and all Stationary Dual-fuel Engines*

Conversions

2,000 lb/ton

1,000,000 Btu/MMBtu

Hazardous Air Pollutants (HAP) and Greenhouse Gases (GHG) - continued

Mobile Source - Diesel Engines - continued

Diesel GHG Emission Factors:	73.96 *kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03 *kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04 *kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Diesel Combustion 416,948 *MMBtu/yr*

Diesel GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	33,993	1	33,993
CH4	1.4	25	34
N2O	0.3	298	82
Total GHG			34,109

** 40 CFR 98, Table A-1*

Fugitive Dust Sources

Activity Information

Activity	PM ton/yr	HAP ton/yr
Facility and Infrastructure Construction	95.23	1.01E-01
Pre-Production Waste Rock Removal	41.28	4.39E-02
Total Fugitive Dust	136.51	1.45E-01
		chk

Construction and Waste Dust HAP Concentrations * and Emissions

Pollutant	Ore/Waste ppm	Emissions ton/yr
Antimony	12.46	1.70E-03
Arsenic	119.12	1.63E-02
Beryllium	5.10	6.96E-04
Cadmium	0.34	4.67E-05
Chromium	8.72	1.19E-03
Cobalt	6.95	9.49E-04
Lead	12.22	1.67E-03
Manganese	659.99	9.01E-02
Nickel	14.19	1.94E-03
Phosphorus	223.10	3.05E-02
Selenium	1.38	1.88E-04
Total HAP		1.45E-01

** (LNC 2019b)*

Conversions
2,000 lb/ton
907.184 kg/ton

Exploration Emissions

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Exploration Emission Summary

Activity	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr	Total HAP ton/yr	CO2e ton/yr
Exploration Operations	4.4	1.5	0.2					4.7E-03	
Mobile Equipment Tailpipe	0.3	0.3	0.3	15.2	9.3	0.03	2.4	6.1E-02	3,018
Total	4.7	1.8	0.5	15.2	9.3	0.03	2.4	0.07	3,018

Air Sciences Inc.	PROJECT TITLE: Thacker Pass			BY: E. Huelson
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AIR EMISSION CALCULATIONS	SUBJECT: Exploration Emissions	DATE: December 13, 2019		

Exploration Operations

Activity Information

Operating Schedule	4	month/yr			*Exploration during summer months only*
Duration	41	yr	164	mo	*(LNC 2019)*
Exploration disturbance	150	acres	0.91	acre/mo	*(LNC 2019)*
Total wet drilling (maximum)	600	holes	15	holes/yr	*(LNC 2019)*
Average core length	600	ft			*(LNC 2019)*

Construction Emission Factors

PM	1.2	ton/acre per month of activity	*AP-42, Page 13.2.3-1, 1/95*

Wet Drilling Emission Factors

PM10	8.0E-5	lb/ton (material blasted)	*AP-42, Table 11.19.2-2 (wet drilling), Rev. 8/04*
Typical blast size	772.1	ton blasted/hole	*(Dyno 2010)*
	0.062	lb PM10/hole	

PM Scaling Factors

PM	0.74	*AP-42, Sec. 13.2.4-4, 11/06*
PM10	0.35	*AP-42, Sec. 13.2.4-4, 11/06*
PM2.5	0.053	*AP-42, Sec. 13.2.4-4, 11/06*

Exploration Operations Emissions

Activity	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr
Drill Pad and Access Road Construction	4.39	1.54	0.23
Exploration Drilling	9.6E-04	4.5E-04	6.8E-05
Total	4.39	1.54	0.23

Conversions

2,000	lb/ton
12	in/ft

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Mobile Equipment Tailpipes

Activity Information

Operating Schedule 4 month/yr 2,880 hr/yr *Exploration during summer months only*

Final emission factor options:

EPA Engine Certification Data
EPA Non-Road Standards
EPA AP-42 - Diesel

AP-42 Emission Factors

	Emission Factor (lb/hp-hr)					
Engine Description	PM	CO	NOX	VOC	Reference	0
Diesel industrial engines ≤600 hp	0.0022	0.0067	0.0310	0.0025	*AP-42, Table 3.3-1, 10-96*	1
Large stationary diesel engines >600 hp	0.0007	0.0055	0.0240	0.00064	*AP-42, Table 3.4-1, 10-96*	600

SO2 emission factor:

Diesel Sulfur Content 0.0015% *40 CFR 80.510 sulfur content of non-road diesel*

$$\frac{0.0015\%\ \text{~~lb S~~}}{\text{~~lb Fuel~~}} \Big| \frac{6.943\ \text{~~lb Fuel~~}}{\text{gal Fuel}} \Big| \frac{64.064\ \text{lb SO2}}{32.065\ \text{~~lb S~~}} = \frac{0.000208\ \text{lb SO2}}{\text{gal Fuel}}$$

Mobile Equipment Specifications and Activity [(1)]

Equipment	Category	Total Units	Model Year[(2)]	Rating hp[(3)]	Oper. hr/yr	Avg Load Factor[(4)]	Output hp-hr/yr	Diesel gal/yr	Rating kW	Power Category	
Hydraulic Excavator	Shovel	1	2011	665	2,880	65%	1,244,880	62,244	496	130≤kW<560, Ph-out	chk
Dozer	Dozer	1	2006	600	2,880	58%	993,600	49,680	447	225≤kW<450, ≤2010	chk
Supervisor Truck	Mining Truck	2	2018	450	2,880	35%	907,200	45,360	336	130≤kW<560, Ph-out	chk
Pipe Truck	Mining Truck	4	2018	450	2,880	35%	1,814,400	90,720	336	130≤kW<560, Ph-out	chk
Drill Rigs[(5)]	Shovel	4	2006	340	351	65%	310,478	15,524	254	225≤kW<450, ≤2010	chk

(1) *(LNC 2019)*
(2) *Oldest model year listed based on tier rating*
(3) *(Caterpillar 2016)*
(4) *Average medium application load factor by equipment category (Caterpillar 2016), pages 25-9 to 25-40.*
(5) *(Sandvik 2019a)*

Conversions

24 hr/day	32.065 lb S	140,000 Btu/gal diesel
1.341 hp/kW	64.064 lb SO2	7,000 Btu/hp-hr
453.592 g/lb	6.943 lb/gal distillate oil	

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Mobile Equipment Tailpipes - continued

EPA Non-Road Standards

Equipment	Model Year	Power Category	EPA Tier	PM (g/kW-hr)	CO (g/kW-hr)	NOX (g/kW-hr)	VOC (g/kW-hr)	Lookup ID
Hydraulic Excavator	2011	130≤kW<560, Ph-out	4i	0.02	3.5	4	-	T4i-130≤kW<560 2011Ph-out
Dozer	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006
Supervisor Truck	2018	130≤kW<560, Ph-out	4	0.02	3.5	0.4	0.19	T4-130≤kW≤560 2015
Pipe Truck	2018	130≤kW<560, Ph-out	4	0.02	3.5	0.4	0.19	T4-130≤kW≤560 2015
Drill Rigs	2006	225≤kW<450, ≤2010	3	0.2	3.5	4	-	§89-225≤kW<450 2006

Final Emission Factors

Equipment	PM lb/hp-hr	CO lb/hp-hr	NOX lb/hp-hr[1]	VOC lb/hp-hr[1]	SO2 lb/gal	Final Emission Factor
Hydraulic Excavator	0.00003	0.00575	0.00658	0.00064	0.00021	*EPA Non-Road Standards*
Dozer	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*
Supervisor Truck	0.00003	0.00575	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Pipe Truck	0.00003	0.00575	0.00066	0.00031	0.00021	*EPA Non-Road Standards*
Drill Rigs	0.00033	0.00575	0.00658	0.00247	0.00021	*EPA Non-Road Standards*

[1] *If the EPA Non-Road Standard is a combined NOX+VOC limit, then NOX = NOX+VOC and VOC is taken from AP-42.*

Mobile Tailpipe Emissions

Activity	PM ton/yr	PM10 ton/yr	PM2.5 ton/yr	CO ton/yr	NOX ton/yr	SO2 ton/yr	VOC ton/yr
Hydraulic Excavator	0.02	0.02	0.02	3.58	4.09	0.006	0.40
Dozer	0.16	0.16	0.16	2.86	3.27	0.005	1.23
Supervisor Truck	0.01	0.01	0.01	2.61	0.30	0.005	0.14
Pipe Truck	0.03	0.03	0.03	5.22	0.60	0.009	0.28
Drill Rigs	0.05	0.05	0.05	0.89	1.02	0.002	0.38
Total Tailpipe Emissions	0.28	0.28	0.28	15.16	9.28	0.03	2.43

Conversions

2,000 lb/ton
1.341 hp/kW
453.592 g/lb

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AIR EMISSION CALCULATIONS	SUBJECT: Exploration Emissions	DATE: December 13, 2019

Hazardous Air Pollutants (HAP) and Greenhouse Gases (GHG)

Mobile Source - Diesel Engines

Source Data

Description	Fuel	Output hp-hr/yr	Fuel Consumption MMBtu/yr*	HAP ton/yr	CO2e ton/yr
Total Mobile Small Diesel Engines (<=600 hp)	Diesel	4,025,678	28,180	5.5E-02	2,305
Total Mobile Large Diesel Engines (>600 hp)	Diesel	1,244,880	8,714	6.9E-03	713

** Based on brake specific fuel consumption of* 7,000 *Btu/hp-hr* *AP-42, Table 3.3-1* chk chk

Diesel HAP Emission Factors and Emissions

Pollutant	POM	Emission Factor* Small Diesel Engines <=600 hp lb/MMBtu	Emission Factor* Large Diesel Engines >600 hp lb/MMBtu	Emissions ton/yr
Benzene		9.33E-04	7.76E-04	1.65E-02
Toluene		4.09E-4	2.81E-4	6.99E-03
Xylenes		2.85E-4	1.93E-4	4.86E-03
1,3-Butadiene		3.91E-5	0.00E+0	5.51E-04
Formaldehyde		1.18E-3	7.89E-5	1.70E-02
Acetaldehyde		7.67E-4	2.52E-5	1.09E-02
Acrolein		9.25E-5	7.88E-6	1.34E-03
Naphthalene	POM	8.48E-5	1.30E-4	1.76E-03
Acenaphthylene	POM	5.06E-6	9.23E-6	1.12E-04
Acenaphthene	POM	1.42E-6	4.68E-6	4.04E-05
Fluorene	POM	2.92E-5	1.28E-5	4.67E-04
Phenanthrene	POM	2.94E-05	4.08E-05	5.92E-04
Anthracene	POM	1.87E-06	1.23E-06	3.17E-05
Fluoranthene	POM	7.61E-06	4.03E-06	1.25E-04
Pyrene	POM	4.78E-06	3.71E-06	8.35E-05
Benz(a)anthracene	POM	1.68E-06	6.22E-07	2.64E-05
Chrysene	POM	3.53E-07	1.53E-06	1.16E-05
Benzo(b)fluoranthene	POM	9.91E-08	1.11E-06	6.23E-06
Benzo(k)fluoranthene	POM	1.55E-07	2.18E-07	3.13E-06
Benzo(a)pyrene	POM	1.88E-07	2.57E-07	3.77E-06
Indeno(1,2,3-cd)pyrene	POM	3.75E-07	4.14E-07	7.09E-06
Dibenz(a,h)anthracene	POM	5.85E-07	3.46E-07	9.75E-06
Benzo(g,h,i)perylene	POM	4.89E-07	5.56E-07	9.31E-06
POM Subtotal				*3.29E-03*
Total HAP				6.14E-02

** AP-42, Table 3.3-2, (10/96), Gasoline and Diesel Industrial Engines; Tables 3.4-3 & 3.4-4, (10/96), Large Stationary Diesel and all Stationary Dual-fuel Engines*

Conversions
2,000 lb/ton
1,000,000 Btu/MMBtu

Hazardous Air Pollutants (HAP) and Greenhouse Gases (GHG) - continued

Mobile Source - Diesel Engines - continued

Diesel GHG Emission Factors:	73.96 *kg CO_2/MMBtu*	*40 CFR Part 98, Table C-1 to Subpart C (11/2013) No.2*
	3.0E-03 *kg CH_4/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*
	6.0E-04 *kg N_2O/MMBtu*	*40 CFR Part 98, Table C-2 to Subpart C (11/2013) Petroleum*

Total Diesel Combustion 36,894 *MMBtu/yr*

Diesel GHG Emissions

Greenhouse Gas	Emissions ton/yr	Global Warming Potential*	CO2e ton/yr
CO2	3,008	1	3,008
CH4	0.12	25	3.1
N2O	0.02	298	7.3
Total GHG			3,018

** 40 CFR 98, Table A-1*

Fugitive Dust Sources

Activity Information

Activity	PM ton/yr
Exploration Operations	4.39

Construction and Waste Dust HAP Concentrations * and Emissions

Pollutant	Ore/Waste ppm	Emissions ton/yr
Antimony	12.46	5.47E-05
Arsenic	119.12	5.23E-04
Beryllium	5.10	2.24E-05
Cadmium	0.34	1.50E-06
Chromium	8.72	3.83E-05
Cobalt	6.95	3.05E-05
Lead	12.22	5.37E-05
Manganese	659.99	2.90E-03
Nickel	14.19	6.23E-05
Phosphorus	223.10	9.80E-04
Selenium	1.38	6.06E-06
Total HAP		4.67E-03

** (LNC 2019b)*

Conversions
2,000 lb/ton
907.184 kg/ton

Conversion Factors

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Conversions

60	sec/min
3,600	sec/hr
60	min/hr
24	hr/day
8,760	hr/yr
365	day/yr
7,000	gr/lb
453.592	g/lb
1,000	kg/mt
2.20462	lb/kg
2,000	lb/ton
907.184	kg/ton
1.10231	ton/t
12	in/ft
5280	ft/mi
3.28084	ft/m
1609.34	m/mi
2.2369	mi/hr per m/s
4046.9	m^2/acre
43,560	ft^2/acre
27	ft^3/yd^3
35.3147	ft^3/m^3
7.48052	gal/ft^3
3785.41	cm^3/gal
3.78541	L/gal
22.4	L/mol
1.341	hp/kW
292.9	kW-hr/MMBtu
459.67	°R at 0°F
68	°F, standard
273.15	K at 0°C
32	°F at 0°C
1.8	°F/°C
1	atm, standard
8.34	lb H_2O/gal
1.0E+06	Btu/MMBtu
1,000	gal/kgal
51.7149	mmHg/psi

Fuel Specifications

15	ppm S content	*40 CFR 80.510 (Non-road diesel)*
6.943	lb/gal distillate oi	*(NDEP 2019)*
32.065	lb/lb-mol S, and	
64.06	lb/lb-mol SO2	
0.007	MMBtu/hp-hr	*Diesel*
7,000	Btu/hp-hr	*AP-42, Sec. 3.3, (diesel engine fuel use per hp output)*
140,000	Btu/gal diesel	*(NDEP 2019)*
0.14	MMBtu/gal diesel	
91,500	Btu/gal propane	*AP-42, Table 1.5-1 (07/08) Footnote a*
0.0915	MMBtu/gal Propane	
4.24	lb/gal Propane @ 60	*AP-42, App. A*
6.17	lb/gal gasoline	*AP-42, App. A*
0.13	MMBtu/gal gasoline	*AP-42, App. A*
8.34	lb/gal water	
1,020	Btu/scf natural gas	*NDEP Default*

Molecular Weights

64.0638	M.W. SO2
32.065	M.W. S
15.9994	M.W. O
28.01	M.W. CO
1.008	M.W. H
35.453	M.W. Cl
14.0067	M.W. N

Diesel SO2

15 ~~parts S~~	6.943 ~~lb~~	64.06 SO2	~~gal~~	7,440 ~~Btu*~~	=	1.1E-05 lb SO2
1.0E+06	~~gal diese~~	32.065 ~~S~~	140,000 ~~Btu~~	hp-hr		hp-hr

**Conservative value for Clarke Fire Pump Engines (Clarke 2019)*

15 ~~parts S~~	6.943 lb	64.06 SO2	~~gal~~	=	0.0015 lb SO2
1.0E+06	~~gal diese~~	32.065 ~~S~~	0.14 MMBtu		MMBtu

Propane S

185 ~~lb~~ S	44.08 ~~lb C3H8~~	~~lb mol~~	7,000 gr	100 ~~SCF~~	=	15.90 gr S
1.00E+06 ~~lb C3H8~~	~~lb mol~~	359.05 ~~SCF (0C)~~	~~lb~~	100SCF		100 SCF

AP-42, Chapter 13.2.4 Particle Size Fractions

0.35	PM10
0.053	PM2.5

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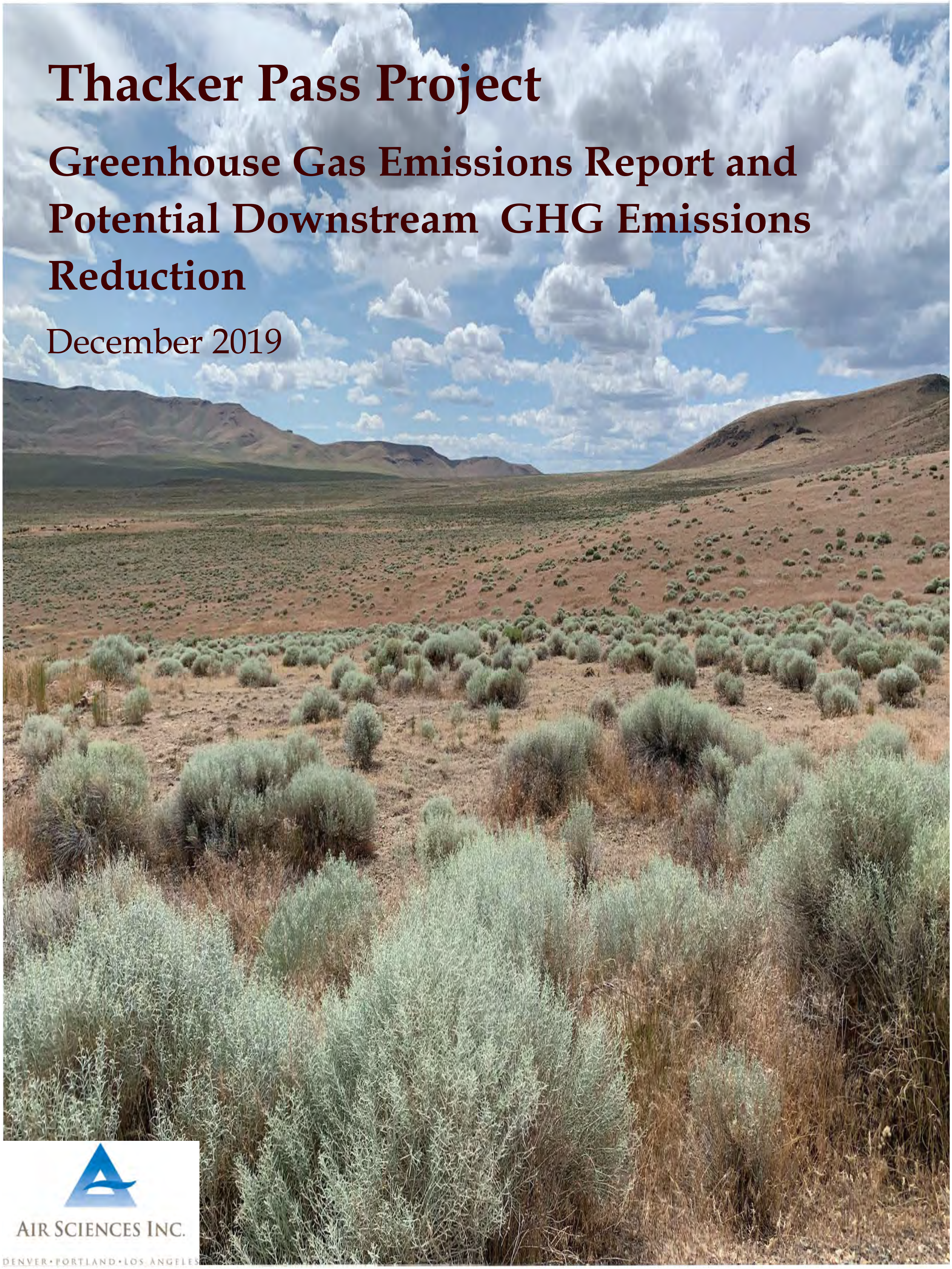
THACKER PASS EMISSIONS AND DOWNSTREAM REDUCTIONS REPORT

(DECEMBER 2019)

Thacker Pass Project

Greenhouse Gas Emissions Report and Potential Downstream GHG Emissions Reduction

December 2019



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Lithium Nevada

Thacker Pass Project

Greenhouse Gas Emissions Report and

Potential Downstream GHG Emissions Reduction

December 2019

Table of Contents

1. Thacker Pass Project Purpose and Need

The purpose of Lithium Nevada Corp.'s (LNC) Thacker Pass Project is to develop the premier lithium operation in the U.S. through an innovative processing approach, engagement with partners, communities and customers, and a commitment to principled entrepreneurship and sustainable development. The proposed production from the operation is anticipated to meet most or all of U.S. lithium demand, thereby significantly reducing exposure to foreign supplies. The Project's design is sensitive to greenhouse gas (GHG) emissions, water demand, and ecological areas.

The Thacker Pass Project will operate in two phases. Phase 1 includes mining and processing for the first four years of the mine life with an average mining rate of 7.7 million tons per year (tpy) on a wet basis and an average annual production of approximately 33,000 tpy of lithium carbonate equivalent (LCE) end-products. Phase 2 is planned to occur from years five to 41, while recognizing that the development of Phase 2 is contingent and dependent upon several factors including market conditions. As planned, Phase 2 would have an average mining rate of approximately 11 million tpy on a wet basis and an average annual production of approximately 66,000 tpy of LCE end-products.

The versatile properties of lithium make it a sought-after metal for many applications. Significant future demand increases of lithium are projected because of its widespread use in electric vehicle batteries and stationary energy storage – technology designed for global transition to renewable energy. The only lithium production in the U.S. in recent years has been from a small brine operation in Nevada. Due to rapidly rising demand by the uptake in electric vehicles and stationary energy storage, securing lithium supply has become a top priority for battery producers and vehicle manufacturers.

Lithium is contained on a list of 35 critical minerals defined by the United States Department of the Interior (83 Federal Registrar [FR] 23295) pursuant to Executive Order 13817 of December 20, 2017, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." The executive order includes a policy clause for "streamlining leasing and permitting processes to expedite exploration, production, processing, reprocessing, recycling, and domestic refining of critical minerals."

2. Greenhouse Effect

Solar radiation strikes the Earth's atmosphere primarily in the form of visible light and ultraviolet (UV) waves. About 30% of this radiation is immediately reflected back into outer space. The other 70% of radiation is absorbed by the Earth's oceans, lands, and atmosphere. As the Earth's oceans, lands, and atmosphere heat up from the absorption of solar radiation, infrared (IR) thermal radiation is released. Greenhouse gases in the atmosphere capture IR radiation, preventing the heat from escaping and keeping the earth warm. This process is called the greenhouse effect. The Earth's temperature increases (i.e., less IR radiation escapes) as more greenhouse gases accumulate in the atmosphere.

3. Regulatory Framework

While recognizing the flux in the Council on Environmental Quality (CEQ) guidance and the uncertainty in the adoption of internal treaties by the U.S. as described below, LNC has commissioned this report as part of the NEPA process to assist the BLM in taking a "hard look" at possible GHG emissions related to the Thacker Pass Project and related impacts.

3.1 International Treaties and Agreements on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty that was adopted May 9, 1992 and came into effect March 21, 1994. The objective of this treaty is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The United States signed the UNFCCC treaty on June 12, 1992 and ratified the treaty on October 15, 1992.

The Kyoto Protocol, which was adopted January 11, 1997 and came into effect February 16, 2005, extends the UNFCCC. The Protocol identifies six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The United States has not ratified the Kyoto Protocol.

The Paris Agreement, which was signed in 2016, is an agreement within the UNFCCC that deals with greenhouse gas emission mitigation, adaptation, and finance. The long-term goal of the Paris Agreement is to keep the increase of global average temperature to well below 2°C above pre-industrial levels, and to limit the temperature increase to 1.5°C. The United States signed the Paris Agreement in April 2016 and announced its intent to withdraw from the Paris Agreement on June 1, 2017.

3.2 Council on Environmental Quality

In 1997, the White House Council on Environmental Quality (CEQ) informed federal agencies that, to ensure compliance with the National Environmental Policy Act (NEPA), they may need to consider whether their actions may affect or be affected by climate change. Since its original guidance, CEQ issued revised draft guidance in 2010 and 2014.

In 2016, after receiving public comments and other feedback from Members of Congress, state agencies, tribes, corporations, trade associations, and other stakeholders, CEQ released final guidance on the consideration of GHG emissions and climate change impacts in NEPA reviews. To determine a federal action's potential to affect climate change, the Guidance recommends that agencies use existing tools to quantify GHG emissions. It also recommends that agencies coordinate with CEQ to identify actions they approve that normally warrant or do not warrant quantification of GHG emissions. Further, the Guidance recommends that agencies consider a proposal's GHG emissions via the following elements of the NEPA process:

- Scoping process – Identify the scope broadly enough to ensure that reasonably connected actions affecting GHG emissions are assessed.
- Alternatives Analysis – Identify and consider alternatives that mitigate GHG emissions.
- Impact Analysis – When direct and indirect GHG emissions are quantified, use those data when analyzing the proposal's direct and indirect effects.
- Mitigation Measures – Identify verifiable, enforceable activities that could reduce a proposal's GHG emissions.

The 2016 Final Guidance on the consideration of GHGs was rescinded via an executive order in 2017. The draft 2014 CEQ guidance indicates a quantitative analysis of GHG emissions is warranted if greater than 25,000 metric tons CO_2e (carbon dioxide equivalent) are emitted on an annual basis. The draft 2019 CEQ guidance states that agencies should attempt to quantify a project's "direct and reasonably foreseeable indirect GHG emissions when the amount of those emissions is substantial enough to warrant quantification, and when it is practicable to quantify them using available data and GHG quantification tools."

3.3 Mobile Source Regulations

The EPA has implemented regulations for GHG emission standards for light-duty and heavy-duty vehicles, heavy-duty engines, and renewable fuel standards for the purpose of reducing GHG emissions.

3.4 EPA GHG Reporting and Global Warming Potentials

The preparation of this report has considered possible emissions relating to the six gases listed under the Kyoto Protocol. Total GHG emissions are reported as carbon dioxide equivalents (CO_2e).

Different GHGs have different atmospheric lifetimes. Some, such as CH_4, react in the atmosphere relatively quickly (on the order of 12 years; see EPA 2018a); others, such as CO_2, typically last for hundreds of years or longer. GHGs also vary with respect to the amount of outgoing radiation absorbed by each gas molecule relative to the amount of incoming radiation it allows to pass through (i.e., its level of radiative forcing). A molecule of N_2O is far more effective at absorbing outgoing radiation than a molecule of CO_2. The impact of a given GHG species on global warming depends both on its radiative forcing and how long it lasts in the atmosphere.

Climate scientists have calculated a GWP for each GHG that accounts for these effects. GWPs are calculated for each GHG species for a specified time interval (typically 20 or 100 years). The GWP for CO_2 is assigned a value of 1, and GWPs for other gases are defined relative to CO_2. GWP is the time-integrated direct (and potentially indirect) radiative forcing of an amount of a GHG species released instantaneously into the atmosphere relative to that of an equal amount of CO_2.

GWP values allow for a direct comparison of the impacts of emissions of different GHGs. Emissions of different GHGs are typically calculated in terms of their CO_2 equivalent emissions defined as the weighted sum of the emissions of each GHG where the weights are the GWPs.

Because the GWP of a given GHG depends in part on the atmospheric lifetime of the GHG, GWP values depend on the time interval for which they are estimated. The GWP for a relatively short-lived GHG, such as CH_4, is larger over a short time period (for example, 20 years) as compared with a much longer time period (such as 100 years) because most of the CH_4 be removed from the atmosphere through oxidation well before 100 years have passed. Conversely, very long-lived GHGs have a 20-year GWP that is lower than the 100-year GWP because the time integrated radiative forcing is less (relative to CO_2) over the shorter time interval.

As a result of various complex feedbacks in the earth-atmosphere system, GWPs can only be roughly estimated; according to the IPCC, GWPs have an uncertainty of ±30 percent and ±39 percent for the 20-year and 100-year CH_4 GWPs, respectively, and ±21 percent and ±29 percent for the 20-year and 100-year N_2O GWPs, respectively (IPCC 2013). Estimates of GWPs have been updated over the years as the models used to calculate them have been refined and to reflect the changing composition of the atmosphere that impacts the GWP of each additional ton of GHG emissions. GWPs have been calculated for several GHGs over different time horizons, including 20 years, 100 years, and 500 years. The choice of time horizon depends on the type of application and policy context; hence, no single time horizon is optimal for all policy goals. The United Nations Framework Convention on Climate Change and its Kyoto Protocol adopted the 100-year GWP, and it is used widely as the default measure.

In this report, carbon dioxide equivalents are calculated using the global warming potential (GWP) of each gas on a 100-year time horizon. The GWPs for each chemical specific GHG (CO_2, CH_4, and N_2O), and the GWPs for an example from each GHG group (HFCs, PFCs, and SF_6) are listed in Table 1.

Table 1. 100-Year GWP for Selected GHGs

Gas	GWP	Gas	GWP
CO_2	1	HFC-23 (CHF_3)	14,800
CH_4	25	PFC14 (CF_4)	7,390
N_2O	298	SF_6	22,800

100-Year GWPs – 40 CFR Part 98 Table A-1

3.5 EPA GHG Permitting

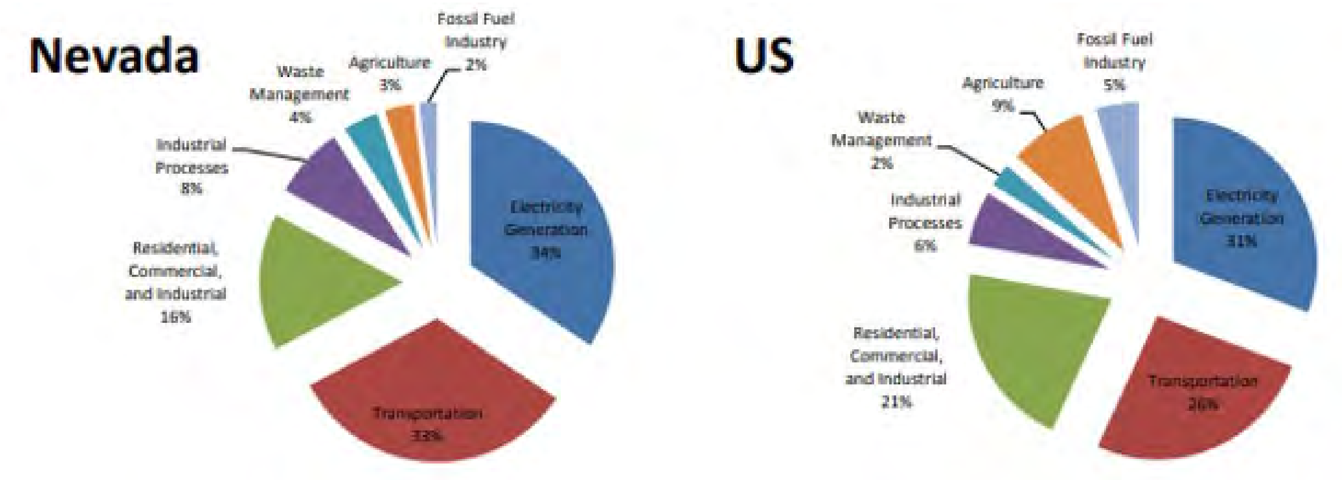
The EPA has incorporated GHG permitting requirements into its New Source Review (NSR) and Title V permitting programs.

4. Nevada and U.S. Greenhouse Gas Emissions

Every four years the Nevada Department of Environmental Protection (NDEP) completes a Statewide Greenhouse Gas Emissions Inventory. The 2016 Report inventoried GHGs emitted in 2013. The next NDEP GHG Emissions Inventory will be released in 2020.

In 2013, U.S. GHG emissions were 6,800 million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The net U.S. GHG emissions, after accounting for land use land use change, and forestry sinks, were estimated to be 6,040.4 $MMTCO_2e$. Nevada accounted for 0.65 percent of both gross and net U.S. GHG emissions. More than half of total gross GHG emissions for both Nevada and the U.S. were generated from the transportation and electricity generation sector. In the U.S., 26% of total gross GHG emissions were generated from the transportation sector and 31% of total gross GHG emissions were generated from the electricity generation sector. Similarly, in Nevada, 33% of total gross GHG emissions were generated from the transportation sector and 34% of total gross GHG emissions were generated from the electricity generation sector.

Figure 1. Relative Contributions of Gross Emissions for Nevada and the U.S., 2013



NDEP 2016 GHG Inventory

5. Thacker Pass Project GHG Accounting

5.1 Total Project Emissions

Projected construction, offsite transport, exploration, and facility wide GHG emissions were calculated for the Thacker Pass project and include CO_2, CH_4, and N_2O.

Construction of the Thacker Pass Project will be temporary and is expected to last approximately two years. GHG emissions from construction are a result of mobile equipment and will average 34,114 tons CO_2e per year.

Offsite transportation emissions include both truck and rail transport. Upstream transportation emissions are a result of chemical and reagent delivery for lithium processing. Chemicals and reagents will be trucked from a transloading facility in Winnemucca to the Thacker Pass Project site. Delivery estimates for Phase 1 include 60 double-trailer haul trucks per day on average, doubling in Phase 2 to 120 double-trailer haul trucks per day on average. Downstream transportation emissions are a result of final product shipments. Final lithium products will be trucked from the Thacker Pass Project site to a transloading facility in Winnemucca. The final destination of LNCs lithium products is uncertain, but it can reasonably be assumed the products will be shipped via rail to a port in California, and further shipped overseas. Final product shipment estimates for Phase 1 include four single-trailer haul trucks per day on average, doubling in Phase 2 to eight single-trailer haul trucks per day on average. Offsite transportation emissions total 5,162 tons CO_2e per year in Phase 1 and 10,324 tons CO_2e per year in Phase 2. Upstream emissions account for most offsite transport emissions and are a result of shipping chemicals and reagents to the Thacker Pass Project site. A summary of offsite transportation GHG emissions is shown in Table 2.

Table 2. Thacker Pass Offsite Transport CO_2e GHG Emissions (tons/year)

Emission Source	Upstream/ Downstream	Phase 1 CO_2e	Phase 2 CO_2e
Reagent Trucking	Upstream	4,547	9,095
Product Trucking	Downstream	303	606
Product Tranport by Rail	Downstream	312	623
Total CO2e GHG Emissions (ton/yr)		**5,162**	**10,324**

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Limited exploration will take place throughout the project, resulting in a small amount of GHG emissions. Exploration activity is expected to occur four months of each year, totaling at most 164 months of exploration by the end of the Thacker Pass mine life. Calculations are based on that maximum activity, but likely will be less. Exploration disturbance is expected to total 150 acres, and a maximum of 600 exploration holes will be drilled. Estimated GHG emissions from exploration are a result of mobile equipment, and total 3,018 tons of CO_2e per year.

The largest source of GHG emissions are facility emissions, primarily onsite mobile emissions from diesel engines, followed by carbonate destruction in the lithium process facility. Phase 1 GHG emissions currently total 80,088.7 tpy CO_{2e} and Phase 2 GHG emissions currently total 132,678.3 tpy CO_2e. Phase 1 stationary GHG emissions total 21,342.3 tpy (19,361.4 metric tons per year) and Phase 2 stationary GHG emissions total 42,656.6 tpy (38,697.3 metric tons per year). A summary of facility wide GHG emissions is shown in Table 3.

Table 3. Thacker Pass Facility Wide CO_2e GHG Emissions (tons/year)

Emission Source	Stationary/ Mobile	Phase 1				Phase 2			
		CO_2	CH_4	N_2O	Total CO_2e	CO_2	CH_4	N_2O	Total CO_2e
Diesel - External Combustion	Stationary	3,679.0	3.7	8.9	3,691.6	7,359.0	7.5	17.8	7,384.3
Diesel - Engines	Stationary	21.2	2.2E-02	5.1E-02	21.3	31.8	1.3E-02	7.7E-02	31.9
Propane - Engines	Stationary	17.3	2.1E-02	5.0E-02	17.4	17.3	2.1E-02	5.0E-02	17.4
Diesel - Engines	Mobile	55,831.0	57.0	135.0	56,023.0	84,646.0	86.0	205.0	84,937.0
Gasoline - Engines	Mobile	2,713.6	2.9	6.9	2,723.4	5,066.5	5.4	12.9	5,084.8
Tail Gas Scrubber (Sulfuric Acid)	Stationary	579.0	0.0	0.0	579.0	1,157.0	0.0	0.0	1,157.0
Lithium Process Facility	Stationary	17,033.0	0.0	0.0	17,033.0	34,066.0	0.0	0.0	34,066.0
Total CO2e GHG Emissions (ton/yr)		**Phase 1 Total GHG Emissions:**			**80,088.7**	**Phase 2 Total GHG Emissions:**			**132,678.3**

AirSciences, Lithium Nevada – Thacker Pass Project NEPA Air Quality Impact Analysis Report (Dec. 2019)

5.2 Sustainability and Carbon Neutrality

A long-term goal of the Thacker Pass Project is to reduce GHG emissions and reach carbon neutrality. This goal begins with designing and constructing a sustainable project, which is, in part, why LNC chose to produce its sulfuric acid onsite instead of shipping sulfuric acid to the site.[1] Producing sulfuric acid onsite will reduce the materials transported to the mine by over 50 percent, reducing truck traffic and offsite GHG emissions associated with the Project. Additionally, onsite sulfuric acid production will create steam as a byproduct. Steam produced from the sulfuric acid plant will be used in the lithium process for

[1] Sulfuric Acid Plant design found in the CHEMETICS 2640 MTPD Sulphur Burning Sulphuric Acid Plant Prefeasibility Study – REPORT, August 2018. 2,900stpd plant assumed for Phase 1. 5,800 stpd plant assumed for Phase 2.

crystallization of sulfate salts instead of burning natural gas to create necessary steam for the process. It is estimated that steam generated from the sulfuric acid process reduces approximately 200,000 tpy of CO_2e in Phase 1 and 400,000 tpy of CO_2e in Phase 2 that would otherwise be emitted by burning natural gas to produce the same amount of steam necessary for the process[2]. Excess steam will be used to generate carbon-free electricity that will be used onsite or sold to the grid in a cogeneration (cogen) facility. Initially, steam production will create an average of approximately 26 megawatts of carbon-free electricity that will be available for onsite consumption or sale to the grid. It is estimated that this will offset the Project's total emissions by approximately 100,000 tpy of CO_2e in Phase 1 and 200,000 tpy of CO_2e in Phase 2, assuming the carbon-free power created is offsetting GHG emitting power from a natural gas power plant[3].

LNC is analyzing strategies to further reduce and offset GHG emissions and plans to build its sustainability program as the project progresses.

6. Electric Vehicles and Downstream GHG Emission Reduction

6.1 Electric Vehicle Development

Some form of electric vehicle technology has been around since the 1800s, but modern electric vehicle technology began in the 1990s with the passage of the 1990 Clean Air Act Amendments and the 1992 Energy Policy Act. The Toyota Prius was developed with a nickel-metal hydride battery and was released world-wide in 2000, becoming the world's first mass-produced hybrid electric vehicle (HEV). Following the production of PEVs, in 2003, Tesla Motors was founded, to produce electric vehicles using lithium ion batteries that would go more than 200 miles on a single charge. Most HEVs today are still made with nickel-metal hydride batteries, and most plug-in hybrid vehicles (PHEV) and all-electric vehicles (EV) are made with lithium ion batteries.

Since the startup of Tesla, many big automakers have introduced their own electric vehicle. In 2010, the Chevy Volt (a PHEV) and Nissan LEAF (an EV) were released to the U.S. market. Audi, BMW, Ford, Honda, Mercedes-Benz, Volkswagen, and many other major car manufacturers have also introduced one or more electric vehicles.

It is likely that electric vehicle sales will increase over time. At the end of 2018, a total of 276.1 million vehicles, including 96.6 million cars, were registered in the U.S. of which approximately 1 million cars were electric vehicles (including battery electric and plug-in hybrid electric). In 2018, a total of 361,307 electric vehicles were sold in the U.S., up 81% over 2017, comprising 6% of total passenger car sales[4].

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[2] CO_2 reduction from steam production estimation calculated using information from the CHEMETICS 2640 MTPD Sulphur Burning Sulphuric Acid Plant Prefeasibility Study – REPORT, August 2018 and a heating value for natural gas. CH_4 was assumed the only component of natural gas.

[3] CO2 offset estimated using average operating heat rate for natural gas and CO2 Uncontrolled emission factors from U.S. Energy Information Administration website. https://www.eia.gov/tools/faqs/faq.php?id=74&t=11. 26.5 MW of average power creation was determined from the CHEMETICS 2640 MTPD Sulphur Burning Sulphuric Acid Plant Prefeasibility Study – REPORT, August 2018.

[4] Hedges & Company U.S. Vehicle Registration Statistics https://hedgescompany.com/automotive-market-research-statistics/auto-mailing-lists-and-marketing/

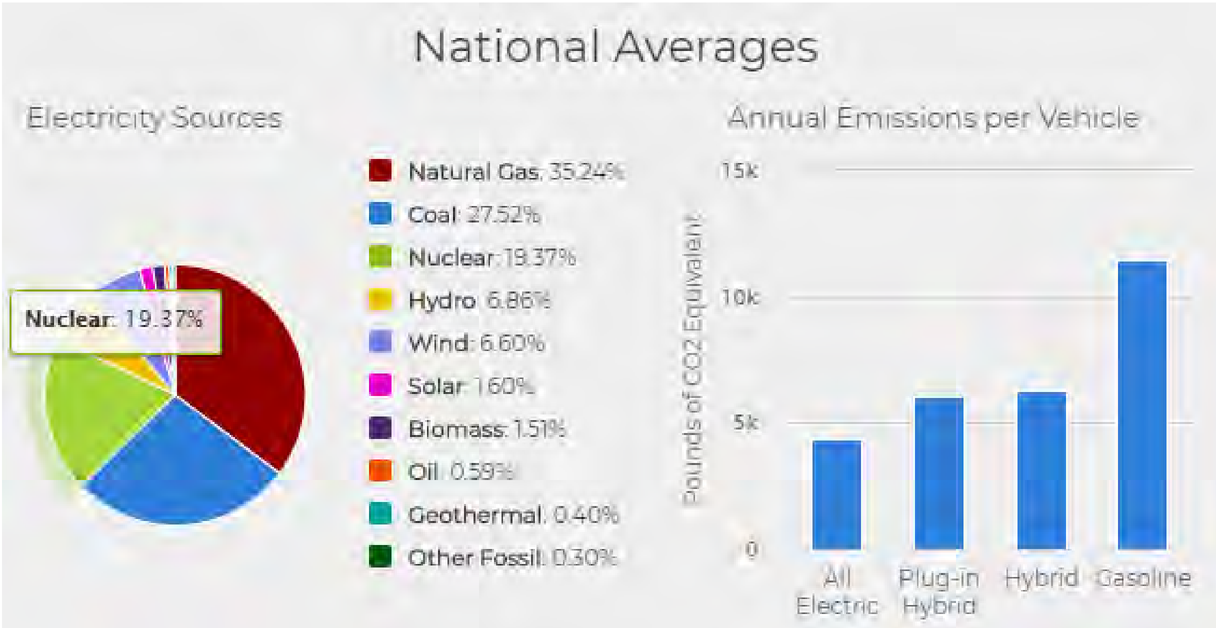
As automobile companies increase the models of electric vehicles available to consumers (including commercial and industrial sectors) sales are expected to increase. In addition, the performance of EV will improve over time, with longer range and faster charging. Manufacturing efficiencies are expected to bring EVs into cost parity with internal combustion cars within 3-5 years. Finally, the rapid growth of the charging network is also expected to improve EV uptake.

6.2 GHG Emission Reductions from Electric Vehicles

The U.S. Department of Energy's Alternative Fuels Data Center completed a well-to-wheel emissions analysis on electric vehicles (EV), plug-in hybrid vehicles (PHEV), hybrid vehicles (HEV), and conventional gasoline vehicles. Well-to-wheel emissions include all emissions related to fuel production, processing, distribution and use. In the case of gasoline, emissions are produced while extracting petroleum from the earth, refining it, distributing the fuel to stations, and burning it in vehicles. In the case of electricity, most electric power plants produce direct emissions, and there are additional emissions associated with the extraction, processing, and distribution of the fuel sources they use for electricity generation, such as coal or natural gas. Although this analysis does not include emissions created during electric or conventional vehicle manufacturing, it serves as a basis for comparison.

Electricity source is important when measuring well-to-wheel emissions. In geographic areas that use relatively low-polluting energy sources, such as hydroelectric and solar, for electricity generation, the benefits of EVs and PHEVs are large. In states that use relatively high-polluting energy sources, such as coal and other fossils fuels, the benefits of EVs and PHEVs are lower. Nationally, conventional gasoline vehicles produce 11,435 pounds of CO_2e emissions annually per vehicle, HEVs produce 6,258 pounds of CO_2e emissions annually per vehicle, PHEVs produce 6,044 pounds of CO_2e emissions annually per vehicle, and EVs produce 4,352 pounds of CO_2e emissions annually per vehicle. In Nevada, given the energy sources used to generate electricity in the state, HEVs produce 6,258 pounds of CO_2e emissions annually per vehicle, PHEVs produce 5,609 pounds of CO_2e emissions annually per vehicle, and EVs produce 3,662 pounds of CO_2e emissions annually per vehicle.

Figure 2. National Averages for Well-to-Wheel Emissions



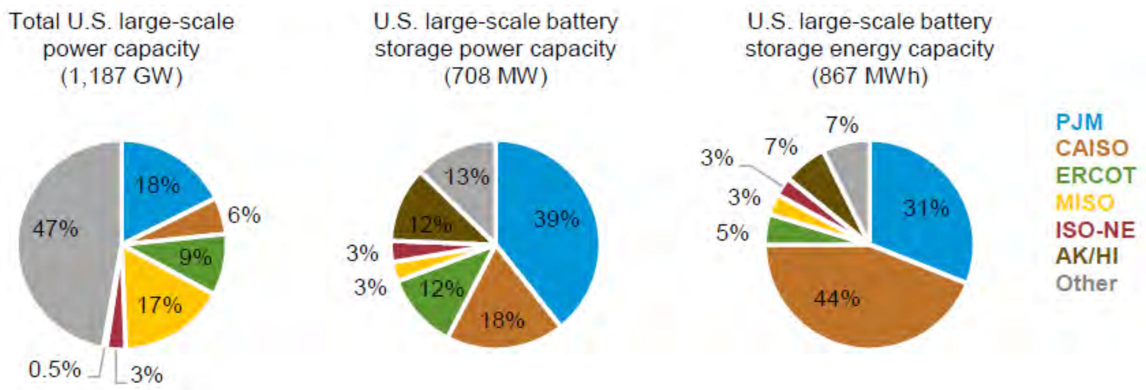
U.S. Department of Energy: Alternative Fuels Data Center

7. Stationary Energy Storage and Downstream Emission Reduction

7.1 Energy Storage Development

Energy storage is used to store electricity created during times of low demand to be used during peak demand hours. Hydroelectric pumped storage currently accounts for the greatest share of large-scale energy storage capacity in the United States; however, since 2003, large-scale energy storage capacity additions have been almost exclusively lithium ion battery storage. As of 2017, U.S. large-scale battery storage projects in operation accounted for 708 megawatts (MW) of power capacity, representing 867 megawatt hours (MWh) of energy capacity. The energy storage capacity of battery storage is projected to increase due to legislative policy and advancements in battery technology. California set a mandate for the state's investor-owned utilities to procure 1,325 MW of energy storage by 2020. Nevada has determined a statewide deployment of up to 175 MW of large-scale energy storage could be cost-effective by 2020 and up to 1000 MW of large-scale energy storage could be cost-effective by 2030.

Figure 3. Large-Scale U.S. Power and Energy Capacity by Region (2017)



U.S. Battery Storage Market Trends

7.2 GHG Emission Reductions from Energy Storage

Electricity generation currently accounts for 31% of gross U.S. GHG emissions totaling 2,108 $MMTCO_2e$ emitted annually. GHG emissions from electricity generation are a largely a result of coal and natural gas power plants. Biomass, oil, and other fossil fuels also account for a smaller portion of GHG emissions produced from electricity generation. In 2018, total U.S. electricity generation was 4,177,810 gigawatt hours (GWh) and approximately 65% of total electricity generation was from GHG emitting sources. Approximately 1.76 million pounds of CO_2e are emitted for every gigawatt-hour of electricity that is generated from GHG-emitting sources in the U.S.

Energy storage can reduce overall GHG emissions from electricity generation by increasing the efficiency of intermittent renewable energy sources such as wind and solar power. Batteries can store energy from wind or solar power, to be used later during peak hours or other times when coal or natural gas energy sources have traditionally been the only option. Power supplied from batteries releases zero GHG emissions. Every megawatt-hour of electricity stored in a battery is a mega-watt hour of electricity that no longer needs to be produced from GHG emitting sources.

The GHG emission reduction facilitated by battery storage is important for reducing GHG emissions attributed to electric vehicles. As discussed above, GHG emissions from electric vehicles are a result of the GHG emitting sources used to create the electricity to charge the vehicle's battery. As the electricity grid transitions away from high GHG emitting energy sources, with the help of increased energy storage, emissions from EV use will continue to decrease.

8. Thacker Pass Project Downstream Emission Reduction Potential

8.1 Electric Vehicles

Based on the lithium grades and expected product purity from the lithium at Thacker Pass, the Thacker Pass products are expected to be well-suited for GHG-reducing uses such as electric vehicle batteries and energy storage. Although the demand for and use of the lithium carbonate equivalent (LCE) end-products from Thacker Pass is dependent on market conditions, it is likely that one of the main uses will be for batteries for electric vehicles. The demand of lithium salts and the size of the battery pack for a vehicle varies between manufacturers, LNC has estimated approximately 130 pounds of LCE end-products are used to produce a battery pack for one electric vehicle. In Phase 1 of the Thacker Pass Project, LNC will produce enough LCE-end products to manufacture approximately 507,000 electric vehicle batteries per year. LNC's LCE production would double in Phase 2, allowing approximately 1,014,000 electric vehicle batteries for to be manufactured every year.

The Thacker Pass Project will produce a total of 5,148 million pounds of LCE-end products throughout the life of the mine – enough lithium to produce batteries for 39.6 million electric vehicles, potentially replacing 41% of the non-electric cars currently registered in the U.S. with electric vehicles. In the U.S., the transportation sector accounts for 1,768 MMTCO_2e emitted annually[5]. Of the transportation sector annual emissions, 501 MMTCO_2e are a result of passenger cars. If all the LCE end-products produced from The Thacker Pass Project were used in battery packs for U.S. electric vehicles, the Project would decrease U.S. car emissions from 501 MMTCO_2e emitted annually to 374 MMTCO_2e emitted annually; a reduction of 127 MMTCO_2e annually.

8.2 Energy Storage

Batteries for large-scale energy storage projects are a second potential use for the LCE end-products from the Thacker Pass Project. Batteries can be used to store electricity created from renewable energy sources, such as solar and wind power, to be used later. The use of battery storage will increase the efficiency of renewable energy and replace GHG emitting electricity sources. Assuming 130 pounds of LCE is used for one 70-kWh battery, the Thacker Pass Project will have the capability of producing enough LCE to create 2.77 million megawatt hours of energy storage throughout the life of mine. Assuming 31% of total gross GHG emissions in the U.S. are generated from the electricity generation sector and 2,594,420 gigawatt hours (gWh) of electricity are generated in the U.S. annually from GHG emitting sources – energy storage created from the Thacker Pass Project would have the potential to eliminate 2.25 MMTCO_2e emissions from the electricity generation sector on every charge.

9. Conclusion:

The Thacker Pass Project has been strategically designed as a sustainable project with a low carbon footprint. Efforts are being made to advance efficiencies in sustainability as the Project progresses. Phase 1 GHG emissions are currently projected to total 80,088.7 tpy CO_{2e} and Phase 2 GHG emissions are currently projected total 132,678.3 tpy CO_2e. GHG emissions will largely be offset by producing carbon-free electricity through the cogen facility onsite. The current design of the cogen facility is estimated to offset GHG emissions by approximately 100,000 tpy CO_2e in Phase 1 and 200,000 tpy CO_2e in Phase 2.

The Project has potential for significant downstream GHG emission reductions through the production of lithium ion batteries for electric vehicles or energy storage. LNC's LCE production would allow for over 1 million electric vehicle batteries to be manufactured every year (Phase 2) or create energy storage for 2.77 million megawatts electricity (life of mine).

[5] Nevada Division of Environmental Protection: Nevada Statewide Greenhouse Gas Emissions Inventory and Projections https://ndep.nv.gov/uploads/air-pollutants-docs/GHG_Report_2016.pdf

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THACKER PASS EMISSION CALCULATIONS FOR RAIL TRANSPORT

THACKER PASS EIS -- CRITERIA POLLUTANT EMISSIONS FROM RAIL TRANSPORT

Air Sciences included GHGs but omitted criteria pollutantss from their 12/2019 AQ analysis report.
Method: Emissions (tons/year) = Fuel used (gallons/year) * Emission factor (grams/gallon) * (tons/gram conversion)

Diesel fuel used (gal/yr)
Source: Air Sciences 12/19 AQ analysis report, Appendix A, page 169 of pdf file.

Phase 1	27,209
Phase 2	54,419

Emission Factors
Source: EPA (2009) EPA-420-F-09-025 emission factors for "large line-haul" service, calendar year 2021

Pollutant	Emission Factor (g/gal)	Adjustment/Calc. Factors	
CO	26.6	CO emis. factor (g/bhp/hr)	1.28
NO_2	94		
PM10	2.2		
PM2.5	2.13	PM2.5/PM10 fraction	0.97
HC	3.4		
VOC	3.58	VOC/HC ratio	1.053
SO_2	0.094	SO_2 (g/gal) = (fuel density) × (fraction oxidized) × (64 g SO_2/32 g S) × (S content of fuel)	
		Fuel density (g/gal)	3200
		Fraction of S oxidized to SO2	0.978
		Molecular weight ratio (SO2/S)	2
		Fuel S content 15 ppm as fraction	1.50E-05

Engine efficiency (bhp/gal)	20.8
US tons/gram	1.10231E-06

Total Rail Emissions (tons/yr) for EIS Table 4.7 Off-Site Transport Emissions

Activity	PM10	PM2.5	CO	NOx	SO2	VOC
Phase 1	0.07	0.06	0.80	2.82	0.003	0.11
Phase 2	0.13	0.13	1.60	5.64	0.006	0.21
Total	0.20	0.19	2.40	8.46	0.01	0.32

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