ADEQ CLASS II PERMIT

Permit Application

Copper World Project / Pima County, AZ

Prepared By:

David E.B. Strohm II – Managing Consultant
Shannon K. Manoulian, P.E. – Senior Consultant

TRINITY CONSULTANTS
702 W. Idaho Street
Suite 1100
Boise, ID 83702
(208) 472-8837

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1. EXECUTIVE SUMMARY

Rosemont Copper Company (Rosemont, Rosemont Copper), a subsidiary of Hudbay Minerals, Inc. (Hudbay), plans to construct and operate an open-pit mining, milling, leaching, and solvent extraction/electrowinning facility, known as the Copper World Project (Project, Copper World). The Copper World Project will be located approximately 28 miles southeast of Tucson, in Pima County.

The Copper World Project will develop mineral resources on both the west and east sides of the Santa Rita mountains, including a portion of the Rosemont deposit located on the east side of the Santa Rita mountains. All processing facilities associated with the Project are proposed to occur on the west side of the Santa Rita mountains. Copper World operations will occur on land privately owned and controlled by Rosemont. **Figure 1-1** indicates the central location of the Rosemont ore deposit located on the east side of the Santa Rita Mountains as well as a location of the proposed Copper World Project Processing Facility located on the west side.

The Copper World Project has the following address:

- 9025 E. Santa Rita Road, Sahuarita, Arizona 856629-5800

This document presents the information necessary for the Arizona Department of Environmental Quality (ADEQ) to process the Copper World Project application and issue a Class II Air Quality Permit as required by Arizona Administrative Code (A.A.C.) R18-2-304.I.1. ADEQ jurisdiction is required by § 36-17(A)(1) of the Arizona State Implementation Plan (SIP), Rule 112.B.1.a of the Pima County SIP, and an ADEQ assertion of jurisdiction dated August 1, 2022. The information provided in this document includes all applicable information required by A.A.C. R18-2-304. A completed Standard Permit Application Form is provided in **Appendix A** of this application and includes a compliance certification signed by the responsible official of the Copper World Project.

Rosemont will accept voluntary emissions limitations for the Copper World Project to stay below major source thresholds consistent with the mining, processing and fleet utilization inputs used to develop this application. Consequently, a Class II synthetic minor permit is applicable to Copper World.

Figure 1-1. General Location Map

Process rates for the Copper World Project are summarized in **Table 1-1**.

Table 1-1. Maximum Process Rate Summary for Copper World Project

Process	2022 Application Maximum Annual Process Rate* (ton/year)
Loading – Ore	38,325,000
Loading Waste	51,100,000
Crushing – Sulfide ore	21,900,000
Crushing – Oxide ore	16,425,000
Stockpile Reclaim – Sulfide	21,900,000
Stockpile Reclaim – Oxide	16,425,000
SAG Mill Total	21,900,000
Pebble Crusher Total	4,380,000
Secondary Crusher Feed – Oxide ore	16,425,000
Copper Concentrate	511,000
Moly Concentrate	3,407

*The maximum annual process rates presented do not all occur in the same Mine Life Year. A maximum emissions inventory is included in Appendix F that includes emissions at maximum from any year but that does not coincide with a single year within the mine plan.

Further description of Copper World processes is included in **Section 2**.

The proposed Project will trigger requirements under A.A.C §R18-2-334 for mNSR purposes. Pursuant to A.A.C. R18-2-334.C, Rosemont must submit either a Reasonably Available Control Technology (RACT) demonstration pursuant to R18-2-334.C.1 & D or a modeling demonstration pursuant to R18-2-334.C.2. Rosemont has submitted a modeling demonstration meeting R18-2-334.C.2 requirements that demonstrates the Copper World Project will not interfere with attainment or maintenance of any NAAQS as shown in **Appendix B**.

2. PROCESS DESCRIPTION

The following sections provide descriptions of the proposed Copper World Project.

2.1 Copper World Project

2.1.1 General Process Description

Major operations associated with the Copper World Project include: (a) open-pit mining from six (6) pit areas that will include drilling, blasting, loading, stockpiling, and hauling of sulfide and oxide ore and development rock (waste rock); (b) primary crushing and stockpiling of sulfide and oxide crushed ore; (c) stockpile reclaim; (d) milling and flotation of sulfide ore; (e) heap leaching of oxide ore; (f) tailings thickening and placement in a "conventional" storage facility; (g) concentrate leaching and precious metals recovery; (h) optional copper concentrate dewatering and preparation for shipment; (i) moly concentrate drying and bagging, (j) solvent extraction and electro-winning (SX-EW) and copper cathode production from copper concentrate and oxide leach circuits; and (k) a sulfuric acid plant.

Secondary processes include: (a) fuel burning equipment; (b) reagent systems; (c) storage tanks; (d) organic reagent use; (e) an analytical metallurgical laboratory; and (f) the use of mobile support vehicles.

The production schedule was developed from detailed mining sequence plans. The mine sequencing provides detailed information through year 15 using only proven and probable mineral reserves. The annual maximum mining rate for Sulfide Ore is 21.9 million tons per year (M TPY) starting in Year 5 and continuing until the end of Year 14. The maximum annual movement of waste rock is 51.1M TPY which occurs in Year 10. Additionally, the mining and hauling of oxide ore peaks in Years 6-8 at 16.425M TPY. Although ore and waste rock quantities vary annually, the primary contributor to offsite emissions impacts is directly linked to the distance traveled by the mine vehicle fleet. The vehicle miles traveled (VMTs) for the mine fleet increase to a maximum rate in Year 14 of the mine life. As a result, this year represents the maximum mine emissions profile and maximum potential for adverse ambient impacts.

Although Year 14 represents the maximum potential for overall ambient impacts, it also represents a larger geographic area of operational development. As a result, a secondary assessment of impacts was generated for the review during the first five years of the development of the Project. Although annual mining rates would be lower during this time frame, operations would be geographically constrained to multiple pits on the west and central portions of the mine property. Based on a review of the geographic location of proposed mine activities, as well as the maximum mining rates, it was determined that Year 2 would represent the maximum potential for impacts during the early mine development period.

During all periods of the mine development, mining of the ore will occur via conventional open-pit mining techniques including drilling, blasting, loading, hauling and unloading. Waste rock will be transported by haul trucks for placement in waste rock storage areas (termed waste rock facility, or WRF). Upon arrival at the processing plant area (Plant Site), ROM Sulfide Ore will be crushed and transferred via conveyor to the mill for further processing. ROM oxide ore either will either be placed directly on the heap leach pad (HLP) or will be crushed and conveyed to the HLP. The molybdenum concentrate from the milling and flotation operation will be shipped off site for further processing. The copper concentrate will be processed onsite in a concentrate leach circuit, with the recovery of copper occurring in a Solvent Extraction and Electrowinning (SX-EW) plant. However, modeling has also assumed conventional handling (dewatering and shipment) of copper concentrate.

General process flow diagrams for these processes are presented in **Appendix C**.

Descriptions of the major processes, related potential air pollutant emissions from the processes, and the methods that will be used to control emissions, are discussed below. In addition, a plan view map of the facility showing the process locations is presented in Section 3.

The processes at the Copper World Project have the potential to produce air pollutant emissions including: total suspended particulate matter (TSP), particulate matter (PM), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), sulfuric acid (H_2SO_4), hazardous air pollutants (HAPs), and greenhouse gases (GHGs). GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

2.1.2 Open Pit Mining

Open pit mining will be conducted using large-scale equipment including rotary blasthole drills (diesel), a hydraulic percussion track drill, hydraulic mining shovels, front end loaders, off-highway haul trucks, crawler dozers, rubber-tired dozers, motor graders and off-highway water trucks. Open pit mining is scheduled for 24 hours per day, 7 days per week, and 365 days per year. Peak mining rates are expected to reach 187,671 tons per day (tpd) of total material mined (sulfide ore and waste rock) in Year 14. The maximum mining rate expected in Year 2 is 74,987 tpd of total material mined (combined sulfide and oxide ore and waste rock).

Peak mining rates are presented in this application to allow maximum production flexibility, although it is not anticipated that all peak rates can be achieved simultaneously, and rates will naturally fluctuate with time. Emissions from mining operations are dependent primarily upon the mining rate and haul truck travel, with haul truck travel (vehicle miles traveled, VMTs) representing approximately 40% of total particulate related emissions.

The highest projected combination of annual mining rate and haul truck travel, both in and outside of the pit, will occur in Year 14 (68,500,000 tons of ore and waste per year; 2,127,672 haul truck VMTs). By comparison, the projected annual mining rate and haul truck travel for Year 2 are 27,370,096 tons of ore and waste and 257,884 haul truck VMTs, respectively. Ambient impacts from operations during all other years are anticipated to maintain lower ambient emissions impacts than during Year 14. Because ore and waste rock tonnage and haul mileage can offset each other, the stated haul truck VMTs for Year 14 is a conservative maximum. Ore and waste rock tonnage could increase from the average values but are offset by a haul distance decrease during a particular phase of operations. As a result, emissions would not be anticipated to increase even if short-term haul truck tonnages increased.

The emission information presented in this permit application for the Copper World Project is based on operations during Year 2 and Year 14.

2.1.3 Drilling and Blasting

Drilling and blasting are performed within the Rosemont open pit mine and the smaller early mine development pits (Peach, Elgin, Heavy Weight, Copper World and Broadtop Butte). The bulk of production blasthole drilling will be performed by rotary blasthole drills. Ammonium nitrate and fuel oil (ANFO) blasting agents will be used for nearly all rock breakage in dry ground. Ammonium nitrate emulsions will be employed in wet conditions.

Based on an anticipated maximum of 300 blasts per year in Year 14, blasting agent use will average about 60 tons per day (tpd), or 0.3 tons of ANFO per hole drilled and 100 holes drilled per blast. Modeled ANFO use and potential to emit (PTE) was calculated based on two (2) blasting events per day. These blasts were modeled as occurring during a single hour. This represents the worst-case ambient impact.

Emissions from drilling and blasting in Year 2 are based on an anticipated maximum of 175 blasts per year; blasting agent use will average 21 tpd. An average of 0.3 tons of ANFO will be used per hole drilled, with approximately 70 holes drilled per day. In Year 2, modeled ANFO use, and PTE was calculated based on the following limitations below:

- The maximum hourly and daily blast rates were limited to 70 holes for the Copper World and Heavy Weight Pits; and
- For the Peach and Elgin Pits, the maximum hourly blast rate was limited to 35 holes while the maximum daily blast rate was limited to 70 holes.

Both drilling and blasting have the potential to emit regulated air pollutants. Drilling has the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions while blasting has the additional potential to emit CO, NO_x, SO_2, and GHG emissions. During the early mine life (Year 2), potential fugitive particulate emissions from drilling will be controlled by the addition of water and by shrouds on an as needed basis in order to inhibit the escape of particulate emissions from the top of the hole during the drilling process. The controls will be used for the duration that drilling occurs in the Copper World, Heavy Weight, Peach and Elgin Pits. After completion of drilling in those pits, emissions from drilling will no longer be controlled with shrouds and water sprays.

2.1.4 Loading and Hauling

Ore and waste rock are loaded into haul trucks by shovels and loaders and hauled to their respective processing locations. Both sulfide and oxide ore will be mined and processed. Sulfide ore will be transported from the open pits and either dumped directly into the sulfide primary crusher dump hopper or unloaded to the run of mine stockpile located close to the primary crusher. The sulfide ore will be crushed and stockpiled in an uncovered coarse ore stockpile prior to being processed by the mill. Oxide ore will be transported from the open pits and either dumped directly into the oxide primary crusher dump hopper, dumped directly onto a heap leach pad, or unloaded to the run of mine stockpile located close to the primary crusher.

Temporary placement of ore materials in the run of mine stockpile is only anticipated during the startup phase and during times such as crusher maintenance or short-term operating disruptions.

Waste rock from the open pit will be transported to the main waste rock facility or to other waste rock storage areas such as the area underneath the heap leach pad.

Loading and hauling throughputs for Year 2 and Year 14 reflect operations in those respective years' PTE. It should be noted that oxide ore mining operations cease well before Year 14. These emissions have been included in the emissions estimates for the Year 2 modeling impact assessment but are not included in the Year 14 modeling impact assessment.

Loading ore and waste rock into the haul trucks from the open pit mine has the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. Additionally, using haul trucks to transport the ore and waste rock creates fugitive particulate emissions from the unpaved haul roads.

Fugitive particulate emissions from haul roads and unpaved, regularly traveled access roads are proposed to be controlled by watering or chemical surfactant. The application of control was designed to ensure enhanced control on sections of the haul road network with the potential for offsite impacts. The road emission control strategy was designed to achieve 95% control on all processing plant roads and on the heavy haul road network when the dust emitting operations are in closest proximity to the ambient air boundary. The exact extent of the road network proposed for 95% control is detailed in the modeling report in **Appendix B** and the associated dispersion modeling files.

2.1.5 Primary Crushing and Coarse Ore Stockpile

A run of mine stockpile, located near the primary crusher, will be used in the early mine life years to provide flexibility in handling short-term operating disruptions in the crushing and conveying system (it will no longer be in use by Year 14). It is estimated that during operations approximately 10% of the mined sulfide ore will need to be stockpiled prior to primary crushing. The majority of the sulfide ore will be dumped directly into the primary crusher dump hopper. For the sulfide ore that is stockpiled, it will be transported via loader or haul truck to the crusher dump pocket.

It is also estimated that less than 10% of the mined oxide ore will need to be stockpiled. This would primarily occur during the early mine life operations (oxide ore mining operations cease prior to Year 14). During operations, oxide ore will either dumped directly into the primary crusher dump hopper and crushed or placed directly on the heap leach pad. As currently estimated, about 70% of the oxide ore would be crushed. The remaining run of mine material would be dumped directly on the heap.

There are two primary crushers and coarse ore stockpiles planned: one for sulfide ore and one for oxide ore, though the oxide crusher and stockpile will only be used during the early mine life. The transition from both oxide and sulfide ore to just sulfide is detailed in the mine planning values in **Appendix B** in support of the facility dispersion modeling.

The sulfide crusher dump hopper will directly feed the sulfide primary crusher. Primary crushed sulfide ore will be withdrawn from the crusher discharge vault by a crusher discharge conveyor. The conveyor will discharge to the stockpile feed conveyor belt that discharges to the sulfide coarse ore stockpile. Emissions created by the unloading of sulfide ore to the dump pocket is controlled by water sprays. The primary crusher and transfers to the crusher vault, discharge feeder and stockpile feed conveyor are controlled by the Sulfide Primary Crusher Cartridge Dust Collector. The sulfide coarse ore stockpile is not enclosed; therefore, the stockpile is uncontrolled. A process flow diagram of the sulfide primary crushing and coarse ore stockpiling process is presented in **Appendix C**.

The oxide crusher dump hopper will directly feed the oxide primary crusher. Primary crushed oxide ore will be withdrawn from the crusher discharge vault by a crusher discharge conveyor. The crusher discharge conveyor will discharge to the stockpile feed conveyor belt that discharges to the oxide coarse ore stockpile. Emissions created by the unloading of oxide ore to the dump pocket is controlled by water sprays. The primary crusher and transfers to the crusher vault, discharge feeder and stockpile feed conveyor are controlled by the Oxide Primary Crusher Cartridge Dust Collector. The oxide coarse ore stockpile is not enclosed; therefore, the stockpile is uncontrolled. A process flow diagram of the oxide primary crushing and coarse ore stockpiling process is presented in **Appendix C**.

Throughputs associated with the crushing system reflect operations in Year 2 and Year 14. Note: Oxide ore mining operations cease well before Year 14.

The run of mine stockpile, material transfer to the primary crusher, primary crushing, and material transfers from the primary crusher to the coarse ore stockpiles have the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions.

2.1.6 Coarse Ore Stockpile Reclaim

Primary crushed sulfide ore will be stockpiled in an open sulfide coarse ore stockpile. The stockpile will sit directly on the ground and a reclaim tunnel will be installed beneath the stockpile. Sulfide ore will be withdrawn from the coarse ore stockpile by apron feeders installed in the reclaim tunnel. The feeders will discharge to a conveyor belt which will discharge to a SAG mill. A process flow diagram of the stockpile reclaim and transfer to the SAG mill process is presented in **Appendix C**.

The SAG mills will each operate in closed circuit with a pebble feeder and a pebble crusher. Rock pebbles will be transported by conveyor to the pebble crusher bin and then into the pebble crusher feeder and pebble crusher, where it will be processed and returned by belt conveyors to the SAG mill. A process flow diagram of the pebble crusher process is presented in **Appendix C**.

The material transfer points from the reclaim feeders to the SAG mill have the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. Particulate matter emissions due to material transfers from the sulfide coarse ore stockpile to the reclaim feeders and from the reclaim feeders to the SAG mill conveyor are controlled by the Reclaim Tunnel Line and Pebble Crusher Line Dust Collector. The transfer from the SAG mill feed conveyor to the SAG mill will be controlled with water addition; therefore, this part of the process is not a source of particulate emissions.

The material transfer points from the SAG mill to the sulfide pebble crusher feed bin and all material transfer points upstream of the pebble crusher will be controlled with water addition; therefore, this part of the process is not a source of particulate emissions. Particulate matter emissions from the material transfer points from the pebble crusher through to the SAG mill feed conveyor are controlled by the Sulfide Reclaim Tunnel and Pebble Crusher Cartridge Dust Collector.

Primary crushed oxide ore will be stockpiled in an open coarse ore stockpile. The stockpile will sit directly on the ground and a reclaim tunnel will be installed beneath the stockpile. Oxide ore will be withdrawn from the coarse ore stockpile by apron feeders installed in the reclaim tunnel. The feeders will discharge to a conveyor belt which will discharge to a secondary feeder screen. Oversized materials will discharge to a secondary crusher. Material from the feeder screen and the secondary crusher will discharge to a discharge conveyor feeding an Agglomerator. Agglomerated oxide ore would then be conveyed to the heap leach pad. A process flow diagram of the stockpile reclaim and transfer to the secondary crusher process is presented in **Appendix C**.

The material transfer points from the reclaim feeders to the Agglomerator have the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. Particulate matter emissions due to material transfers from the oxide coarse ore stockpile to the reclaim feeders and from the reclaim feeders to the Secondary Crusher Discharge Conveyor are controlled by the Secondary Crusher Dust Collector. The transfer from the Secondary Crusher Discharge Conveyor to the Agglomerator will be controlled with water addition; therefore, this part of the process is not a source of particulate emissions.

Throughputs associated with the stockpile reclaim system reflect operations in Year 2 and Year 14. Note: Oxide ore mining operations cease well before Year 14.

2.1.7 Milling and Flotation

Sulfide ore will be ground with water to the final product size in a SAG and ball mill grinding circuit. The SAG mill will operate in a closed circuit with a trommel screen, pebble feeder, and a pebble crusher. Trommel screen oversize (rock pebbles) will be transported by belt conveyor to the pebble crusher bin and then into the pebble crusher feeder and pebble crusher, where it will be processed and returned by belt conveyor to the SAG mill. Trommel undersize will be the final product from the SAG circuit and will report to the ball mills for additional grinding. Flotation follows processing by the ball mills to produce the copper and molybdenum mineral concentrate slurries, which are transported to the copper and molybdenum dewatering circuits, respectively. Process flow diagrams of the milling and flotation processes are presented in **Appendix C**.

Except for the pebble crushing process, all material processed by the SAG mill grinding circuit and the flotation circuit contains a sufficient amount of moisture such that no potential particulate emissions are formed. In the SAG mill, the added moisture causes fine particles in the crushed ore to agglomerate. Therefore, there will be no emissions due to milling, screening, or material transfer.

As material sits in the pebble crusher, the ore may start to dry out. Therefore, the material transfer points from the pebble crushing process and the material transfer points (after pebble crushing) have the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. These emissions will be controlled by the Sulfide Reclaim Tunnel Line and Pebble Crusher Cartridge Dust Collector.

Throughputs associated with the sulfide ore milling and flotation process reflect operations in Year 2 and Year 14.

2.1.8 Copper Concentrate and Molybdenum Concentrate Dewatering/Shipment

The Copper World Project will primarily employ concentrate leach technology to eliminate the need for offsite shipping of copper concentrate. However, a conventional copper concentrate filtering and shipment process is included in this application to allow for the use of either process on a dynamic basis.

Copper concentrate slurry will be dewatered and thickened in a copper concentrate thickener. Thickener underflow (thickened mineral slurry) will be pumped to copper concentrate filters. Filter cake will be transferred to the copper concentrate stockpile located in the copper concentrate loadout building. Copper concentrate will be reclaimed by front-end loaders and placed in trucks or containers for shipment to market. A process flow diagram of the copper concentrate dewatering process is presented in **Appendix C**.

The copper concentrate dewatering operation will produce a final product with an approximate moisture content of 10%. TSP, PM, PM_{10}, and $PM_{2.5}$ emissions have the potential to be released during material transfer points following processing by the filters where the moisture content is reduced. HAP potential (As, Cd, and Pb) in the copper concentrate is low as all concentrations are <0.1% with the concentrate produced. The copper concentrate stockpile is enclosed in a building to prevent the release of windblown fugitives. Emissions from the building will be controlled by the Copper Concentrate Building Dust Collector.

The molybdenum concentrate slurry stored in the molybdenum filter feed tank will be pumped to a molybdenum concentrate plate and frame filter. Molybdenum filter cake will then discharge to a dryer. The dried concentrate will be placed in a concentrate storage bin and then transferred to the molybdenum concentrate bag feeder and placed into the bag loader. The molybdenum concentrate supersacks will be loaded onto trucks for shipment to market. A process flow diagram of the molybdenum concentrate dewatering process is presented in **Appendix C**.

The molybdenum concentrate dewatering operation will produce molybdenum concentrate with an approximate moisture content of 10% to 12%. Material transfer points, subsequent to processing by the plate and frame filter, have the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. The dried molybdenum concentrate material transfer to the molybdenum concentrate bin will be controlled by the Molybdenum Concentrate Storage Bin Dust Collector. Emissions from the bag loading process will be controlled by the

Molybdenum Bag Loader Dust Collector. Additionally, the molybdenum drying operation has the potential to produce TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. These emissions will be controlled by the molybdenum dryer scrubber.

Throughputs associated with the copper concentration and molybdenum dewatering systems reflect operations in Year 2 and Year 14.

2.1.9 Oxide Ore Leaching

The leaching of both run of mine (ROM) and crushed and agglomerated oxide ore is anticipated in this application for the Copper World Project. The crushing and placement of the agglomerated oxide ore on the heap leach pad is described in **Section 2.1.6**. **Sections 2.1.4 and 2.1.5** describe the mining and hauling of oxide ore to the heap leach pad.

Oxide ore is placed on the heap leach pad in 30-foot lifts. Irrigation is provided by a drip emitter-type irrigation system designed to deliver 0.002 gph/ft2 of a mild sulfuric acid solution. Cells are placed under irrigation for a period of approximately 120 days. Pregnant leach solution (PLS) is collected from each heap cell by a series of drainpipes at the bottom of the heap that ultimately report (by gravity) to a PLS Pond.

The hauling and dumping of ROM oxide on the heap leach pad has the potential to emit TSP, PM, PM10, and PM2.5 emissions, as discussed in previous sections and will only occur in the early mine years (prior to Year 14). The placement of crushed and agglomerated oxide ore on the heap leach pad is a wet process where added moisture causes fine particles in the crushed ore to agglomerate such that no potential particulate emissions are formed.

2.1.10 Concentrate Leach and Precious Metal Recovery

The concentrate leach technology consists of two steps. The first is mechanical liberation, achieved by ultrafine grinding of the sulfide concentrate using IsaMill™ technology. The second step is chemical liberation, achieved by oxidation of the concentrate in a series of leach reactor tanks to extract copper into solution. Copper is then recovered from solution by the solvent extraction-electrowinning (SX-EW) process (see **Section 2.1.12**).

The dewatered copper concentrate is pumped from the copper concentrate storage tank to a M7500 IsaMill™ where it is ground to 80% passing 12 microns. The milled concentrate is then pumped to the first of approximately eight leach reactors operating in serial configuration with a combined residence time of 48 hours, each with a live volume of 1760 m^3, where the concentrate is oxidized in an acidic oxidative leach solution to achieve a copper extraction of 98%. The concentrate leach plant has a design nominal capacity of 1,870 t/d.

Raffinate from the SX-EW plant is added to the oxidative leaching circuit with concentrated acid added as necessary to maintain an excess of about 10 g/L free acid in the output stream. Oxygen is injected into the oxidative leach reactors with the HyperSparge™ supersonic gas injectors to facilitate leaching. The oxidative leach discharge reports to sulfur flotation.

The discharge from the concentrate leach process is pumped to two Jameson Cells to recover sulfur from the residue. The sulfur concentrate is pumped to the sulfur concentrate thickener. The thickener underflow is pumped to a belt filter, which discharges via chute to the sulfur concentrate conveyor. The filtrate is returned to the thickener. The thickener overflow is pumped to the iron control circuit along with the sulfur flotation tails.

The sulfur concentrate is conveyed to the sulfur melting tank, where it is melted prior to being filtered. The heat required to melt the sulfur is provided as waste heat from the sulfur burner. The molten sulfur filtrate is transferred to molten sulfur storage tanks and the residue reports to the precious metal recovery circuit.

The sulfur flotation tails are pumped to the iron control/neutralization circuit together with the sulfur concentrate thickener overflow. Limestone is added and controlled pH precipitation is performed to remove iron, arsenic, and other deleterious dissolved elements from the leached slurry. Oxygen is injected into the neutralization reactors to convert ferrous iron to ferric prior to precipitation as goethite. The neutralization circuit consists of five reactors, each with a live volume of 400 m^3. The oxidized residue is pumped to a thickener. The thickener underflow is pumped to a belt filter which discharges via chute to the oxidized residue conveyor. The filtrate is combined with the thickener overflow and pumped to the PLS Pond where it is combined with PLS from the oxide heap and then transferred to the SX-EW circuit.

The oxidized residue from the neutralization circuit is combined with the sulfur filter residue and re-pulped prior to being fed to a lime boil to decompose any silver-jarosite which may have formed during the oxidation step. From the lime boil, the slurry reports to a cyanidation circuit to leach gold and silver. The pregnant liquor and leach residue flow to solid-liquid separation and washing carried out in a countercurrent decantation (CCD) circuit. The residue is sent to a cyanide destruction step prior to being sent to the tailings storage facility and the pregnant liquor to the Merrill-Crowe zinc cementation process.

From the CCD circuit, the solution is clarified using leaf filters pre-coated with diatomaceous earth. Dissolved oxygen is removed from the clarified solution by passing it through a vacuum de-aeration column. Zinc dust is added to the clarified, de-aerated solution which precipitates gold and silver. The gold and silver precipitates are filtered and smelted to a doré bar.

The process will consist of approximately six (6) tanks for the leach stage followed by five (5) thickeners for the counter current decantation. The tanks will be covered; in addition, there are no particulate or gaseous pollutant emissions anticipated to be associated with these tanks. The precious metal refinery will utilize an electric induction furnace; particulate emissions from the refinery and furnace will be controlled by the refinery dust collector.

2.1.11 Sulfuric Acid Plant

The acid plant is a double-contact double-absorption process. Molten sulfur is pumped from the molten sulfur storage tanks to a sulfur furnace where it is mixed with high pressure air to atomize the sulfur and dry combustion air to burn it. To remove any moisture in the air prior to combustion, it is drawn in from the atmosphere by the main blower through an air filter and drying tower. In the drying tower, moisture is removed through absorption in sulfuric acid. Off-gas, containing SO_2, is cooled by passing through a waste heat boiler. The SO_2 is then catalytically converted to SO_3 in a four-bed converter with vanadium pentoxide as the catalyst. Between each of the four converter beds, heat exchangers and economizers are used to regulate the temperature. After passing the first three converter beds, the hot SO_3 gas is cooled in a cold interpass exchanger and economizer before reaching the interpass adsorption tower, where it is absorbed into strong sulfuric acid. Outlet gas from the interpass tower is reheated using heat exchangers before entering the fourth converter bed, where the remaining SO_2 gas is converted to SO_3. The SO_3 gas feeds the final absorption tower to absorb the formed SO_3 into H_2SO_4. The acid plant has a production capacity of 1,130 tons/day of H_2SO_4.

Steam produced from cooling the sulfur burner is superheated and used to create electrical power in the steam turbine generator. Low-pressure steam used to start up the sulfur burner is generated by an electric start-up/emergency boiler. Some low-pressure steam is also extracted from the steam turbine engine to be used by the molten sulfur heating system during the acid-making process.

The sulfuric acid plant has the has the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions, H_2SO_4 and SO_2. Emissions of particulates and H_2SO_4 will be controlled by the acid plant scrubber. The sulfuric acid plant will be subject to 40 CFR Part 60 Subpart H, as discussed in **Section 5.1.1 and Appendix H**.

2.1.12 Solvent Extraction and Electrowinning

From the PLS Pond, PLS is pumped to the SX circuit to extract copper. The SX circuit consists of five (5) Dispersion Overflow Pump (DOP) tanks, five (5) DOP turbine tanks, ten (10) mixer tanks and five (5) extraction settlers. In the circuit, PLS flows counter-currently through the extraction cells where it is contacted with an organic solvent. Copper is transferred from the PLS to the organic phase. The barren raffinate flows to the Raffinate Pond and the loaded organic flows to the loaded organic tank. Loaded organic is then pumped to the wash stage where iron is scrubbed away to reduce electrolyte iron contamination. Washed loaded organic flows into the stripping stage, where it is stripped of copper by a high-acid aqueous phase (electrolyte) and recycled back to the extraction cells. The electrolyte is pumped through electrolyte filters to the tankhouse where the copper is plated on stainless steel cathodes in the electrowinning process. Cathodes are removed from the cells and transferred to a stripping machine. Stripped cathode blanks are returned to the electrowinning process and the copper cathodes are bundled and stacked for shipping.

The SX system has the potential to emit VOC and HAP emissions. The EW cells have the potential to emit H_2SO_4 and cobalt compounds. The H_2SO_4 and cobalt compound emissions will be controlled by the Electrowinning Plant Scrubbers.

2.1.13 Tailings Dewatering/Thickening and Placement

Tailings associated with the Copper World Project will be placed in conventional storage facilities and are therefore wet processes. Tailings slurry, with a density of about 65% solids by weight, will be pumped to the tailings storage facilities from the tailings thickeners. The tailings slurry will be cycloned at the crest of the tailings embankment. The heavier sand potions of the tailings will be used to build the embankments while the finer materials will flow to the inside of the impoundments. Decanted water will pond on the top surface of the tailings impoundment and will be pumped back into the process.

A Tailings Management Plan will be developed for the tailings storage facilities that outlines dust control measures during embankment construction, general operations, and high wind conditions.

The throughputs associated with tailings thickening and placement reflect operations in Year 2 and Year 14.

With the exception of the wind erosion of the tailings storage area, the tailings management process is a completely wet process. Therefore, there are no emissions associated with the tailings management. Wind erosion of the tailings storage area has the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions.

2.1.14 Secondary Processes

The following secondary processes are necessary to support the operations at the Copper World Project and are capable of producing emissions: (a) fuel burning equipment; (b) reagent systems; (c) storage tanks; (d) organic reagent use; (e) acid leach; (f) an analytical, metallurgical laboratory; (g) the use of mobile vehicles; and (h) open burning.

There are four pieces of stationary fuel burning equipment that will be used at Copper World; three emergency generators used during commercial power outages, and one fire water pump used in emergency situations. The emergency generators will use diesel fuel and have output capacities of 1,345 kW each. The fire water pump is also diesel fired with an output capacity of 400 hp. Additionally, Rosemont uses multiple nonroad engines and on-road vehicles. Regulated air pollutants emitted from the diesel fuel burning equipment include TSP, PM, PM_{10}, $PM_{2.5}$, CO, NO_x, SO_2, VOCs, HAPs, and GHGs. The nonroad engines and on-road vehicles are not regulated by ADEQ.

Reagent systems include delivery of reagents to the facility, possible mixing and/or preparation of reagents, storage, and distribution to a process stream. Some of the reagents delivered to the facility are in solid form and will be mixed with water at the facility. Other reagents may be delivered in liquid form or may remain in solid form prior to use in the process. The material transfer points of the solid phase reagents have the potential to emit TSP, PM, PM_{10}, and $PM_{2.5}$ emissions. The liquid phase reagents stored in tanks prior to use may produce VOC and HAP emissions from breathing and working losses depending on the properties of the reagent.

Emissions from the reagent systems will be controlled by the Collector Storage and Distribution Tanks Stack and the Collector Area Ventilation Fan Stack. The transfer of lime to the lime storage bins is controlled by the Quicklime Dust Collector, emissions from the Lime Slaking Mill are controlled by the Lime Scrubber and the transfer of flocculant from the supersacks to the flocculant feed bin will be controlled by the Flocculant Feed Bin Cartridge Dust Collector. Process flow diagrams of the reagent systems are presented in **Appendix C**.

Copper World will include multiple storage tanks containing volatile organic liquids that are either greater than 10,000 gallons with a vapor pressure equal to or greater than gasoline, or greater than 40,000 gallons with a vapor pressure equal to or greater than diesel fuel. Emissions from such tanks will result in the form of breathing and working losses. Rosemont will have five tanks that meet these criteria. All other tanks that do not meet these criteria are considered insignificant activities.

Reagents are used in various processes at Copper World. Frothers, promoters, flocculants, and xanthates for copper and molybdenum promotion and collection are added during the bulk flotation and molybdenum flotation processes. Antiscalants and flocculants are added to the dewatering processes. The types of reagents and the quantities used may be modified to address the changes in ore and processing conditions. All VOC emissions from organic reagent use in the flotation and dewatering processes are fugitives and are negligible due to the dilution of the organic reagents in large quantities of water and the comparatively low vapor pressures of the organics when compared to water.

The analytical, metallurgical laboratory will be a single-story pre-engineered building and will consist of a sample preparation area, metallurgical laboratory, reagent storage area, and balance rooms. The sample preparation area will contain sample crushers, pulverizers, splitters, sieve shakers, blenders, and one dust collector (Laboratory Dust Collector) and one scrubber (Laboratory Scrubber) to capture and contain any particulate matter emissions generated from these operations. There are no other processes taking place in the metallurgical laboratory that will produce emissions.

The use of mobile vehicles is an integral part of operations at Copper World. The mobile vehicles include major mine equipment and mining support equipment. The mobile vehicles have the potential to produce particulate matter emissions from traveling on unpaved roads at the facility. The unpaved road emissions from the mobile vehicles are fugitive emissions and are controlled by road watering and/or chemical treatment as discussed in **Section 2.1.4**.

Open burning may periodically need to be performed at Rosemont. Rosemont will obtain the necessary open burn permits prior to any open burning activities, and proper open burning procedures and requirements will be followed.

2.1.15 Insignificant Activities

Rosemont is identifying insignificant activities at the facility. These are listed in **Appendix D**.

2.2 Alternate Operating Scenarios and Products

There are no alternate operating scenarios or products proposed. Minor changes in process unit configuration and to process chemicals in order to respond to the evolving ore characteristics are a routine part of the mining process and not subject to alternate operating scenario treatment. These types of changes are encompassed within the estimated emission calculations presented in this application. Changes to the Copper World Project requiring notification or revisions will be properly addressed through the permitting process.

2.3 Material Balance

Material balance methods were used to calculate sulfur dioxide (SO_2) emissions from the combustion of diesel fuel by the emergency generators and fire water pumps. This method assumes that all of the sulfur contained in the fuel is converted to SO_2 and released to the atmosphere during combustion. Emission calculations are presented in **Appendix F**.

2.4 Dust Control Plan

It is anticipated that a Dust Control Plan will be required for the Copper World Project. As such, Rosemont is proposing to use a combination of Dust Control Programs A, B, C and D for fugitive dust control on the haul roads. The dust control programs are summarized below:

Dust Control Program A consists of the application of sufficient chemical suppressant to achieve a ground inventory of 0.25 gallons/yard^2 with a reapplication frequency of 1-month (where reapplication frequency refers to the time interval between applications used to maintain a specific ground inventory). The term “ground inventory” represents the residual accumulation of a dust suppressant from previous applications. Dust suppressants which could be used for this purpose in include, among others, lignosulfonates, petroleum resins, asphalt emulsions and acrylic cement. For Program A, the control efficiencies mentioned in EPA referenced model (Fugitive Dust Background Document and Technical Information Documents for Best Available Control Measures) are averages and not maximums. As such, the use of a chemical dust suppressant with a ground inventory of 0.25 gallons/yd^2 could result in control efficiencies higher than 90%.

Dust Control Program B consists of periodic watering in sufficient amounts to achieve 90% control of PM_{10}. Program B will be applied only during days with precipitation of less than 0.01 inches. Different water application intensities necessary to achieve a 90% particulate control efficiency will be presented in the Dust Control Plan B for daytime and nighttime hours. The calculated water quantities required by the formula in Dust Control Program B will be compared to actual usage. Rosemont will use these calculated numbers as a guideline. Should the updated fugitive dust control approach not be effective, resorting to the water application/consumption rates required by the EPA methodology equation will be the default position. Additionally, adjustments to the parameters used in the equation, such as evaporation, will be adjusted to site-specific conditions and not tied to conditions in Tucson, Arizona.

Dust Control Program C consists of the application of sufficient chemical dust suppressant to achieve a ground inventory of 0.05 gallons/yard^2 with a 1-month reapplication frequency (the ground inventory of 0.05 gallons /yard^2 provides a base control efficiency of 62%) plus periodic watering to increase the base control efficiency achieved by chemical dust suppressants alone to 90%. A summary of roadway traffic volume and corresponding annual average watering requirements will be presented in the Dust Control Plan C. The Dust Control Program C will also state that if any type of water adhesion enhancing material, such as a surfactant, is used with this program then application intensities will be reevaluated.

Dust Control Program D was designed to achieve 95% control on all processing plant roads and on the entire heavy haul road network during the Year 1-5 mining operations when dust emitting operations are in closest proximity to the ambient air boundary. After Year 5, the majority of haul roads would be designed to achieve 90% control efficiency while the main haul road between the northern Rosemont Pit rim and the Copper World area would be designed to achieve 95% control.

One of two products, RoadPRO-NT (RPNT) or SoilSement, or equivalent, will be used to achieve 95% control efficiency. For both products, a 'base' of material will be achieved through multiple applications over an initial 30-45 day period. The targeted 'base' building over this period would be one (1) gallon per 70-90 square feet. Maintenance applications will be required over time to deliver 95% control; reapplication is anticipated every two (2) weeks with a target of one (1) gallon per 350-500 square feet. The vendor guarantee is provided in **Appendix E**. the SoilCement product would be used in the Plant Site area while RoadPRO-NT would be used on haul roads.

- ► Dust control programs that utilize chemical dust suppressants require periodic application to replenish the binding material that is removed due to the abrasion of the vehicles on the treated road surface. Each successive application will correspond to the following:

  - The manufacturer's recommendation (if available); or

  - If manufacturer's recommendations are not available, the amount necessary to completely replenish the initial ground inventory every six months.

The frequency of reapplication of water use in Dust Control Programs B and C will depend upon the operational plans of the Project. The frequency can be hourly, less frequent or more frequent, depending upon the traffic density, meteorological conditions, and operational considerations. The application intensities for water should be treated as annual averages as some days will require a greater water application whereas others will require a lesser water application due to seasonal climatic conditions changes. Models will be presented in the Dust Control Plan that predict the same control efficiency independent of whether the water is applied during one pass per hour of the water truck or multiple passes during the 1-hour period. Additionally, watering will not be required for days when natural precipitation equals or exceeds 0.01 inches or when roads are moist due to recent rain, as the control efficiency during such days is assumed to be 100% by AP-42. Additionally, watering will not be required on roads that are moist from the application of previous water control.

3. SITE DIAGRAM

Figure 3-1 contains the Year 2 Facility Layout for the Copper World Project. **Figure 3-2** shows the Year 14 Facility Layout for the Copper World Project.

Figure 3-1. Year 2 Facility Layout for the Copper World Project

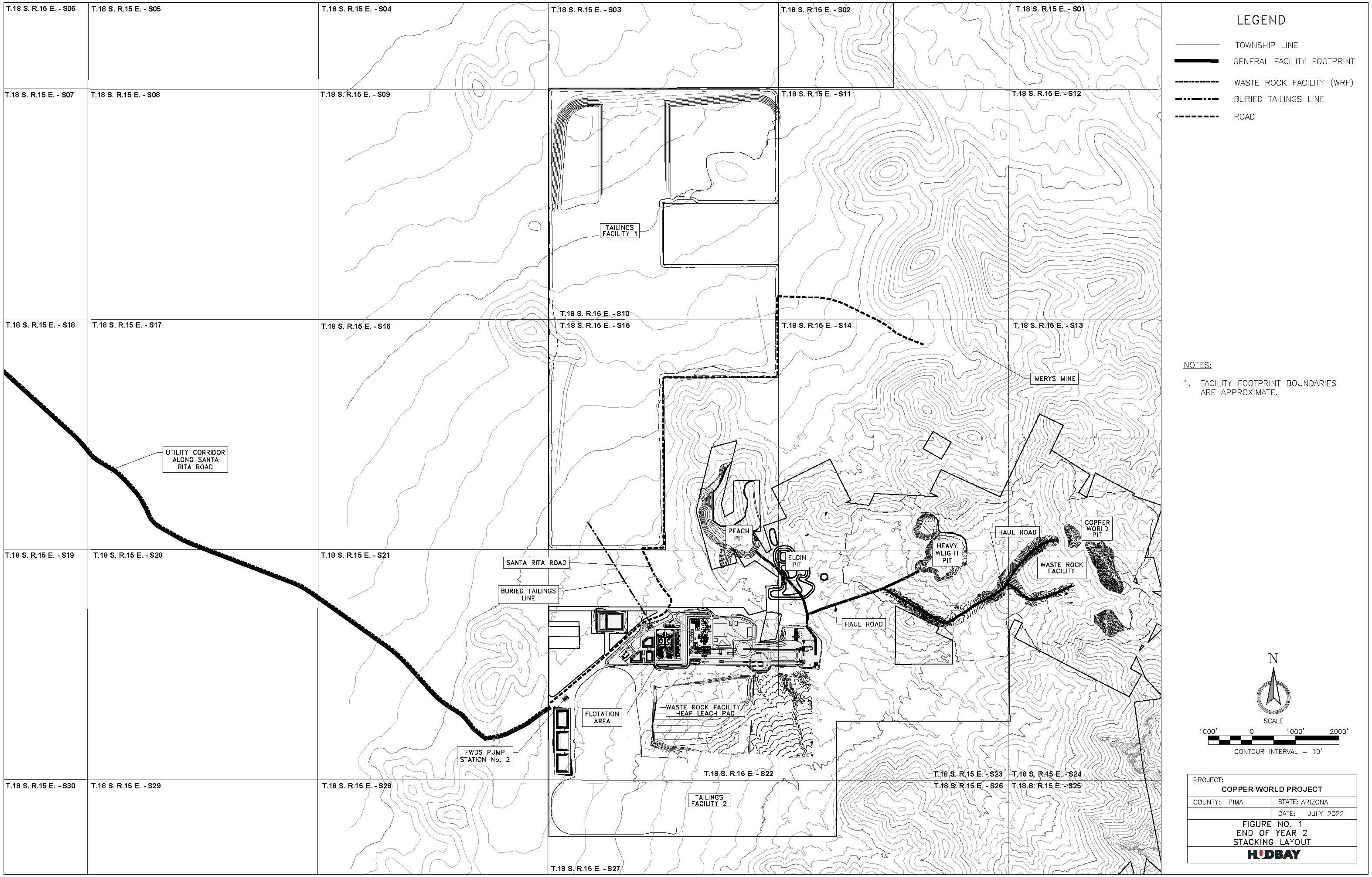
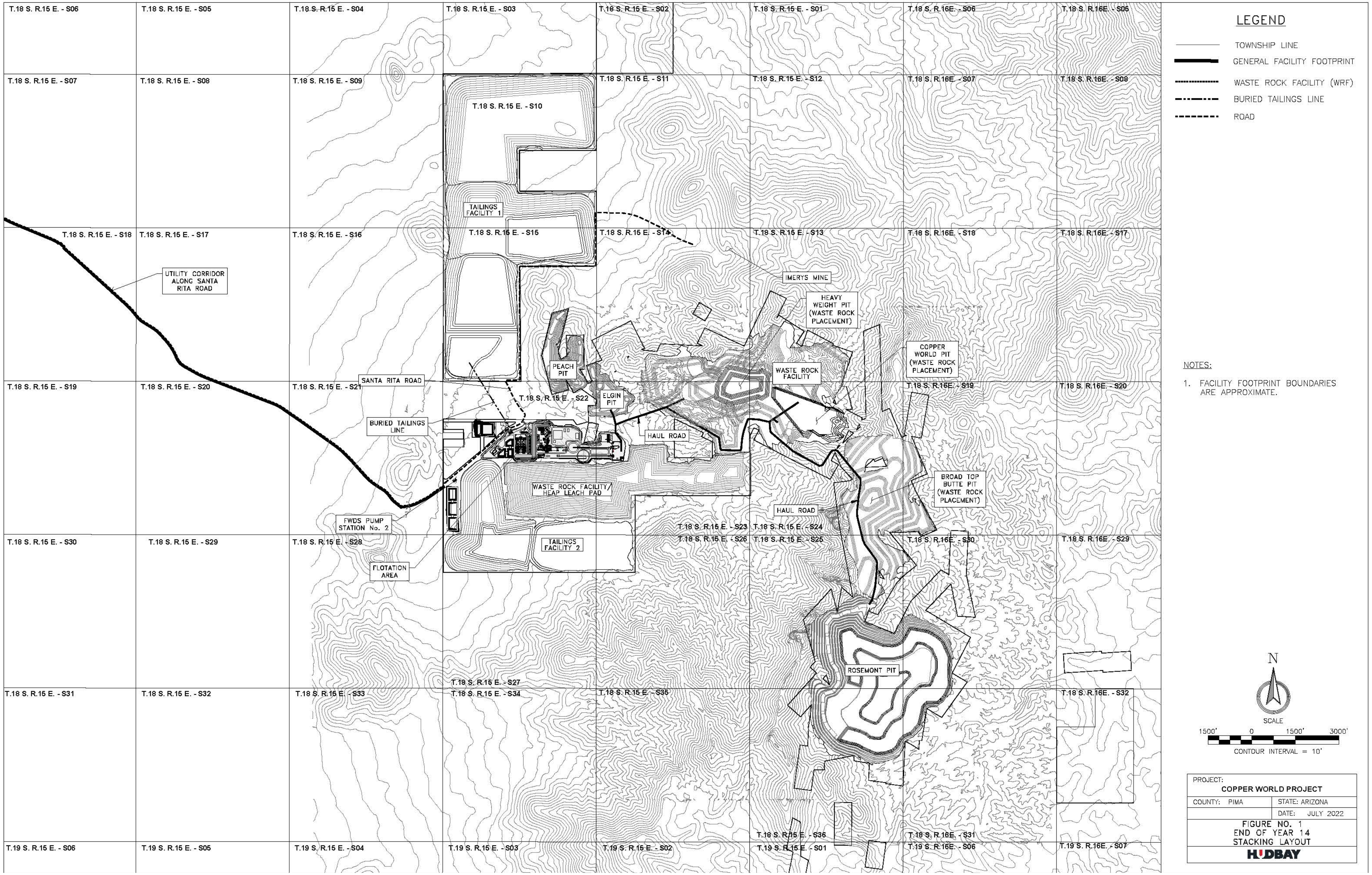


Figure 3-2. Year 14 Facility Layout for the Copper World Project



4. EMISSIONS OF REGULATED AIR POLLUTANTS

The emissions of regulated air pollutants as a result of the proposed Project involves the following pollutants:

- Particulate matter (PM/$PM_{2.5}$/PM_{10});
- Nitrogen oxides (NO_x);
- Carbon monoxide (CO);
- Sulphur dioxide (SO_2);
- Volatile organic compounds (VOCs);
- Hazardous Air Pollutants (HAPs); and
- Greenhouse gases (GHGs).

Detailed emissions calculations are included in **Appendix F** along with information regarding the development of the emission factors, throughputs and controls used to develop the emissions estimates. Additional information on the calculation methodologies is presented in the sections below.

4.1 Emission Calculations

4.1.1 Mining

4.1.1.1 4.1.1.1 Drilling (Unit ID: MN01)

Process Rate

The annual, maximum daily, and hourly process rates for drilling blasting holes are calculated based on the number of blasts that are performed either annually, daily, and hourly and a drilling rate of 35 holes/blast or 70 holes/blast in Year 2 and 100 holes/blast in Year 14 (see **Appendix F**).

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from drilling are calculated using the emission factor of 1.3 lb/hole, from AP-42, Table 11.9-4 (10/98) for total suspended particulates (TSP) from drilling of overburden at western surface coal mines. The TSP emission factor is assumed to be applicable for PM. PM_{10} and $PM_{2.5}$ emissions from drilling are not listed in Table 11.9-4. PM_{10} emissions are assumed equal to 33% of PM emissions based on the ratio of PM_{10} to PM emissions for tertiary crushing of high moisture ore in AP-42, Table 11.24-2 (08/82).

$PM_{2.5}$ emissions are estimated to be 18.5% of PM_{10} emissions based on the ratio of $PM_{2.5}$ to PM_{10} controlled emissions for tertiary crushing in AP-42, Table 11.19.2-2 (08/04). This is higher than the actual value because pollution control devices have a lower efficiency for smaller size particulates.

Control Efficiency

For the Year 2 mine planning, additional control strategies for drilling emissions associated with blasthole drilling will be utilized. For drilling operations in Peach/Elgin pits 1&2, as well as within the Heavy Weight and Copper World pits, drilling shrouds or dust suppression sprays will be utilized to reduce drilling particulate emissions by 85%. The controls will be used for the duration that drilling occurs in the Copper World, Heavy Weight, Peach and Elgin Pits. These controls are not proposed to be utilized once mining moves out of the Copper World, Heavy Weight, Peach and Elgin pits.

4.1.1.2 4.1.1.2 Blasting (MN02)

Process Rate

The Copper World operation is capable of performing 175 blasts/year in Year 2 and 300 blasts/year in Year 14. However, the actual annual process rates for blasting at Copper World will vary from year to year depending on mining needs. The annual quantity of blasts per year anticipated at Copper World is determined by the mine plan of operations and is presented in the emissions inventory in **Appendix F**. The maximum daily process rate for blasting during the early mine life (represented by Year 2 in the emissions inventory and modeling analysis) is assumed to be 1 blast per day and is assumed to be 2 blasts/day in the later years (represented by Year 14 in the emissions inventory and modeling analysis). Similarly, the hourly process rate is equal to 1 blast per hour in Year 2 and 2 blasts/hr in Year 14.

The annual process rate for the amount of ANFO used for blasting is calculated by employing the ANFO usage rate for Rosemont, 0.3 tons of ANFO/drill hole, and multiplying it by the amount of holes drilled/year. The maximum daily and hourly process rates are calculated similarly based on the maximum daily and hourly drilling rates.

Emission Factor

Uncontrolled PM, PM10, and PM2.5 emissions from blasting are calculated using the emission factor expression from AP-42, Table 11.9-1 (10/98) for blasting at western surface coal mines (Equation 1):

$EF = (k)(0.000014)(A)^{1.5}$

where:

EF = emission factor (lb/blast)
K = scaling factor (1 for TSP, assumed to be equivalent to PM, 0.52 for PM10, 0.03 for PM2.5)
A = horizontal area of the blast (ft2; 181,202 maximum, calculated by multiplying the average amount of holes drilled per blast (200 holes) by the approximate spacing (30 ft) and burden (30 ft) of the drilling pattern)

Uncontrolled CO and SO2 emissions from blasting are calculated using the emission factors from AP-42, Table 13.3-1 (02/80) for the detonation of ANFO. Uncontrolled NOx emissions are calculated using the emission factor found in "NOx Emissions from Blasting Operations in Open-Cut Coal Mining" by Moetaz I. Attalla, Stuart J. Day, Tony Lange, William Lilley, and Scott Morgan (2008) (0.9 kg per metric ton based on reported average on page 7881 of the reference).

Uncontrolled CO2, CH4, and N2O emissions are calculated using the emission factors of 73.96 kg/MMBtu, 3*10-3 kg/MMBtu, and 6*10-4 kg/MMBtu, respectively, from 40 CFR 98, Tables C-1 and C- 2 for distillate fuel oil No. 2. A diesel fuel oil to ammonium nitrate ratio of 9% and a diesel heating value of 19,300 Btu/pound of diesel fuel were used to express the CO2, CH4, and N2O emission factors in terms of lb/ton of ANFO.

The gaseous emission factors for blasting are presented in the emissions inventory in **Appendix F**.

Control Efficiency

Besides good operating practices, other pollution control methods cannot be implemented during blasting.

4.1.1.3 4.1.13 Loading Concentrate Ore, ROM Ore, and Waste Rock (Unit IDs: MN03, MN04, and MN05)

Process Rate

The annual process rates for loading concentrate ore, ROM ore, and waste rock into haul trucks are equal to the annual ore and waste rock mining rates at Copper World. The mining rates (see **Appendix F**) are based on geologic and pit development studies completed at the Copper World Project and presented in the mine plan of operations. The maximum daily process rates for loading ore and waste rock in Years 2 and 14 in the life of the mine are calculated by dividing the annual loading rates by 365, the quantity of days per year when mining will be performed. The hourly process rates for loading ore and waste rock are calculated by dividing the maximum daily loading rates by 24 hours/day.

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from loading concentrate ore, ROM ore, and waste rock into haul trucks are calculated using the emission factor expression from AP-42, Section 13.2.4.3 (11/06) for aggregate drop processes. This expression (Equation 2) is:

$$EF = (k)(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}} \qquad (2)$$

where:

EF = emission factor (lb/ton)

k = particle size multiplier (0.74 for PM_{30} (assumed to be equivalent to PM), 0.35 for PM_{10}, 0.053 for $PM_{2.5}$)

U = mean wind speed (The mean wind speed in the pits is 6.15 mph)

M = material moisture content (3.5% for concentrate ore, ROM ore, and waste rock from the mine as determined by Rosemont[1])

Control Efficiency

Besides good operating practices, other pollution control methods are not implemented during concentrate ore, ROM ore, and waste rock loading.

4.1.1.4 4.1.1.4 Hauling Concentrate Ore, Leach Ore, and Waste Rock (Unit IDs: MN06, MN07, and MN08)

Process Rate

The annual, daily, and hourly process rates for the amount of vehicle miles traveled (VMT) by the haul trucks in order to haul sulfide ore to the primary crusher/run of mine stockpile, leach ore to the leach pad, and waste rock to the waste rock storage area are calculated by multiplying the distance traveled (i.e. the distance from the mining location in the pit(s) to the primary crusher dump hopper/run of mine stockpile, leach pad, or waste rock storage area) by the amount of truckloads needed to haul the material. The number of truckloads is determined by dividing the anticipated annual, daily, or hourly amount of material mined by the average haul truck load (255 tons) and multiplying this number by two to account

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[1] 3.5% moisture represents a conservative minimum moisture content for water balance purposes, consistent with the Copper World Project's Aquifer Protection Permit (APP) application.

for the haul trucks returning empty to the mining location. The distances traveled by the haul trucks in order to haul the sulfide ore to the primary crusher/run of mine stockpile, leach ore to the leach pad, crusher, or stockpile, and waste rock to the waste rock storage area are determined by the mine plan presented in **Appendix F**.

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions resulting from the use of haul trucks on unpaved roads at the Copper World Project are calculated from the emission factor expression (Equation 3a) in AP-42, Section 13.2.2 (11/06):

$$EF = (k)(\frac{s}{12})^a(\frac{W}{3})^b \qquad (3a)$$

where:

EF = emission factor (lb/VMT)

k = particle size multiplier (4.9 lb/VMT for PM_{30}, assumed to be equivalent to total suspended particulate matter and PM, 1.5 lb/VMT for PM_{10}, 0.15 lb/VMT for $PM_{2.5}$)

a = constant (0.7 for PM, 0.9 for PM_{10} and $PM_{2.5}$)

b = constant (0.45 for PM, PM_{10}, and $PM_{2.5}$)

s = surface material silt content (5.0%, a value consistent with recently permitted copper mines)

W = mean vehicle weight (294 tons, calculated by averaging the empty weight of the haul trucks [167 tons] and the loaded weight of the haul trucks [422 tons])

The emission factor for annual emissions is modified by the following precipitation factor to account for days when the roads are wet, and emissions are reduced:

$$EF_{annual} = (EF)(\frac{365-p}{365}) \qquad (3b)$$

where:

EF_{annual} emission factor used to estimate annual emissions of particulate matter (lb/VMT)

EF = emission factor used to estimate hourly and daily emissions of particulate matter (lb/VMT, calculated by Equation 3a)

P = number of days per year with greater than 0.01 inch of precipitation (61 days/year, average data from 1950 – 2008 from the Western Region Climate Center, Santa Rita Experimental Range weather station located 8 miles southwest of the Copper World Project at 4,300 feet above mean sea level)

Control Efficiency

Emissions of particulate matter resulting from haul truck traffic on haul roads at the Copper World Project will be controlled by the application of water and/or chemical dust suppressant to the road surface. Additional detail on haul road control efficiency is presented in **Section 2.4**.

4.1.1.5 Unloading

This section covers unloading operations such as sulfide ore to the crusher or stockpile, leach ore to the crusher, stockpile or heap, and waste rock to the waste rock facility (WRF). Unit IDs covered include: MN09, MN10, and MN11.

Process Rate
The annual, maximum daily, and hourly process rates for unloading concentrate ore to the crusher stockpile, leach ore to the leach pad and waste rock to the waste rock storage area are equal to the leach ore and waste rock loading rates.

Emission Factor
Uncontrolled PM, PM10, and PM2.5 emissions from unloading leach ore to the leach pad, sulfide ore to the crusher stockpile, and waste rock to the storage area are calculated using Equation 2. The material moisture content (M, 3.5%) is the material moisture content of the ore as determined by Rosemont. The mean wind speed (7.92 mph) is the average wind speed out of the pit based on 2016-2020 Tucson AERMET data. Since the unloading process at the Copper World Project is unprotected from the wind, the unaltered wind speed is used in the emission factor equation presented in Equation 2.

Control Efficiency
Besides good operating practices, other pollution control methods are not implemented while unloading sulfide ore to the crusher stockpile (or crusher), leach ore to the leach pad (or stockpile or crusher), and waste rock to the waste rock facility area (WRF).

4.1.1.6 Bulldozer Use (Unit ID: MN12)

Process Rate
The annual process rates for bulldozer use are calculated by summing the annual number of hours each type of bulldozer will be used, as determined by the mine plan of operations (see **Appendix F**). The maximum daily process rates are calculated by dividing the annual hours by 365, the quantity of days per year the bulldozers will be used. The hourly process rates are calculated by dividing the maximum daily process rates by 24 hours/day.

Emission Factor
Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from bulldozing operations are calculated from the emission factor expression in AP-42, Table 11.9-1 (10/98) for the bulldozing of overburden at western surface coal mines. This expression (Equation 4) is:

$$EF = (k)\left(\frac{s^a}{M^b}\right) \qquad (4)$$

where:

EF = emission factor (lb/hr)

k = particle size multiplier (5.7 for TSP assumed to be equivalent to PM, 0.75 for PM_{10}, 0.60 for $PM_{2.5}$ (5.7*0.105))

s = material silt content (bulldozing operations primarily represent handling of waste rock and ore with a bulldozer. The silt content of these materials is uncertain. AP-42, Table 13.2.4-1 (11/06) provides the silt content of various materials. The silt content of overburden in this table is 7.5% and was assumed for the silt content of the material handled by bulldozers.)

M = material moisture content (3.5% for sulfide ore, leach ore, and waste rock from the mine as determined by Rosemont)

a = constant (1.2 for PM and $PM_{2.5}$, 1.5 for PM_{10})

b = constant (1.3 for PM and $PM_{2.5}$, 1.4 for PM_{10})

Control Efficiency
Besides good operating practices, other pollution control methods are not implemented during bulldozer use.

4.1.1.7 Water Truck Use (Unit ID: MN13)

Process Rate
The annual, daily, and hourly process rates for water truck use were provided by Rosemont based on anticipated needs for each mine plan year.

Emission Factor
Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions resulting from the use of water trucks on unpaved roads at the Copper World Project are calculated using Equations 3a and 3b. The surface material silt content (s, 5.0%) and number of days per year with greater than 0.01 inches of precipitation (p, 61 days/year) are equal to the values used to calculate the emission factor in **Section 4.1.1.4**. Explanations for how these values are determined are presented in **Section 4.1.1.4**.

The mean vehicle weight (W, 186.5 tons) is calculated by averaging the empty (125 tons) and loaded weights (248 tons) of the water trucks.

Control Efficiency
Emissions of particulate matter resulting from water truck use on haul roads at the Copper World Project will be controlled by the application of water and/or chemical dust suppressant to the road surface. Additional detail on haul road control efficiency is presented in **Section 2.4**.

4.1.1.8 Grader Use (Unit ID: MN14)

Process Rate
The annual process rates for grader use are calculated by summing the annual amounts of VMT for the grader. The VMT are calculated by multiplying the hours of operation for the graders, as determined by the mine plan of operations (see **Appendix F**) by the average speed the graders will be traveling 4.6 mph). The maximum

daily amounts of VMT by the graders are calculated by dividing the annual VMT by 365, the quantity of days per year graders will be used. The hourly process rates are calculated by dividing the daily grader usage rates by 20 hours/day.

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from grader use are calculated from the emission factor expression in AP-42, Table 11.9-1 (10/98) for grading at western surface coal mines. This expression (Equation 5) is

$$EF = (k)(a)(S)^b \quad (5)$$

where:

EF = emission factor (lb/VMT)

k = particle size multiplier (1 for TSP assumed to be equivalent to PM, 0.60 for PM_{10}, 0.031 for $PM_{2.5}$)

S = mean vehicle speed (4.6 mph)

a = constant (0.040 for PM, 0.051 for PM_{10}, 0.040 for $PM_{2.5}$)

b = constant (2.5 for PM, 2.0 for PM_{10}, 2.5 for $PM_{2.5}$)

Control Efficiency

Besides good operating practices, other pollution control methods are not implemented during grader use.

4.1.1.9 Support Vehicle Use (Unit ID: MN15, MN16)

Process Rate

The annual, maximum daily, and hourly process rates for support vehicle use were provided by Rosemont based on anticipated needs for each mine plan year.

Except for the drills and shipment and delivery vehicles, the annual amount of VMTs for each type of support vehicle is based on usage determinations, which are anticipated to be consistent throughout the life of the mine.

For the drills, the annual, maximum daily, and hourly amounts of VMTs is determined by the distance traveled to prepare for a blast and the maximum number of blasts per year, day, or hour.

For the shipment and delivery trucks, the annual, maximum daily, and hourly amounts of VMTs are calculated by multiplying the number of shipments and deliveries in any given year, day, or hour by the distance the shipment and delivery trucks have to travel within the Copper World Project property boundaries.

The annual number of shipments and deliveries are calculated by dividing the quantity of the material being shipped or delivered by the capacity of the shipment or delivery truck. The quantities of material being shipped are assumed to be equal throughout the life of the mine except for the copper and molybdenum concentrate and copper cathodes produced. The daily amounts of shipments and deliveries, and the hourly amounts of shipments and deliveries, are based on the maximum number of shipments or deliveries the Copper World Project can accommodate in any one day or hour for each material.

The annual, maximum daily, and hourly VMT process rates, the support vehicle fleet size, and the support vehicle weight are presented in the emissions inventory in **Appendix F**.

<u>Emission Factor</u>
Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions resulting from the use of support vehicles on unpaved roads at the Copper World Project are calculated using Equations 3a and 3b. The surface material silt content (s, 5.0%) and number of days per year with greater than 0.01 inch of precipitation (p, 61 days/year) are equal to the values used to calculate the emission factor in **Section 4.1.1.4**. Explanations for how these values are determined are presented in **Section 4.1.1.4**.

The mean vehicle weight (W, tons) is the weighted average value for all of the support vehicles that will be used at the Copper World Project, based upon the total vehicle miles traveled for each vehicle. Since equal scaling does not occur for all vehicles in the calculation of annual, maximum daily, and hourly vehicle miles traveled, the mean vehicle weight will vary for these time periods. The mean vehicle weight values are presented in the emissions inventory in **Appendix F**.

<u>Control Efficiency</u>
Emissions of particulate matter resulting from water truck use on haul roads at the Copper World Project will be controlled by the application of water and/or chemical dust suppressant to the road surface. Additional detail on haul road control efficiency is presented in **Section 2.4**.

4.1.2 Primary Crushing, Conveying, Coarse Ore Storage, and Reclaim Conveying

4.1.2.1 4.1.2.1 Wind Erosion of the Run of Mine Stockpile (Unit ID: PC01 – Year 2 Only)

<u>Process Rate</u>
The annual, daily, and hourly process rates for wind erosion of the run of mine stockpile are equal to the maximum area of the land containing the stockpile (14 acres) and continuous operation of the stockpile (i.e., 8,760 hours/year, 24 hours/day, 1 hour/hour).

<u>Emission Factor</u>
Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions due to wind erosion of the run of mine stockpile are determined using the following MRI (1978b) equation from the American Mining Congress Report, Fugitive Dust Emission Factors for the Mining Industry (FDEMI) (07/83), Section 3.7:

$$EF = 3400(k)\frac{\left(\frac{e}{50}\right)\left(\frac{s}{15}\right)\left(\frac{f}{25}\right)}{\left(\frac{PE}{50}\right)^2}\left(\frac{1}{2000}\right) \qquad (6)$$

where:

EF = emission factor (tons/acre-year)

k = particle size multiplier (1 for PM, 0.5 for PM_{10}, 0.075 for $PM_{2.5}$ from AP-42, Section 13.2.5, Industrial Wind Erosion (11/06), page 3)

e = surface erodibility (tons/acre-year, 38 for concentrate ore, from page 52 of FDEMI)

s = silt content of surface material (The silt content of the sulfide ore is uncertain. AP-42, Table 13.2.4-1 (11/06) provides the silt content of various materials. The silt content of overburden in this table is 7.5% and was assumed for the silt content of the sulfide ore in the run of mine stockpile.)

f = percentage of time the wind speed exceeds 12 mph (13.12%, value calculated from 2016-2020 Tucson AERMET data)

PE = Thornthwaite's Precipitation-Evaporation Index (22 for the RCP, determined from Figure 14 of FDEMI)

The universal soil loss (USL) equation also presented in Section 3.7 of the FDEMI is modified to Equation 6 for use with fugitive dust sources at mines. It is analogous to the USL equation but eliminates all factors for agricultural crops.

<u>Control Efficiency</u>
Besides good operating practices, other pollution control methods are not used to control emissions from the run of mine (ROM) stockpile.

4.1.2.2 Unprotected Transfer Points (Unit ID: Various)

<u>Process Rate</u>
The annual, daily and hourly process rates are dependent on the point in the material processing process but are typically based on the respective ore mining rates. Process rates for transfers associated with the secondary process such as the secondary screen transfer points and the secondary crusher transfer points are dependent on anticipated routing to the secondary process and are shown in the emissions inventory included in **Appendix F**.

<u>Emission Factor</u>
Uncontrolled PM, PM10, and PM2.5 emissions from unprotected transfer points (indicated in the emissions inventory with Particulate Matter Process Code 'TrStnUnp') are calculated using Equation 2. The mean wind speed (U, 7.92 mph) and material moisture content (M, 3.5%) are equal to the values used to calculate the emission factors in **Section 4.1.5**.

<u>Control Efficiency</u>
Various control technologies such as fogging sprays, dust collectors, water sprays, enclosures, and wet process are used to control emissions from unprotected transfer points and are documented in the emissions inventory included in **Appendix F**. Emissions of particulate matter resulting from unloading ore to the feed bins will be controlled by water fogging sprays. The fogging sprays have a control efficiency of 99%.

4.1.2.3 Rock Breaker and Primary Crusher (Unit ID: OCR02, OCR04, SCR02, SCR04)

<u>Process Rate</u>

The annual and daily process rate for the rock breakers and primary crushers is based on the maximum quantity of ore mined per year and per day (respectively). The hourly process rates are based on the respective maximum hourly crusher capacities.

Emission Factor

Uncontrolled PM and PM10 emissions from the rock breakers and primary crushing are calculated using the emission factors of 0.02 lb/ton and 0.009 lb/ton, respectively, from AP-42, Table 11.24-2 (08/82) for primary crushing of high moisture ore. The inherent moisture content of the concentrate ore at the Copper World Project is estimated to be at least 3.5% with sufficient moisture added to increase the total moisture content to 4% or higher, which according to AP-42, Section 11.24.2 classifies the ore as high moisture. Uncontrolled $PM_{2.5}$ emissions are estimated to be 18.5% of PM_{10} emissions based on the ratio of $PM_{2.5}$ to PM_{10} controlled emissions for tertiary crushing in AP-42, Table 11.19.2-2 (08/04). This is higher than the actual value because pollution control devices have a lower efficiency for smaller size particulates.

Control Efficiency

Emissions of particulate matter resulting from the oxide and sulfide rock breakers are controlled by the oxide and sulfide primary crusher fogging systems, respectively. Emissions of particulate matter from the oxide and sulfide primary crushers are controlled by the oxide area primary crusher cartridge dust collector and sulfide area primary crusher dust collector, respectively. The primary crushers are designed in a conical shape such that crushing and particulate matter generation occurs near the bottom of the crusher and is emitted through the exit of the crusher. The dust collectors have a control efficiency of 99%.

4.1.2.4 Oxide Secondary Feeder Screen (Unit ID: OCR16)

Process Rate

The annual and daily process rate for the oxide secondary feeder screen is based on the maximum quantity of ore mined per year and per day (respectively). The hourly process rate is based on the maximum hourly oxide ore crusher capacity.

Emission Factor

Uncontrolled PM and PM_{10} emissions from the secondary feeder screen are calculated using the emission factors of 0.025 lb/ton and 0.0087 lb/ton, respectively, from AP-42, Table 11.19.2-2 (08/04) screening. Uncontrolled $PM_{2.5}$ emissions are estimated to be 6.8% of PM_{10} emissions based on the ratio of $PM_{2.5}$ to PM_{10} controlled emissions for controlled screening in AP-42, Table 11.19.2-2 (08/04). This is a higher than the actual value because pollution control devices have a lower efficiency for smaller size particulates.

Control Efficiency

Emissions of particulate matter resulting from the secondary feeder screen is controlled by the oxide secondary crusher dust collector system. The dust collector has a control efficiency of 99%.

4.1.2.5 Oxide Secondary Crusher (Unit ID: OCR23)

Process Rate

The annual, daily, and hourly process rate for the oxide secondary crusher is based on the portion of the mined oxide ore per year, per day, and per hour (respectively) that will be diverted to the secondary crusher (approximately 20%).

Emission Factor

Uncontrolled PM and PM_{10} emissions from the secondary crusher are calculated using the emission factors of 0.05 lb/ton and 0.02 lb/ton, respectively, from AP-42, Table 11.24-2 (08/82). Uncontrolled $PM_{2.5}$ emissions are estimated to be 18.5% of PM_{10} emissions based on the ratio of $PM_{2.5}$ to PM_{10} controlled emissions for controlled tertiary crushing in AP-42, Table 11.19.2-2 (08/04). This is a higher than the actual value because pollution control devices have a lower efficiency for smaller size particulates.

Control Efficiency

Emissions of particulate matter resulting from the secondary feeder screen is controlled by the oxide secondary crusher dust collector system. The dust collector has a control efficiency of 99%.

4.1.2.6 Wind Erosion of the Coarse Ore Stockpile (Unit ID: OCR10, SCR10)

Process Rate

The annual, daily, and hourly process rates for wind erosion of the coarse ore stockpiles are equal to the surface area of the stockpile building (oxide stockpile - 3 acres, sulfide stockpile – 2 acres) and continuous operation of the stockpile (i.e., 8,760 hours/year, 24 hours/day, 1 hour/hour).

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions due to wind erosion of the stockpiles are determined using the MRI (1978b) equation from the American Mining Congress Report, Fugitive Dust Emission Factors for the Mining Industry (FDEMI) (07/83), Section 3.7, as documented in **Section 4.1.2.1.**

Control Efficiency

Besides good operating practices, other pollution control methods are not used to control emissions from the run of mine (ROM) stockpile.

4.1.3 Milling

4.1.3.1 Sulfide SAG Mill (Unit ID: SCR15)

Process Rate

The annual, daily, and hourly process rates for the SAG mill are equal to the sulfide ore mining rates.

Emission Factor

Uncontrolled PM and PM_{10} emissions from the SAG mill are calculated using the emission factors of 0.05 lb/ton and 0.02 lb/ton, respectively, from AP-42, Table 11.24-2 (08/82) for secondary crushing of high moisture ore, due to the fact that they SAG mill is a wet process. Uncontrolled $PM_{2.5}$ emissions are estimated to be 18.5% of PM_{10} emissions based on the ratio of $PM_{2.5}$ to PM_{10} controlled emissions for tertiary crushing in AP-42, Table 11.19.2-2 (08/04). This is higher than the actual value because pollution control devices have a lower efficiency for smaller size particulates.

Control Efficiency

The SAG mill is a wet process where added moisture causes fine particles in the crushed ore to agglomerate such that no potential particulate emissions are formed, and a 100% control efficiency is assumed.

4.1.3.2 Pebble Crusher (Unit ID: SCR21)

Process Rate

The annual, daily, and hourly process rate for the pebble crusher is based on the portion of the mined sulfide ore per year, per day, and per hour (respectively) that will be diverted to the pebble crusher (approximately 20%).

Emission Factor
Uncontrolled PM and PM_{10} emissions from the pebble crusher are calculated using the emission factors of 0.06 lb/ton and 0.02 lb/ton, respectively, from AP-42, Table 11.24-2 (08/82) for tertiary crushing of high moisture ore, due to the fact that the concentrate ore processed by the pebble crusher is previously processed by the SAG mill which is a wet process.

Uncontrolled $PM_{2.5}$ emissions are estimated to be 18.5% of PM_{10} emissions based on the ratio of $PM_{2.5}$ to PM_{10} controlled emissions for tertiary crushing in AP-42, Table 11.19.2-2 (08/04). This is a higher than actual value because pollution control devices have a lower efficiency for smaller size particulates.

Control Efficiency
The pebble crusher is a wet process where added moisture causes fine particles in the crushed ore to agglomerate such that no potential particulate emissions are formed, and a 100% control efficiency is assumed.

4.1.4 Copper Concentrate Dewatering and Stockpiling

4.1.4.1 Material Transfers

This section discusses material transfers from the Copper Concentrate Filters to the Copper Concentrate Stockpile Building, from the Copper Concentrate Loadout Stockpile to shipment trucks via front end loader, and from the Copper Concentrate Stockpile Building Dust Collector Filtered Media Pump to the process circuit (Unit IDs: CCD01, CCD03 and CCD04).

Process Rate
The annual process rates for the material transfers from the copper concentrate filters to the copper concentrate loadout stockpile and from the copper concentrate loadout stockpile to the copper concentrate shipment trucks via front end loaders are based on past project experience.

Emission Factor
Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from the material transfers from the copper concentrate filters to the copper concentrate loadout stockpile, from the copper concentrate loadout stockpile to the copper concentrate shipment trucks and from the copper concentrate stockpile building dust collector filtered media pump to process are calculated using Equation 2. The filters are designed to remove 90% of the water from the copper concentrate such that a 10% material moisture content is used in Equation 2. The mean wind speed (U, 1.3 mph for protected transfer points and 7.92 mph for unprotected transfer points) is equal to the minimum value used to develop the AP-42 emission factors and the average wind speed out of the pit based on the 2016-2020 Tucson AERMET data, respectively.

Control Efficiency
The material transfers from the copper concentrate filters to the copper concentrate loadout stockpile and from the copper concentrate stockpile building dust collector filtered media pump to process area a wet process where added moisture causes fine particles in the crushed ore to agglomerate such that no potential

particulate emissions are formed, and a 100% control efficiency is assumed. The copper concentrate loadout via front end loader is an uncontrolled process.

4.1.4.2 Copper Concentrate Loadout Stockpile (Unit ID: CCD02)

Process Rate

The copper concentrate stockpile is completely enclosed in a building. Emissions from the building are controlled by the Copper Concentrate Building Dust Collector; therefore, emissions associated with the stockpile are represented by the dust collector emissions.

4.1.5 Molybdenum Dewatering and Packaging

4.1.5.1 Molybdenum Material Transfers (Unit IDs: MD01, MDO02 and MD04 through MD07)

Process Rate

The annual process rates for the material transfers associated with the molybdenum concentrate process were estimated from past Rosemont experience.

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from the material transfers from the molybdenum concentrate filter to the molybdenum dryer and from the molybdenum dryer to the molybdenum concentrate packaging and weigh system are calculated using Equation 2. The plate and frame filter is designed to remove 85% of the water from the molybdenum concentrate. The dryer removes an additional 3% to 5% of moisture, resulting in a material moisture content of 10%. A material moisture content of 10% was used in Equation 2 for all molybdenum material transfers as a worst-case estimate.

The mean wind speed (U, 1.3 mph for protected transfer points and 7.92 mph for unprotected transfer points) is equal to the minimum value used to develop the AP-42 emission factors and the average wind speed out of the pit based on the 2016-2020 Tucson AERMET data, respectively.

Control Efficiency

Emissions of particulate matter resulting from the material transfers from the molybdenum concentrate feeder to the molybdenum dryer and from the molybdenum dryer to the molybdenum concentrate storage bin are enclosed and considered 100% controlled. Transfers of molybdenum concentrate from the storage bin to the bag feeder, from the bag feeder to the bag loader and from the bag loader to the truck for shipment are controlled by the molybdenum concentrate storage bin dust collector and bag loader dust collector. The dust collector has a control efficiency of 99%.

4.1.5.2 Molybdenum Drying (Unit ID: MD03)

Process Rate

The annual, maximum daily, and hourly process rates for the molybdenum dryer are equal to the molybdenum concentrate material transfer process rates as shown in the emissions inventory in **Appendix F**.

Emission Factor

Uncontrolled PM and PM_{10} emissions from the molybdenum dryer are calculated using the emission factors of 19.7 lb/ton and 12.0 lb/ton, respectively, from AP-42, Table 11.24-2 (08/82) for drying of all high moisture minerals except titanium/zirconium sands. The moisture content of the molybdenum concentrate is 15% prior to drying, which according to AP-42, Section 11.24.2 classifies the concentrate as high moisture. Uncontrolled $PM_{2.5}$ emissions are estimated to be 30% of PM emissions based on the information presented for Category 4, material handling and processing of processed ore, in AP-42, Appendix B.2 (08/04). Since the molybdenum dryer is heated using an electric hot oil heater, there are no combustion emissions from the molybdenum drying operations.

Control Efficiency

Emissions of particulate matter resulting from the molybdenum drying are collected and processed by the molybdenum scrubber system. The scrubber system has a 100% capture efficiency and a control efficiency of 99%.

4.1.6 Tailings Storage

4.1.6.1 Tailings Storage (Unit ID: TDS19)

Process Rate

The annual, daily, and hourly process rates for wind erosion of the tailings storage are equal to the maximum area of the land containing the tailings and is susceptible to wind erosion (500 acres) and continuous operation of the storage area (i.e., 8,760 hours/year, 24 hours/day, 1 hour/hour).

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from the tailings storage are calculated using the methodology and equations from AP-42, Section 13.2.5 (11/06), including:

$$EF = (k)\left(\sum_{i=1}^{N} P_i\right)\left(\frac{1\,lb}{453.59\,g}\right)\left(\frac{4{,}406.86\,m^2}{1\,acre}\right) \qquad (7a)$$

$$P = (58)(u^* - u_t^*)^2 + (25)(u^* - u_t^*) \qquad \text{for } u^* > u_t^* \qquad (7b)$$

$$P = 0 \qquad \text{for } u^* \leq u_t^* \qquad (7c)$$

$$u^* = (0.053)(u_{10}^+) \qquad (7d)$$

where:

EF = emission factor (lb/acre-year), the PM emission factor is assumed to be equal to the emission factor for PM_{30}

k = particle size multiplier (1 for PM, 0.5 for PM_{10}, 0.075 for $PM_{2.5}$)

P = erosion potential function

N = number of disturbances (1, the tailings storage area will only be disturbed when the tailings are added)

u^* = friction velocity (m/s)

u_t^* = threshold friction velocity (0.17 m/s, equal to mine tailings in Hayden, AZ from Table 4-4 of EPA Document, Control of Open Fugitive Dust Sources, September 1988)

u_{10}^* = fastest mile for the time period between disturbances (calculated using the linear regression proposed by ADEQ from previous project modeling and maximum hourly average wind speed (15.11 m/s) from the 2016-2020 Tucson AERMET file.)

Control Efficiency
Emissions of particulate matter resulting from wind erosion of the tailings storage are controlled by ponding and the crustal formation that occurs during drying.

4.1.7 Fuel Burning Equipment

4.1.7.1 Plant Area Emergency Generators (Unit IDs: FB01 through FB03)

Process Rate
The annual, daily, and hourly process rates for the diesel fueled emergency generators are based on the power ratings of the generators and the hours of operation. The emergency generators have power ratings of 1,345 kW. All emergency generators will only be used in emergency power situations and for periodic testing and maintenance purposes, estimated at 500 hours/year (see EPA memorandum distributed on September 6, 1995, providing guidance on calculating the PTE for emergency generators). However, the emergency generators are capable of operating 24 hours/day and 1 hour/hour. Although PTE is calculated based on 500 hours/year, actual operation for testing, maintenance and other purposes will range from 100 to 50 hours or less a year consistent with NSPS and NESHAP requirements to maintain emergency status.

Emission Factor
Uncontrolled PM, PM_{10}, $PM_{2.5}$, CO, NO_x, and VOC emissions from the emergency generators are calculated using the exhaust emission standards for nonroad engines from the new source performance standards (NSPS), 40 CFR 89, Section 112. The emission standards for the emergency generators with engines rated greater than 560 kW and manufactured after 2006 (Tier 2) are presented in the emissions inventory in **Appendix F**. PM_{10} and $PM_{2.5}$ emissions from internal combustion engines are not listed as emission standards and are assumed to be equal to PM emissions. The NO_x and VOC emission standards are combined in the NSPS as a single emission standard. Based on EPA documentation (*Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition*), NO_x and VOC emissions for engines greater than 560 kW are assumed to be equal to 93.75% and 6.25%, respectively, of the combined NO_x and VOC emission standard.

Uncontrolled SO_2 emissions are calculated assuming all the sulfur in the diesel fuel is converted to SO_2 emissions, and the sulfur content of the diesel fuel is 0.0015%. This leads to an uncontrolled SO_2 emission factor of 0.00003-pound SO_2 per pound of diesel fuel (or 0.0066 grams of SO_2 per kW-hr). Uncontrolled HAP emissions are calculated using the emission factors from AP-42, Tables 3.4-3 and 3.4-4 (10/96) for large (> 600 hp) stationary, diesel engines.

Uncontrolled CO_2, CH_4, and N_2O emissions are calculated using the emission factors of 73.96 kg/MMBtu, $3*10^{-3}$ kg/MMBtu, and $6*10^{-4}$ kg/MMBtu, respectively, from 40 CFR 98, Tables C-1 and C- 2 for distillate fuel oil No. 2.

A diesel heating value of 19,300 Btu/pound of diesel fuel, an average brake-specific fuel consumption value of 7,000 Btu/hp-hr, and a diesel fuel density of 7.3775 lb/gallon were used to calculate the HAP emissions and the SO_2, CO_2, CH_4, and N_2O emission factors in terms of g/kW-hr.

Control Efficiency

Besides good operating practices and inherent controls built into the design of the generators, other pollution control methods are not implemented during the use of the generators.

4.1.7.2 Primary Crusher Fire Water Pump (Unit IDs: FB04)

Process Rate

The annual, daily, and hourly process rates for the diesel fueled primary crusher fire water pump are based on the power ratings of the fire pumps and the hours of operation. The fire water pump has a power rating of 400 hp (298.4 kW) and will only be used in emergency situations and for periodic testing and maintenance purposes, estimated at 500 hours/year (see EPA memorandum distributed on September 6, 1995, providing guidance on calculating the PTE for emergency generators). However, the fire water pump is capable of operating 24 hours/day and 1 hour/hour. Although PTE is calculated based on 500 hours/year, actual operation for testing, maintenance and other purposes will range from 100 to 50 hours or less a year consistent with NSPS and NESHAP requirements to maintain emergency status.

Emission Factor

Uncontrolled PM, PM_{10}, $PM_{2.5}$, CO, NO_x, and VOC emissions from the fire water pump are calculated using the emission standards for stationary fire pump engines from NSPS, 40 CFR 60, Subpart IIII, Table 4. The emission standards for fire pump engines rated between 225 and 450 kW and manufactured after 2009 are presented in in the emissions inventory in **Appendix F**. PM_{10} and $PM_{2.5}$ emissions from fire pump engine is not listed as emission standards and are assumed to be equal to PM emissions. The NO_x and VOC emission standards are combined in the NSPS as a single emission standard. Based on EPA documentation (*Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition*), NO_x and VOC emissions for engines between 300 and 600 hp are assumed to be equal to 93.33% and 6.67%, respectively, of the combined NO_x and VOC emission standard.

Uncontrolled SO_2 emissions are calculated assuming all the sulfur in the diesel fuel is converted to SO_2 emissions, and the sulfur content of the diesel fuel is 0.0015%. This leads to an uncontrolled SO_2 emission factor of 0.00003-pound SO_2 per pound of diesel fuel (or 0.0066 grams of SO_2 per kW-hr). Uncontrolled HAP emissions are calculated using the emission factors from AP-42, Table 3.3-2 (10/96) for industrial diesel engines.

Uncontrolled CO_2, CH_4, and N_2O emissions are calculated using the emission factors of 73.96 kg/MMBtu, $3*10^{-3}$ kg/MMBtu, and $6*10^{-4}$ kg/MMBtu, respectively, from 40 CFR 98, Tables C-1 and C- 2 for distillate fuel oil No. 2.

A diesel heating value of 19,300 Btu/pound of diesel fuel, an average brake-specific fuel consumption value of 7,000 Btu/hp-hr, and a diesel fuel density of 7.3775 lb/gallon were used to calculate the HAP emissions and the SO_2, CO_2, CH_4, and N_2O emission factors in terms of g/kW-hr.

Control Efficiency

Besides good operating practices, other pollution control methods are not implemented during the use of the fire water pump.

4.1.8 Miscellaneous Sources

4.1.8.1 Lime Loading (Unit ID: MS01)

Process Rate

The annual process rate for the lime loading is based on an annual lime usage rate of 32,120 tons in Year 2 and 48,180 tons in Year 14. The usage rate varies throughout the life of the mine but is expected to be at a maximum in Year 14. The maximum daily process rate is calculated from the annual usage rate divided by 365 days/year, the quantity of days per year lime will be used at the Copper World Project. The hourly process rate is determined by dividing the maximum daily usage rate by 24 hours/day.

Emission Factor

Uncontrolled PM emissions from the lime loading are calculated using the emission factor of 0.61 lb/ton, from AP-42, Table 11.17-4 (02/98) for lime product loading, enclosed truck. Uncontrolled PM_{10} and $PM_{2.5}$ emissions are estimated to be 47% and 7.2%, respectively, of PM emissions based on the particle size fractions in AP-42, Section 13.2.4.3 (11/06) for aggregate drop processes.

Control Efficiency

Emissions of particulate matter resulting from loading lime into the storage vessels are controlled by the quick lime dust collector system. The dust collector system is designed to be used as a collector to prevent the loss of material, but also treat the dust entrained displacement air generated during the loading process. The dust collector system has a pickup efficiency of 100% (it will be located directly on the storage containers) and a 99% control efficiency, as determined by the dust collector vendor.

4.1.8.2 Lime Slaking Mill (Unit ID: MS05)

Process Rate

The annual process rate for the lime slaking mill is based on an annual lime usage rate of 32,120 tons in Year 2 and 48,180 tons in Year 14. The usage rate varies throughout the life of the mine but is expected to be at a maximum in Year 14. The maximum daily process rate is calculated from the annual usage rate divided by 365 days/year, the quantity of days per year lime will be used at the Copper World Project. The hourly process rate is determined by dividing the maximum daily usage rate by 24 hours/day.

Emission Factor

Uncontrolled PM emissions from the lime loading are calculated using the emission factor of 8.0 lb/ton, from AP-42, Table 11.17-2 (02/98) for atmospheric hydrator with wet scrubber. A control efficiency of 99% for the wet scrubber was used to back-calculate the uncontrolled PM emission factor.

Control Efficiency

The lime slaking mill is a wet process; therefore, it is considered to be 100% controlled.

4.1.8.3 Reagent Material Transfer Points (Unit IDs: MS02-MS04, MS06, MS08- MS16)

Process Rate

The annual process rates for the reagent material transfer points are based on the annual reagent usage rates presented in the emissions inventory in **Appendix F**. The usage rates will vary throughout the life of the mine but are expected to be at a maximum in Year 14. The maximum daily process rates are calculated from the annual usage rates divided by 365 days/year, the quantity of days per year reagents will be used at the Copper World Project. The hourly process rate is determined by dividing the maximum daily usage rate by 24 hours/day.

Emission Factor

Uncontrolled PM, PM_{10}, and $PM_{2.5}$ emissions from the reagent material transfer points are calculated using Equation 2. The mean wind speed (U, 7.92 mph for unprotected transfer points) is the average wind speed out of the pit (based on 2016-2020 Tucson AERMET data). The material moisture content value used in Equation 2 is unknown for the different chemicals. A 1% material moisture content is used as a worst-case scenario.

Control Efficiency

Emissions of particulate matter resulting from the reagent material transfer points are controlled by good operating practices, enclosures, dust collector systems or are wet processes. When process material is transferred to an enclosed piece of equipment, particulate emissions are controlled due to the emissions not being able to escape and a 100% control efficiency is assumed. The dust collector systems provide a 100% pick up efficiency and a 99% control efficiency of particulate emissions (as determined by the dust collector vendors). Wet processes are considered 100% controlled. The particulate matter control method used at each reagent material transfer point is presented in the emissions inventory in **Appendix F**.

4.1.9 Solvent Extraction and Electrowinning

4.1.9.1 Solvent Extraction Mix Tanks and Settlers (Unit IDs: SXE01)

Process Rate

The annual, daily, and hourly process rates for the solvent extraction mix tanks and settlers are equal to the surface area of the tanks and continuous operation of the solvent extraction system (i.e., 8,760 hours/year, 24 hours/day, 1 hour/hour). The surface area of the solvent extraction mix tanks and settlers is presented in **Table 4-1**.

Table 4-1. Surface Area of the Solvent Extraction Mix Tanks and Settlers

Solvent Extraction Mix Tank or Settler	Surface Area (ft^2)
5 DOP Tanks (13.125' D x 9.83' H each)	676.5
5 DOP Turbine Tanks (5.25' D x 5.73' H each)	108.2
5 Spirok Mixer Tanks (13.125' D x 19.6875' H each)	676.5
5 Spirok Mixer Tanks (9.28' D x 15.135' H each)	338.2
5 Extraction Settlers (104' L x 47.99' W x 8' H each)	24,955
Total	26,754

Emission Factor

Uncontrolled VOC and HAP emissions from the solvent extraction tanks are calculated using the methodology and equations from the Hydrometallurgy of Copper, presented at an international copper mining convention in 1999. The methodology presented in the paper is a more accurate way to estimate the evaporative loss of diluent than using the EPA Tanks program to model the mixers and settlers as tanks. The following equations (Equations 1a and 1b) and data (**Table 4-2**) are used to calculate VOC and HAP emissions from the solvent extraction mix tanks and settlers. The full paper is presented in **Appendix G**.

$$F_i = \frac{\left(C_i^0 - C_i^H\right)\left(\frac{D_i}{100^2}\right)}{(H)}\left(\frac{60\text{ sec}}{1\text{min}}\right)\left(\frac{60\text{ min}}{1\text{ hr}}\right)\left(\frac{1\text{ lb}}{453.59\text{ g}}\right)\left(\frac{1\text{ m}^2}{(3.2808\text{ ft})^2}\right) \tag{1a}$$

$$D_i = \left(10^{-3}\right)\left(T^{1.75}\right)\left(\frac{\left(\frac{(M_i + M_A)}{(M_i)(M_A)}\right)^{1/2}}{\left((P)\left(V_i^{1/3} + V_A^{1/3}\right)\right)^2}\right) \tag{1b}$$

where:

F_i = diffusive flux of component i in the air (lb/ft^2-hr)

C_i^0 = component concentration at the surface (g/m^3, see Table 4-2)

C_i^H = component concentration at the measured height (g/m^3, see Table 4-2)

H = height at which concentration measurement was taken (1 m)

D_i = diffusivity of component i in the air (m^2/s)

T = temperature (335.6 K, the average value calculated from hourly data collected at the meteorological station at the RCP from April 2006 through May 2009)

M_i = molecular weight of the component in the air (gram/gram-mole, see Table 4-2)

M_A = molecular weight of the air (28.97 gram/gram-mole)

P = pressure (0.8 atm, calculated based on the elevation at the RCP (5,350 ft) and the estimate that for every 1,000 feet above sea level, the pressure decreases by 1 inch of mercury.)

V_i = sum of atmospheric diffusion volume increments by atom and structure for the component in the air (see Table 4-2)

V_A = sum of atmospheric diffusion volume increments by atom and structure for air (20.10)

Table 4-2. Data Used to Calculate VOC and HAP Emissions from the Solvent Extraction Mix Tanks and Settlers

Data	Benzene	Toluene	Ethylbenzene	Xylenes	Others (including Hexane)[a]
C_i^0 (ppm_v)	25	350	1400	1912	2500
C_i^H (ppm_v)	0.0018	0.0668	0.0568	0.0371	16.921
M_i (g/g-mole)	78.11	92.13	106.16	106.16	--
V_i	90.68	111.14	131.6	131.6	--

a. The diffusivity of the "other" component (D_{other}) is given in the Hydrometallurgy of Copper as 0.07. It is corrected for the temperature and pressure associated with the former Rosemont Copper Project (RCP) to be 0.10.

4.1.10 Sulfuric Acid Plant

Process Rate

The annual, daily, and hourly process rates for the sulfuric acid plant assume continuous operation of the plant (24 hours/day, 8,760 hours/year).

Emission Factor

The acid plant will be a source of particulates, sulfuric acid (as particulate) and SO_2. The particulate emissions will be controlled by the acid plant scrubber; emissions are calculated based on the acid plant scrubber design control maximum emissions rate of 0.02 gr/dscf and a flow rate of 30,000 acfm. The emission factor for SO_2 is based on a similar facility design and is provided in units lb SO_2/ton H_2SO_4. The plant will produce approximately 413,000 tons of H_2SO_4 per year.

4.1.11 Dust Collectors and Scrubbers

Process Rate

The annual, daily, and hourly process rates for the dust collectors and scrubbers are based on the exhaust flow rate of the equipment and/or the hours of operation. The exhaust flow rate and the operating hours for each piece of pollution control equipment is presented in the emissions inventory in **Appendix F**. The particulate matter pollution control equipment is assumed to operate at maximum capacity and continuous operation throughout the life of the mine even if the processes being controlled are operating at less than maximum capacity.

Emission Factor

Particulate matter emissions from the pollution control devices are based on PM outlet grain loadings provided by the equipment vendor. The PM_{10} and $PM_{2.5}$ fractions of PM emissions are estimated based on the ratios of PM10 and PM2.5 to PM for the materials that each emission unit controls. The PM grain loading and particulate size ratios are presented in the emissions inventory in **Appendix F**.

4.2 Emission Summary

The potential emissions of regulated air pollutants resulting from the proposed Project are summarized in **Tables 4-3 and 4-4**.

Table 4-3. Copper World Project Stationary and Fugitive PTE* – Year 2

Description	Pollutant (tpy)													
	PM	PM10	PM2.5	Lead	CO	NO_X	SO_2	VOC	H_2SO4	CO_2	CH_4	N_2O	HAP	GHG
Total Fugitives	2652.38	821.31	108.04	3.00E-01	603	16.2	18	11.05	0.00E+00	3398.7	0.14	0.03	6.59	3427.01
Total Point Source Emissions	74.34	56.02	45.14	0.01	8.36	14.89	13.69	13.42	16.97	1658.14	0.07	0.01	9.79	1664.88
Nested Source (Includes Fugitives)	16.92	16.92	16.92	--	--	--	13.68	--	16.92	--	--	--	--	--
Copper World Project Site-Wide PTE	**2726.72**	**877.33**	**153.18**	**0.31**	**611.36**	**31.09**	**31.69**	**24.47**	**16.97**	**5056.84**	**0.21**	**0.04**	**16.38**	**5091.89**
Federal NSR Thresholds (tpy)	250	250	250	250	250	250	250	250	250	N/A	N/A	N/A	N/A	N/A
Federal NSR Thresholds Nested Source(tpy)	100	100	100	100	100	100	100	100	100	N/A	N/A	N/A	N/A	N/A
Above Nested Source Thresholds?	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*
Above Projectwide NSR Thresholds?	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*
Class I Permit Thresholds (tpy)	100	100	100	100	100	100	100	100	100	N/A	N/A	N/A	25	N/A

*Tailpipe emissions not included in total fugitives

Table 4-4. Copper World Facility Project Stationary and Fugitive PTE*– Year 14

Description	Pollutant (tpy)													
	PM	PM10	PM2.5	Lead	CO	NO_X	SO_2	VOC	H_2SO4	CO_2	CH_4	N_2O	HAP	GHG
Total Fugitives	2652.38	821.31	108.04	3.00E-01	603.00	16.20	18.00	11.05	0.00E+00	3398.70	0.14	0.03	6.59	3427.01
Total Point Source Emissions	74.34	56.02	45.14	0.01	8.36	14.89	13.69	13.42	16.97	1658.14	0.07	0.01	9.79	1664.88
Nested Source (Includes Fugitives)	16.92	16.92	16.92	--	--	--	13.68	--	16.92	--	--	--	--	--
Copper World Project Site-Wide PTE	**2726.72**	**877.33**	**153.18**	**0.31**	**611.36**	**31.09**	**31.69**	**24.46**	**16.97**	**5056.84**	**0.21**	**0.04**	**16.39**	**5091.90**
Federal NSR Thresholds (tpy)	250	250	250	250	250	250	250	250	250	N/A	N/A	N/A	N/A	N/A
Federal NSR Thresholds Nested Source(tpy)	100	100	100	100	100	100	100	100	100	N/A	N/A	N/A	N/A	N/A
Above Nested Source Thresholds?	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*
Above Projectwide NSR Thresholds?	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*
Class I Permit Thresholds (tpy)	100	100	100	100	100	100	100	100	100	N/A	N/A	N/A	25	N/A
Above Class I Thresholds?	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*

*Tailpipe emissions not included in total fugitives

5. REGULATORY ANALYSIS

5.1 Permit Applicability Analysis

5.1.1 Major NSR Applicability

The Copper World mine and processing facility will be a non-categorical stationary under Prevention of Significant Deterioration (PSD). The potential to emit of criteria pollutants from the facility will be below the New Source Review major source threshold of 250 tons/year. Therefore, the facility will not be subject to Prevention of Significant Deterioration (PSD) regulations. The facility will also include a categorical source (nested source) associated with a Sulfuric Acid Plant. The emissions for this nested source (including fugitives) are required to be compared to a major source threshold of 100 tons per year. The emissions associated with the nested sources do not exceed the major source threshold.

Additionally, the potential to emit of hazardous air pollutants (HAPs) will be less than 10 tons/year for any individual (HAP), and less than 25 tons/year for all HAPs combined (fugitive and non-fugitive sources). Therefore, the facility will not be a major HAP source. The potential to emit of criteria pollutants from the facility will also be less than the Title V source threshold of 100 tons per year. Consequently, the facility is proposed to operate under a Class II Permit issued by the ADEQ.

As detailed in the emissions calculations in **Appendix F**, the applicability described above will ensure that the Project will be a "minor source" for Major NSR purposes. Therefore, Major NSR does not apply to the Project.

5.1.2 Minor NSR Applicability

Per A.A.C §R18-2-334.A, minor New Source Review (mNSR) requirements shall apply when:

- *The project involves:*
  - *Construction of any new Class I or Class II source, including the construction of any source requiring a Class II permit under §R18-2-302.01I(4); or*
  - *any minor NSR modification to a Class I or Class II source.*

The Copper World Project will be classified as a new Class II source; therefore, mNSR requirements will apply to the Copper World facility.

- *A regulated minor NSR pollutant emitted by a new stationary source subject to this Section, if the source will have the potential to emit that pollutant at an amount equal to or greater than the permitting exemption threshold.*

Emissions of PM_{10} and $PM_{2.5}$ are above the permitting exemption threshold; therefore, mNSR requirements will apply to the Copper World facility for all other regulated minor NSR pollutants.

- *An increase in emissions of a regulated minor NSR pollutant from a minor NSR modification, if the modification would increase the source's potential to emit that pollutant by an amount equal to or greater than the permitting exemption threshold.*

The proposed Project is not a modification to an existing source.

As detailed above, the proposed Project will trigger requirements under A.A.C §R18-2-334 for mNSR purposes. Pursuant to A.A.C. R18-2-334.C, Rosemont must submit either a Reasonably Available Control Technology (RACT) demonstration pursuant to R18-2-334.C.1 & D or a modeling demonstration pursuant to R18-2-334.C.2. Rosemont has submitted a modeling demonstration meeting R18-2-334.C.2 requirements that demonstrates the Copper World Project will not interfere with attainment or maintenance of any NAAQS as shown in **Appendix B**.

5.2 Applicable Requirements

5.2.1 Regulatory Review

A list of applicable requirements, including NSPS, NESHAP, Arizona Administrative Code (AAC) and Pima County Code (PCC) is included in **Appendix H**.

5.2.2 Post-Construction Air Quality and Meteorological Monitoring

It is anticipated that Rosemont will be required to install, operate and maintain a continuous particulate matter monitor at the Project site to monitor ambient concentrations of PM_{10}. The monitor must operate continuously and collect consecutive hourly readings. The monitor must also be maintained to meet requirements set out in 40 CFR Parts 50 and 58 and the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, U.S. Environmental Protection Agency.

If the monitored daily average of PM_{10} is greater than 150 $\mu g/m^3$, Rosemont will notify the Director by a FAX communication within 24-hours of discovery. The notification will include the cause and any actions that Rosemont will take to avoid a repeat of the exceedance. It is anticipated that the permit will also have data validation and reporting requirements.

It is also anticipated that Rosemont will be required to install a meteorological monitoring station within 90 days prior to the startup of mine operations. This station will likely be required to meet specific data collection quality requirements as set out in the Quality Assurance Handbook for Air Pollution Measurements Systems, Volume IV: Meteorological Measurements and be consistent with a protocol approved by the Director. Data collection and validation requirements are anticipated to be included in the permit. This station has not yet been installed.

6. PERMIT PROCESSING FEE

In accordance with A.A.C. Rule R18-2-326.B and the Permit Fee Schedule (effective November 1, 2021), no fee is being submitted with this significant permit revision application. However, upon receipt of the ADEQ invoice following permit processing, Rosemont agrees to pay the fee of $173.00 per hour (based on the total actual time spent by ADEQ staff on processing this application) as well as any fees associated with public notice and associated meetings.

7. CERTIFICATION OF TRUTH, ACCURACY, AND COMPLETENESS

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete.

October 21, 2022

Javier Del Rio
Vice President, South America and USA
Hudbay Minerals, Rosemont Copper Company

Date

APPENDIX A. ADEQ APPLICATION FORMS AND EQUIPMENT LIST

SECTION 3.1

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Air Quality Division

1110 West Washington • Phoenix, AZ 85007 • Phone: (602) 771-2338

STANDARD CLASS II PERMIT APPLICATION FORM

(As required by A.R.S. § 49-426, and Chapter 2, Article 3, Arizona Administrative Code)

1. Permit to be issued to (Business license name of organization that is to receive permit): Rosemont Copper Company

2. Mailing Address: 5255 East Williams Circle, Suite 1065
City: Tuscson State: Arizona ZIP: 85711

3. Name (or names) of Responsible Official: Javier Del Rio
Phone: 520-495-3500 Fax: Email: javier.delrio@hudbayminerals.com

4. Facility Manager/Contact Person and Title: David Krizek, PE
Phone: 520-495-3527 Fax: Email: david.krizek@hudbayminerals.com

5. Facility Name: Copper World Project
Facility Location/Address (Current/Proposed): 9025 E. Santa Rita Road
City: Sahuarita County: Pima ZIP: 85629-5800
Indian Reservation (if applicable, which one): N/A
Latitude/Longitude, Elevation: 31° 51' N, 110° 46' W, 4300 ft

6. General Nature of Business: Open-pit mining, milling, leaching, and solvent extraction/electrowinning facility

7. Type of Organization:
☒ Corporation ☐ Individual Owner ☐ Partnership ☐ Government Entity ☐ LLC
☐ Other

8. Permit Application Basis: ☒ New Source ☐ Revision ☐ Renewal of Existing Permit
For renewal or modification, include existing permit number (and exp. date):
Date of Commencement of Construction or Modification: TBD
Primary Standard Industrial Classification Code: 1021

9. I certify that I have knowledge of the facts herein set forth, that the same are true, accurate and complete to the best of my knowledge and belief, and that all information not identified by me as confidential in nature shall be treated by ADEQ as public record. I also attest that I am in compliance with the applicable requirements of the Permit and will continue to comply with such requirements and any future requirements that become effective during the life of the Permit. I will present a certification of compliance to ADEQ no less than annually and more frequently if specified by ADEQ. I further state that

I will assume responsibility for the construction, modification, or operation of the source in accordance with Arizona Administrative Code, Title 18, Chapter 2 and any permit issued thereof.

Signature of Responsible Official: ______________________

Printed Name of Signer/Official Title: Javier Del Rio, Vice President South America and USA

Date: October 21, 2022 Telephone Number: 520-495-3500

Appendix A. Equipment List

Equipment	**Qty**	**Max Capacity**	**Make / Model**	**Date of Manufacture**	**Equipment ID / Serial Number**	**NSPS / A.A.C**
Oxide Ore Process						
Oxide ROM Feed Bin	1	45,000 tons			OBN-001	NSPS Subpart LL
Oxide Rock Breaker	1	45,000 tons			0XX-001	NSPS Subpart LL
Oxide Primary Crusher	1	45,000 tons			OCR-001	NSPS Subpart LL
Oxide Primary Crusher Discharge Chute	1	45,000 tons			ODU-001	NSPS Subpart LL
Oxide Primary Crusher Discharge Conveyor	1	45,000 tons			OCV-001	NSPS Subpart LL
Oxide Primary Crusher Conveyor Discharge Chute	1	45,000 tons			ODU-002	NSPS Subpart LL
Oxide Stockpile Feed Conveyor	1	45,000 tons			OCV-002	NSPS Subpart LL
Oxide Stockpile Reclaim Feeder	3	45,000 tons			OFE-001, OFE-002, OFE-003	NSPS Subpart LL
Oxide Stockpile Reclaim Feeder Discharge Chute	3	45,000 tons			ODU-003, ODU-004, ODU-005	NSPS Subpart LL
Oxide Stockpile Reclaim Conveyor	1	45,000 tons			OCV-003	NSPS Subpart LL
Oxide Stockpile Reclaim Conveyor Discharge Chute	1	45,000 tons			ODU-006	NSPS Subpart LL
Oxide Secondary Feeder Screen	1	45,000 tons			OSN-001	NSPS Subpart LL
Oxide Secondary Feeder Screen Discharge Chute	1	36,000 tons			ODU-007	NSPS Subpart LL
Oxide Secondary Crusher Discharge Conveyor	1	36,000 tons			OCV-004	NSPS Subpart LL
Oxide Secondary Crusher Feed Bin	1	9,000 tons			OBN-002	NSPS Subpart LL
Oxide Secondary Crusher Belt Feeder	1	9,000 tons			OFE-004	NSPS Subpart LL
Oxide Secondary Crusher Belt Feeder Discharge Chute	1	9,000 tons			ODU-008	NSPS Subpart LL
Oxide Secondary Crusher	1	9,000 tons			OCR-002	NSPS Subpart LL
Oxide Secondary Crusher Discharge Chute	1	9,000 tons			ODU-009	NSPS Subpart LL
Agglomerator	1	45,000 tons			TBD	NSPS Subpart LL

Equipment	Qty	Max Capacity	Make / Model	Date of Manufacture	Equipment ID / Serial Number	NSPS / A.A.C
Heap Feed Conveyor	1	45,000 tons			TBD	NSPS Subpart LL
Heap Feed Stackers	6	45,000 tons			TBD	NSPS Subpart LL
Sulfide Ore Process						
Sulfide ROM Feed Bin	1	60,000 tons			SBN-001	NSPS Subpart LL
Sulfide Rock Breaker	1	60,000 tons			SXX-001	NSPS Subpart LL
Sulfide Primary Crusher	1	60,000 tons			SCR-001	NSPS Subpart LL
Sulfide Primary Crusher Discharge Chute	1	60,000 tons			SDU-001	NSPS Subpart LL
Sulfide Primary Crusher Discharge Conveyor	1	60,000 tons			SCV-001	NSPS Subpart LL
Sulfide Primary Crusher Discharge Conveyor Discharge Chute	1	60,000 tons			SDU-002	NSPS Subpart LL
Sulfide Stockpile Feed Conveyor	1	60,000 tons			SCV-002	NSPS Subpart LL
Sulfide Stockpile Reclaim Feeders	3	60,000 tons			SFE-001, SFE-002, SFE-003	NSPS Subpart LL
Sulfide Stockpile Reclaim Feeder Discharge Chutes	3	60,000 tons			SDU-003, SDU-004, SDU-005	NSPS Subpart LL
Sulfide SAG Mill Feed Conveyor	1	72,000 tons			SCV-003	NSPS Subpart LL
Sulfide SAG Mill	1	60,000 tons			SAG-001	NSPS Subpart LL
Sulfide Pebble Crusher Feed Bin	1	12,000 tons			SBN-002	NSPS Subpart LL
Sulfide Pebble Crusher Belt Feeder	1	12,000 tons			SFE-004	NSPS Subpart LL
Sulfide Pebble Crusher Belt Feeder Discharge Chute	1	12,000 tons			SDU-006	NSPS Subpart LL
Sulfide Pebble Crusher	1	12,000 tons			SCR-002	NSPS Subpart LL
Sulfide Pebble Crusher Discharge Chute	1	12,000 tons			SDU-007	NSPS Subpart LL
Sulfide Pebble Crusher Product Conveyor	1	12,000 tons			SCV-004	NSPS Subpart LL
Sulfide Pebble Crusher Product Conveyor Discharge Chute	1	72,000 tons			SDU-008	NSPS Subpart LL
Copper Concentrate Dewatering and Stockpiling						
Copper Concentrate "Stockpile" Building	1	1,400 tons			CSP-001	AZ SIP Rule 9-3-521

Equipment	Qty	Max Capacity	Make / Model	Date of Manufacture	Equipment ID / Serial Number	NSPS / A.A.C
Copper Concentrate Stockpile Building Dust Collector	1	1,400 tons			CDC-001	NSPS Subpart LL
Molybdenum Dewatering and Packaging						
Molybdenum Dryer Screw Feeder/Conveyor	1	9 tons			MCV-001	NSPS Subpart LL
Molybdenum Dryer	1	9 tons			MDR-001	NSPS Subpart LL
Molybdenum Concentrate Storage Bin	1	9 tons			MBN-001	NSPS Subpart LL
Molybdenum Concentrate Bag Feeder	1	9 tons			MBF-001	NSPS Subpart LL
Molybdenum Concentrate Bag Feeder/Conveyor	1	9 tons			MCV-001	NSPS Subpart LL
Molybdenum Concentrate Bag Loader	1	9 tons			MBL-001	NSPS Subpart LL
Fuel Burning Equipment						
Emergency Power Generator #1	1	1,345 kW			GEN-001	NSPS Subpart IIII, NESHAP Subpart ZZZZ
Emergency Power Generator #1	1	1,345 kW			GEN-002	NSPS Subpart IIII, NESHAP Subpart ZZZZ
Emergency Power Generator #1	1	1,345 kW			GEN-003	NSPS Subpart IIII, NESHAP Subpart ZZZZ
Primary Crusher Fire Water Pump	1	400 hp			GEN-004	NSPS Subpart IIII, NESHAP Subpart ZZZZ
Miscellaneous Sources - Quicklime						
QuickLime Storage Silo	1	TBD			LSO-001	A.A.C 730
QuickLime Screw Feeder/Conveyor	1	TBD			LCV-001	A.A.C 730
Lime Slaking Mill Feed Chute	1	TBD			LDU-001	A.A.C 730

Equipment	Qty	Max Capacity	Make / Model	Date of Manufacture	Equipment ID / Serial Number	NSPS / A.A.C
QuickLime Slaking Mill	1	TBD			LML-001	A.A.C 730
Lime Transfer Pump Discharge Chute	1	TBD			LDU-002	A.A.C 730
Miscellaneous Sources – Flocculant (Concentrate Leach)						
Concentrate Leach Flocculant Bulk Bags	1	TBD			TBD	A.A.C 730
Concentrate Leach Flocculant Feed Bin	1	TBD			FBN-001	A.A.C 730
Concentrate Leach Flocculant Screw Feeder/Conveyor	1	TBD			FCV-001	A.A.C 730
Concentrate Leach Flocculant Heated Receiving Hopper	1	TBD			FHP-001	A.A.C 730
Concentrate Leach Flocculant Venturi and Mixing Tank	1	TBD			TBD	A.A.C 730
Miscellaneous Sources – Flocculant (Mill Tailings)						
Mill Tailings Flocculant Bulk Bags	1	TBD			TBD	A.A.C 730
Mill Tailings Flocculant Feed Bin	1	TBD			FBN-002	A.A.C 730
Mill Tailings Flocculant Screw Feeder/Conveyor	1	TBD			FCV-002	A.A.C 730
Mill Tailings Flocculant Heated Receiving Hopper	1	TBD			FHP-002	A.A.C 730
Mill Tailings Flocculant Venturi and Mixing Tank	1	TBD			TBD	A.A.C 730
Particulate Matter Pollution Control Equipment						
Primary Crusher Fog System - Oxide Ore	1	TBD	Fog System		OFG-001	A.A.C.721
Primary Crusher Cartridge Dust Collector - Oxide Ore	1	5,000 acfm	Cartridge		ODC-001	A.A.C.721
Oxide Secondary Crusher Cartridge Dust Collector	1	33,000 acfm	Cartridge		ODC-002	A.A.C.721
Primary Crusher Fog System - Sulfide Ore	1	TBD	Fog System		SFG-001	A.A.C.721
Primary Crusher Cartridge Dust Collector - Sulfide Ore	1	10,000 acfm	Cartridge		SDC-001	A.A.C.721
Sulfide Reclaim Tunnel & Pebble Crusher Cartridge Dust Collector	1	66,000 acfm	Cartridge		SDC-002	A.A.C.721
Copper Concentrate Building Dust Collector	1	55,000 acfm	Cartridge		CDC-001	A.A.C.721
Molybdenum Flotation Scrubber	1	1,500 acfm	Wet Scrubber		MSB-001	A.A.C.721

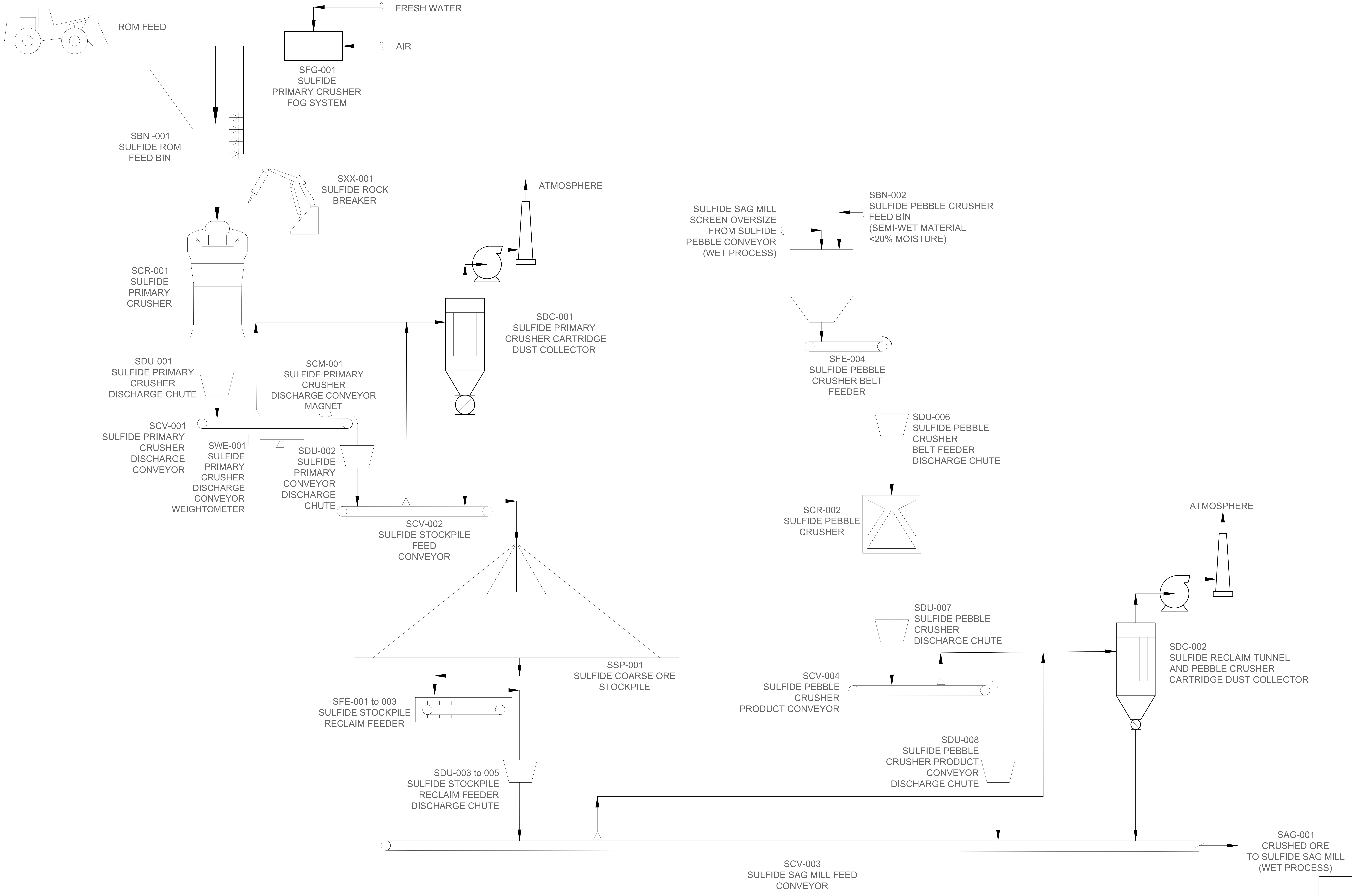
Equipment	**Qty**	**Max Capacity**	**Make / Model**	**Date of Manufacture**	**Equipment ID / Serial Number**	**NSPS / A.A.C**
Molybdenum Concentrate Storage Bin Dust Collector	1	500 acfm	Cartridge		MDC-001	A.A.C.721
Molybdenum Bag Loader Dust Collector	1	500 acfm	Cartridge		MDC-002	A.A.C.721
Molybdenum Dryer Scrubber	1	500 acfm	Cyclone Scrubber		MSB-002	A.A.C.721
Quicklime Dust Collector	1	1,159 acfm	Cartridge		LDC-001	A.A.C.721
Lime Scrubber	1	500 acfm	Wet Scrubber		LSB-001	A.A.C.721
Concentrate Leach Flocculant Feed Bin Cartridge Dust Collector	1	500 acfm	Cartridge		FDC-001	A.A.C.721
Laboratory Dust Collector	1	10,000 acfm	Cartridge		BDC-001	A.A.C.721
Laboratory Scrubber	1	10,000 acfm	Wet Scrubber		BSB-001	A.A.C.721
Mill Tailings Flocculant Feed Bin Cartridge Dust Collector	1	500 acfm	Cartridge		FDC-002	A.A.C.721
Collector Storage and Distribution Tanks Stack	1	1,000 acfm	Stack Fed by Ventilation Centrifugal Fan		TFA-001	A.A.C.721
Collector Area Ventilation Fan Stack	1	500 acfm	Stack Fed by Ventilation Centrifugal Fan		TFA-002	A.A.C.721
Acid Plant Scrubber	1	30,000 acfm	Wet Scrubber		ASB-001	A.A.C.721
Refinery Dust Collector	1	10,000 acfm	Cartridge		3842-DC-002	A.A.C.721
Solvent Extraction and Electrowinning						
DOP Tanks (13.125' D x 9.83' H each)	5	676.5 ft^2			TBD	A.A.C 730
DOP Turbine Tanks (5.25' D x 5.73' H each)	5	108.2 ft^2			TBD	A.A.C 730
Spirok Mixer Tanks (13.125' D x 19.6875' H each)	5	676.5 ft^2			TBD	A.A.C 730
Spirok Mixer Tanks (9.28' D x 15.135' H each)	5	338.2 ft^2			TBD	A.A.C 730
Extraction Settlers (104' L x 47.99' W x 8' H each)	5	24,955 ft^2			TBD	A.A.C 730
Electrowinning Plant Scrubber	1	30,000 scfm	Wet Scrubber		ESB-001	A.A.C 730
Electrowinning Plant Scrubber	1	18,000 scfm	Wet Scrubber		ESB-002	A.A.C 730

Equipment	**Qty**	**Max Capacity**	**Make / Model**	**Date of Manufacture**	**Equipment ID / Serial Number**	**NSPS / A.A.C**
Tanks						
C7 Distribution Tank	1	11,845 gallons			T-C7D	A.A.C 730
MIBC Storage Tank	1	11,845 gallons			T-MIBCS	A.A.C 730
Diesel Fuel Storage Tank - Heavy Vehicles	2	100,000 gallons			T-DFS-HV1	A.A.C 730
Gasoline Fuel Storage Tank	1	10,000 gallons			TBD	A.A.C 710 Pima SIP 314.A.1

APPENDIX B. MODELING REPORT

Provided As Separate Document

APPENDIX C. PROCESS FLOW DIAGRAMS



ANSI D

REFERENCES	
DWG. NO.	TITLE

REFERENCES	
DWG. NO.	TITLE

REVISIONS						
NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION

REVISIONS						
NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION

HUDBAY

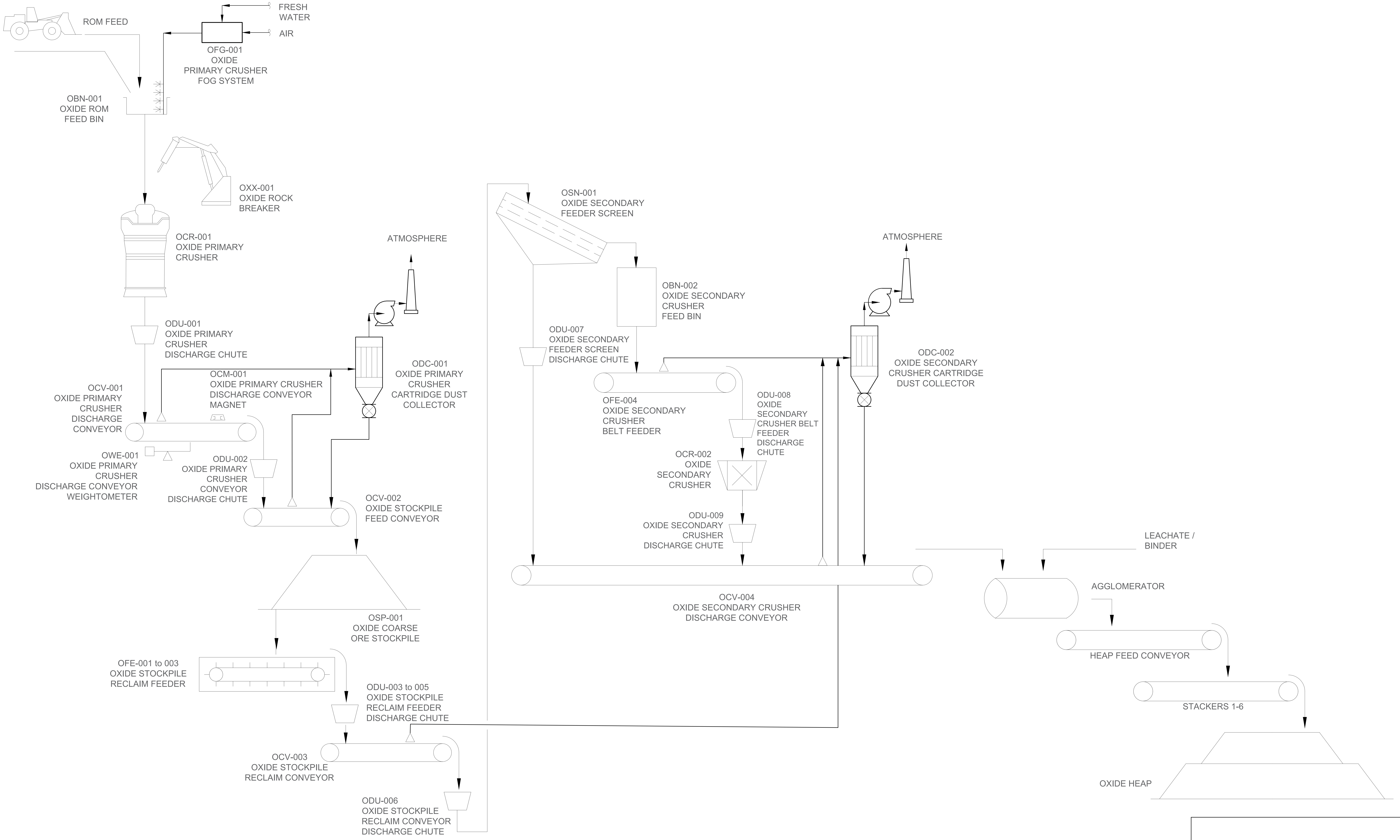
ROSEMONT COPPER WORLD PROJECT

PROCESS PLANT
PROCESS FLOW DIAGRAM
EMISSION POINTS
SHEET 1 OF 6

CONTRACTOR DWG. NO.

DWG. NO.
300-V-010

REVISION	DATE
0	15APR22



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REFERENCES	
DWG. NO.	TITLE

REFERENCES	
DWG. NO.	TITLE

REVISIONS						
NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION

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HUDBAY

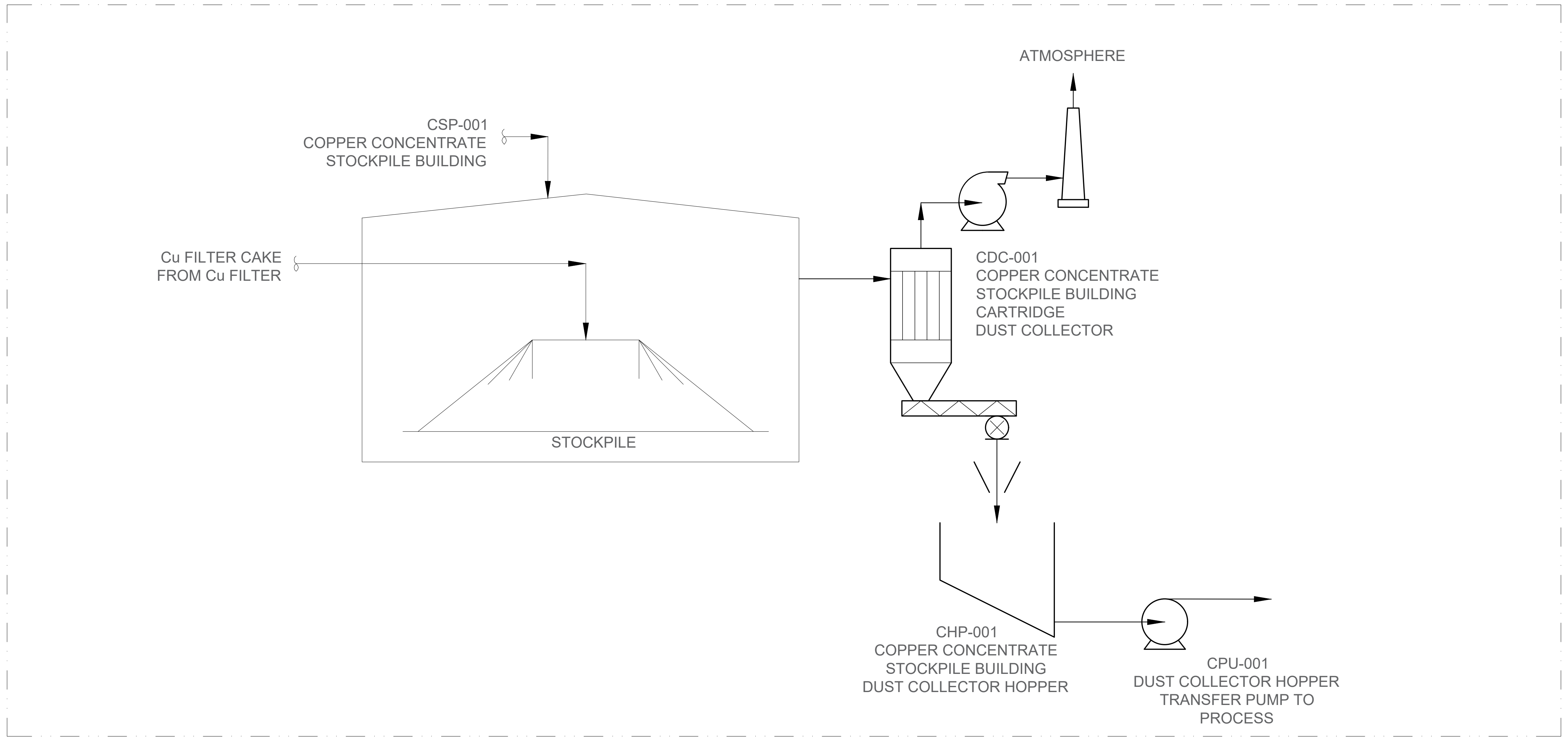
ROSEMONT COPPER WORLD PROJECT

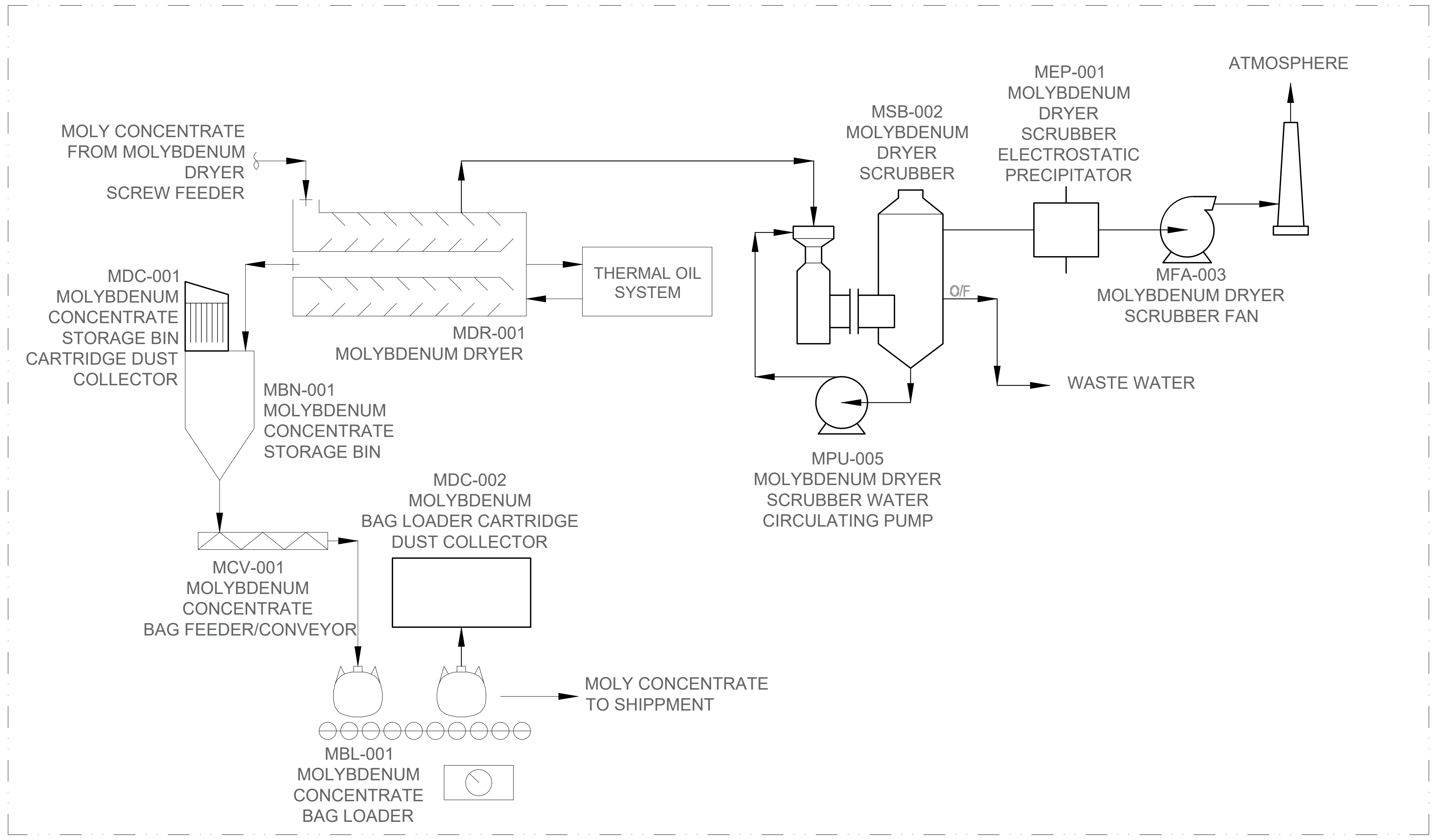
PROCESS PLANT
PROCESS FLOW DIAGRAM
EMISSION POINTS
SHEET 2 OF 6

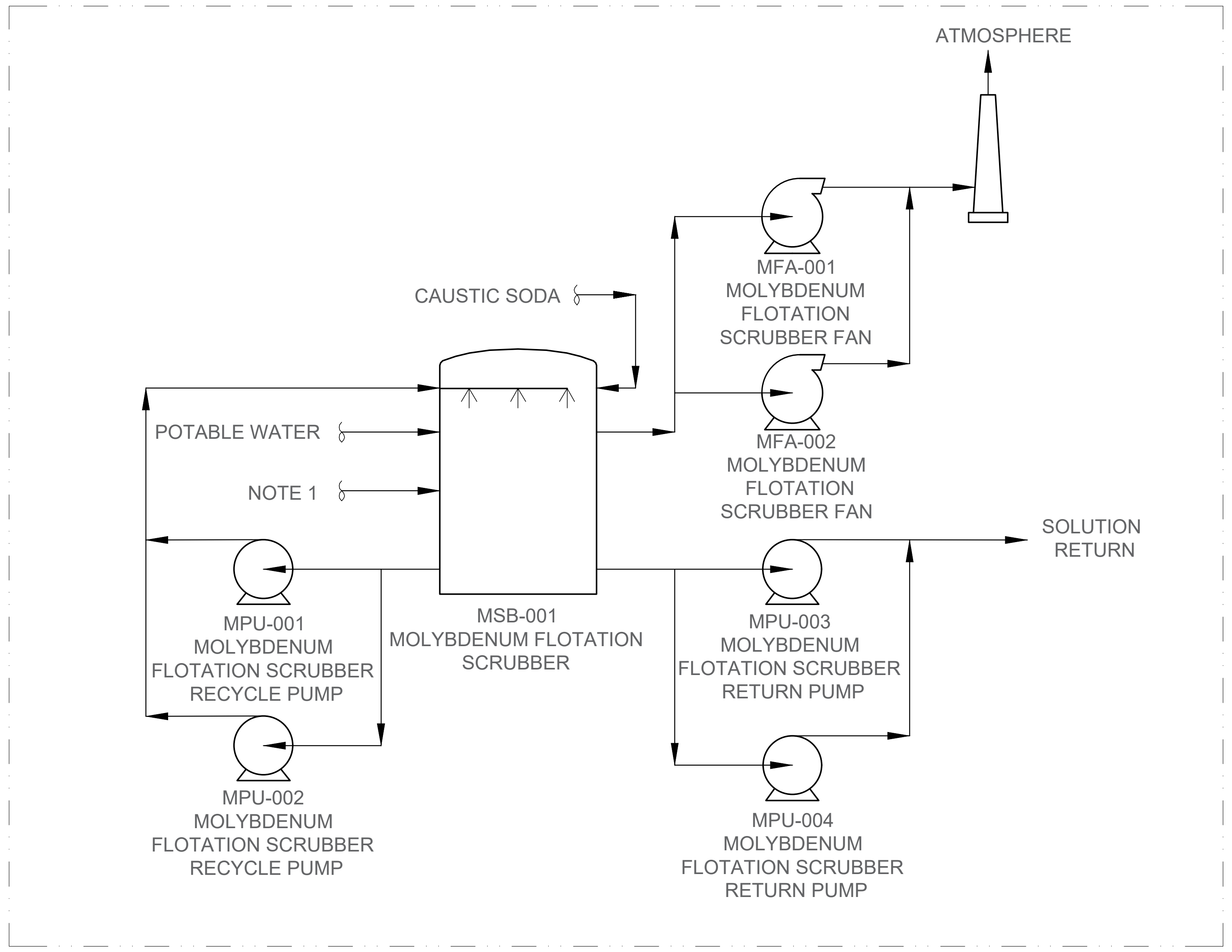
CONTRACTOR DWG. NO.

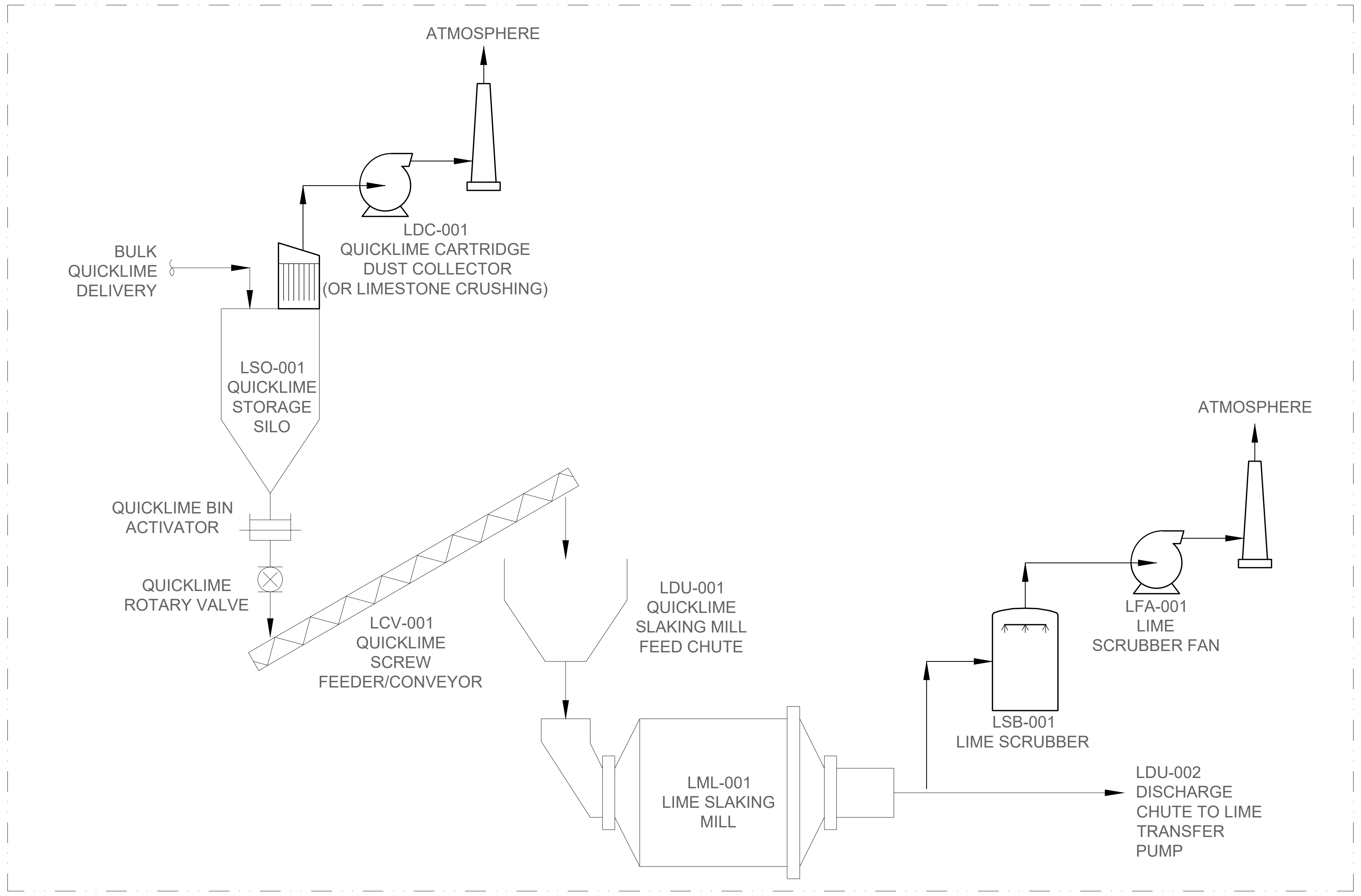
DWG. NO.
300-V-020

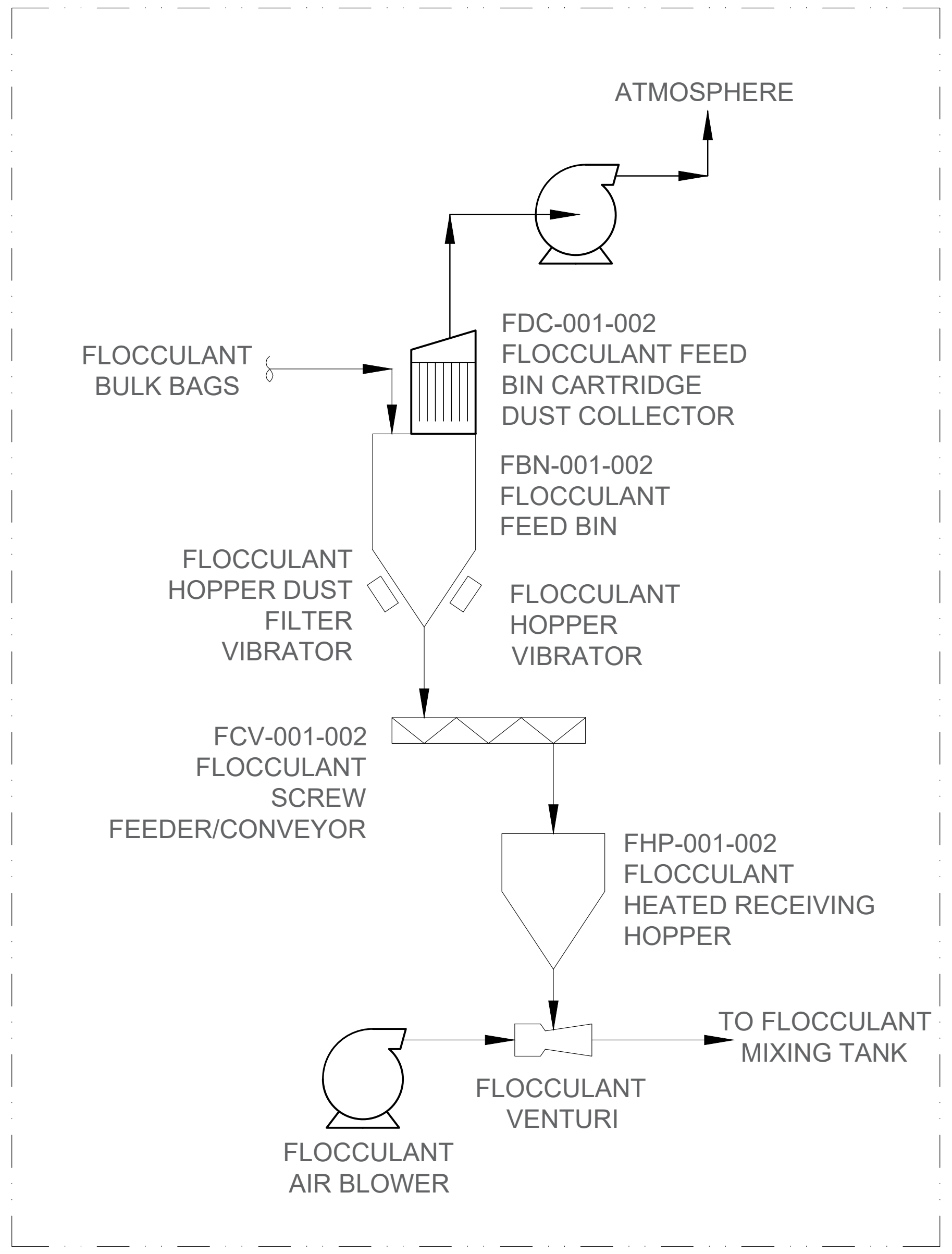
REVISION 0
DATE 06APR22











NOTE:

1. SCRUBBER CONNECTED TO PRESSURE EQUALIZATION LINES OF FLOTATION CELL, CYCLONES, HOPPERS, CONDITIONING & NaSH STORAGE TANKS.

LEGEND:

DUST EXTRACTION SYSTEM	———
MAIN PROCESS	———

ANSI D

REFERENCES		REFERENCES	
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HUDBAY

ROSEMONT COPPER WORLD PROJECT

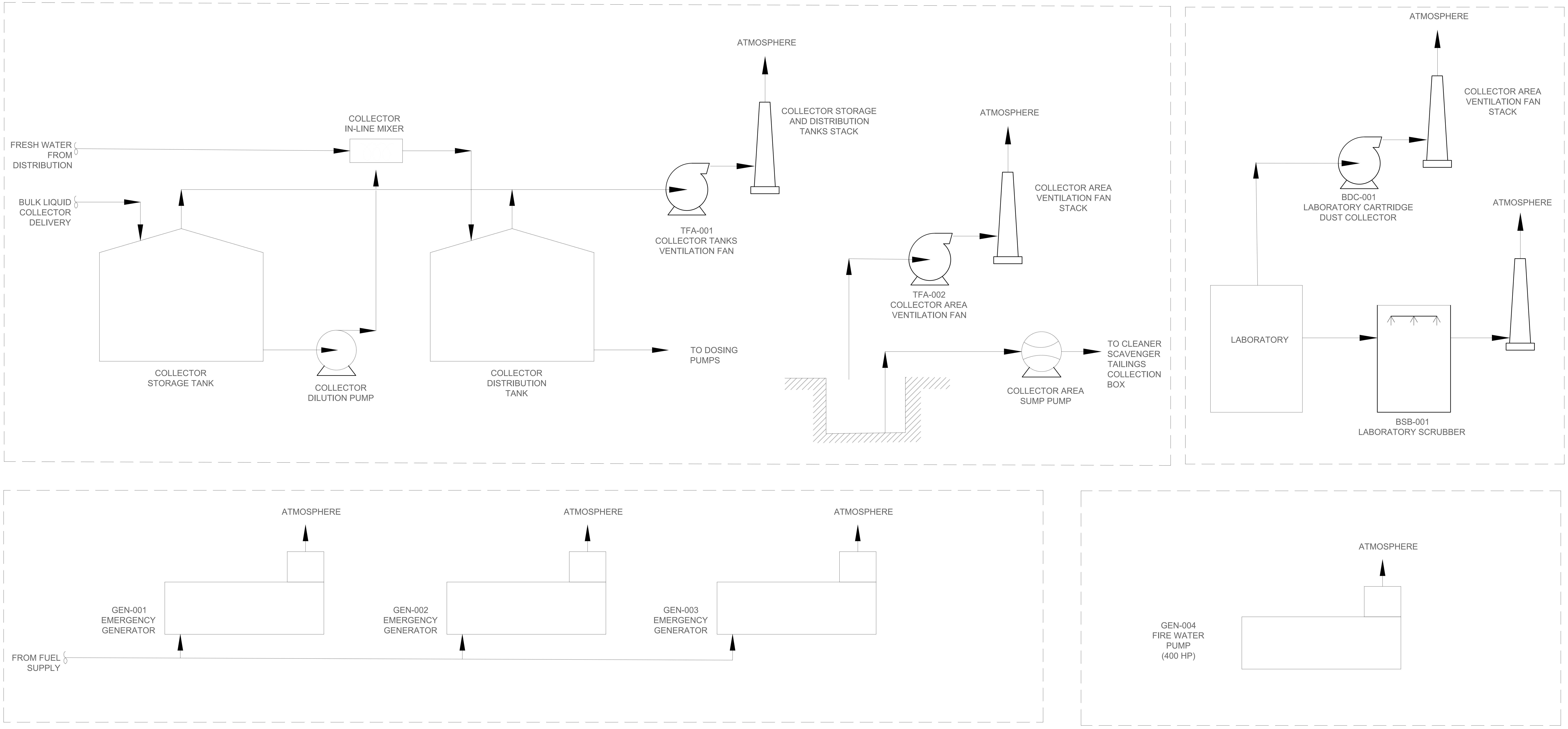
PROCESS PLANT
PROCESS FLOW DIAGRAM
EMISSION POINTS
SHEET 3 OF 6

CONTRACTOR DWG. NO.

DWG. NO. 300-V-030

REVISION 0

DATE 15APR22



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ROSEMONT COPPER WORLD PROJECT

PROCESS PLANT
PROCESS FLOW DIAGRAM
EMISSION POINTS
SHEET 4 OF 6

CONTRACTOR DWG. NO.

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300-V-040

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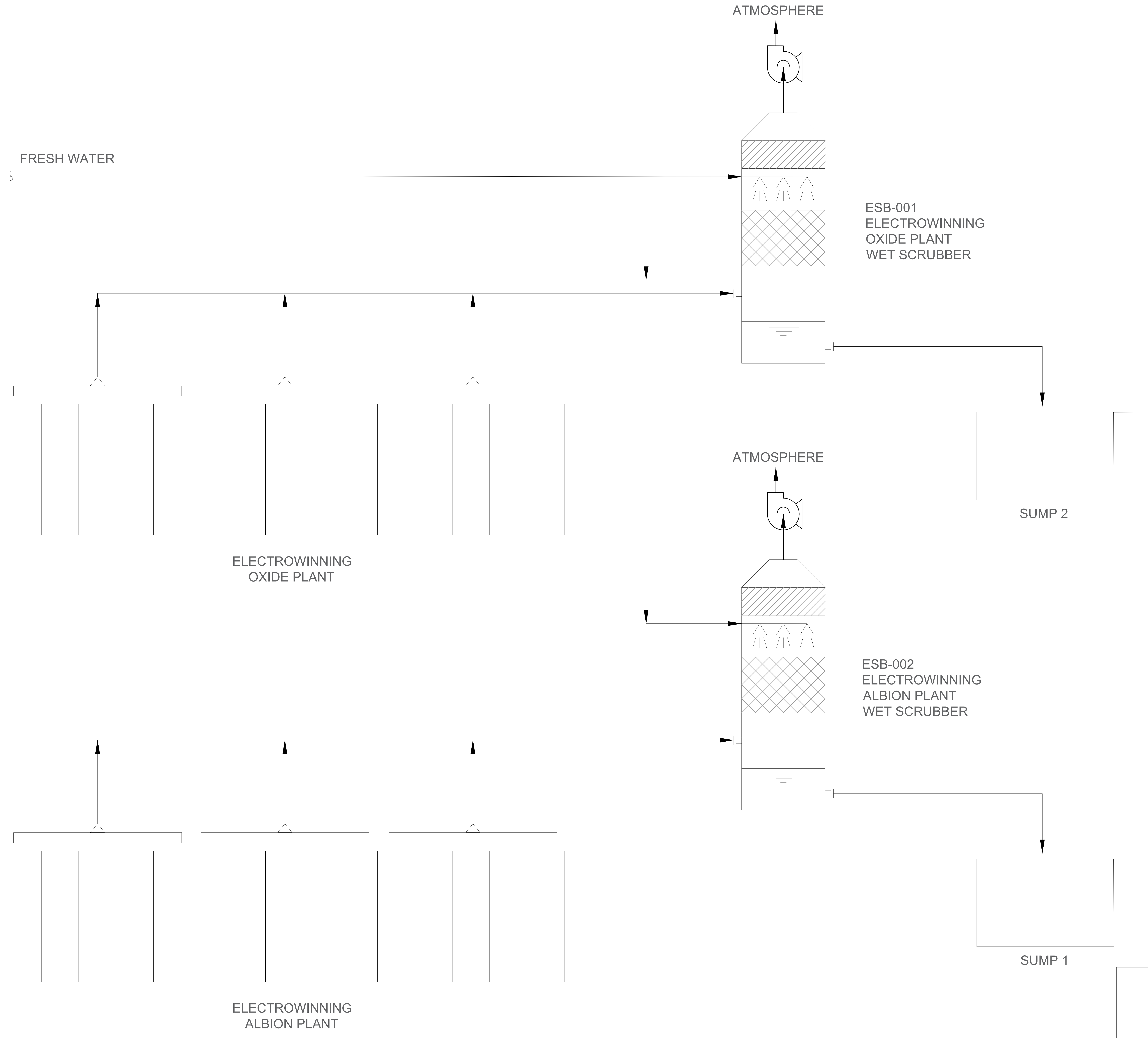

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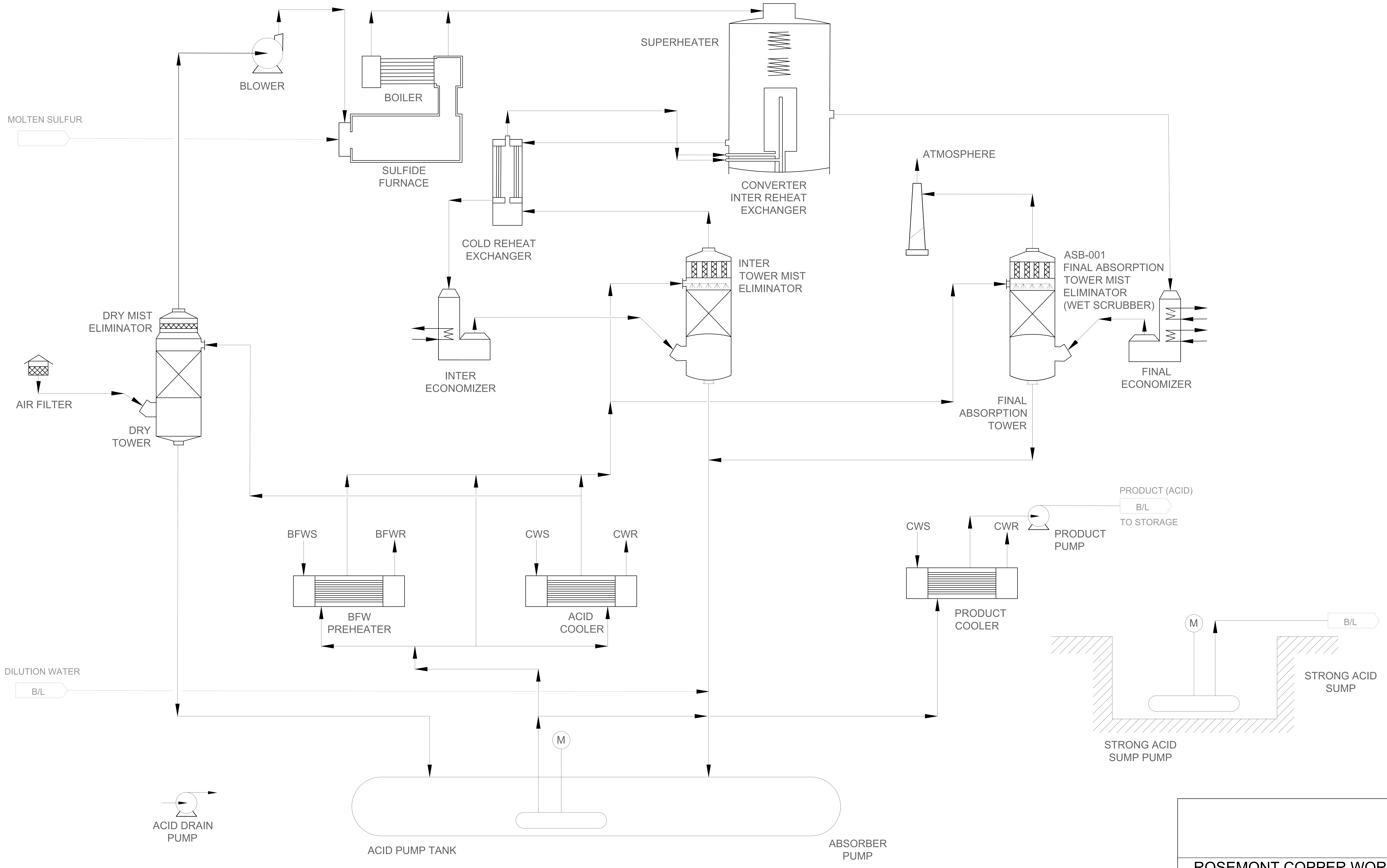
HUDBAY

ROSEMONT COPPER WORLD PROJECT
PROCESS PLANT
PROCESS FLOW DIAGRAM
EMISSION POINTS
SHEET 5 OF 6

CONTRACTOR DWG. NO.

DWG. NO.
300-V-050

REVISION 0
DATE 06APR22



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ROSEMONT COPPER WORLD PROJECT

PROCESS PLANT
PROCESS FLOW DIAGRAM
EMISSION POINTS
SHEET 6 OF 6

CONTRACTOR DWG. NO.

DWG. NO.
300-V-060

REVISION 0
DATE 15APR22

APPENDIX D. INSIGNIFICANT ACTIVITIES

Appendix D. Insignificant/Trivial Activities

Equipment Description	Maximum Size or Capacity	Verification of Insignificance
Diesel and Fuel Oil Storage Tank <40,000 gallons	10,000 gal – Plant Diesel Storage Tank	A.A.C. R18-2- 101.68.a.i
	10,000 gal – Diesel Exhaust Fluid (DEF) Tank #1	
	10,000 gal – Diesel Exhaust Fluid (DEF) Tank #2	
Miscellaneous Storage Tanks <40,000 gallons	21,100 gal – Flocculant Mixing Tank	A.A.C. R18-2- 101.68.a.i
	21,100 gal – Flocculant Mixing Tank	
	21,100 gal – Flocculant Storage Tank	
	21,100 gal – Flocculant Storage Tank	
	1,000 gal – Promoter Storage Tank/Standpipe	
	22,520 gal – Frother Storage Tank	
	31,700 gal – NaHS Storage Tank	
	9,500 gal – NaHS Distribution Tank	
	9,500 gal – Sodium Silicate Storage Tank	
	19,800 gal – Collector (SIBX) Storage Tank (reagent)	
	9,500 gal – Collector (SIBX) Distribution Tank (reagent)	
	9,500 gal – Lime Storage Tank	
	5,000 gal – 10W40 Oil Storage Tank	
	5,000 gal – 15W40 Oil Storage Tank	
	5,000 gal – 30W Oil Storage Tank	
	5,000 gal – 50W Oil Storage Tank	
	5,000 gal – 90W Oil Storage Tank	
	5,000 gal – Anti-Freeze Storage Tank #1	
	5,000 gal – Anti-Freeze Storage Tank #2	
	3,000 gal – Compressor Oil Storage Tank	
	3,000 gal – Gear Oil Storage Tank	
	5,000 gal – HV43 Storage Tank (hydraulic oil)	
	5,000 gal – Spare Lubricant Tank	
	5,000 gal – Used Oil Storage Tank	
	530 gal - Sulfur Residue Thickener Feed Conditioning Tank	
	790 gal - Sulfur Residue Thickener Underflow Tank	
	5,385 gal - Sulfur Residue Thickener Overflow Tank	
	1,850 gal - Sulfur Product Filtrate Transfer Tank	
	2,380 gal - Sulfur Product Filter Wash Discharge Transfer Tank	
	4,755 gal - Leach Residue Thickener Feed Conditioning Tank	
	4,755 gal - Leach Residue Thickener Underflow Tank	
	3,960 gal - Iron Control Filtrate Transfer Tank	
	15,060 gal - Iron Control Product Filter Wash Discharge Transfer Tank	
	5,280 gal - SX Organic Pump Tank	
	130 gal - Guar Silo	
	530 gal - Guar Mix Tank	
	795 gal - Guar Storage Tank	
	130 gal - Cobalt Silo	
	265 gal - Cobalt Mix Tank	
	450 gal - Cobalt Storage Tank	
	795 gal - Hot Demi Water Tank	
	19,020 gal - Backwash Tank	
	Misc. small equipment mounted hydraulic oil tanks	
	Misc. small oil/grease totes	
Storage tanks, vessels and containers holding or storing liquid substances that will not emit any VOC or HAP; Storage tanks of any size containing exclusively soaps, detergents, waxes, greases, aqueous salt solutions, aqueous solutions of acids that are not regulated air pollutants, or aqueous caustic solutions,	288,740 gal - Fine Grinding Mill Product Storage Tank (tank is covered; vent is directed to scrubber)	A.A.C. R18-2-146.e.i/A.A.C. R18-2- 101.68.a.vi
	464,410 gal - Oxidative Leaching Reactor (tank is covered; vent is directed to scrubber)	
	47,020 gal - Desulfurization Feed Conditioning Tank (tank is covered; vent is directed to scrubber)	
	47,020 gal - Sulfur Product Filter Feed Storage Tank (tank is covered; vent is directed to scrubber)	
	47,020 gal - Sulfur Product Filter Feed Storage Tank (tank is covered; vent is directed to scrubber)	
	164,310 gal - Iron Control Reactor (tank is covered; vent is directed to scrubber)	
	164,310 gal - Iron Control Reactor (tank is covered; vent is directed to scrubber)	
	164,310 gal - Iron Control Reactor (tank is covered; vent is directed to scrubber)	
	59,175 gal - Leach Residue Thickener Overflow Tank (tank is covered; vent is directed to scrubber)	
	164,310 gal - Iron Control Product Filter Feed Storage Tank (tank is covered; vent is directed to scrubber)	
	105,670 gal - Iron Control Product Filter Cake Surge Bin	
	42,070 gal - Organic and Crud Treatment Tank	
	198,130 gal - Electrolyte Circulation Tank	
	132,090 gal - Holding Tank	
Batch Mixers	<5 cu. Ft	A.A.C. R18-2- 101.68.c.i
Wet Sand & Gravel Operations excluding crushing/grinding operations	<200 tons per hour	A.A.C. R18-2-101. 68.c.ii
Hand-held or manually operated equipment	Buffing, polishing, carving, cutting, drilling, machining, routing, sanding, sawing, surface, grinding, or turning of ceramic art work, precision parts, leather, metals, plastics, fiberboard, masonry, carbon, glass, or wood	A.A.C. R18-2- 101.146.b.i
Lab Equipment used for chemical & physical analyses	Analytical laboratory equipment Small pilot scale R&D projects	A.A.C. R18-2- 101.146.f.ii

APPENDIX E. DUST CONTROL GUARANTEE

MIDWEST.

8/8/2022

Samantha Valentine
Mine Planning ENG
Hudbay Minerals
Rosemont Copper Company
Tucson AZ

Per Rosemont's request, Midwest has put together the following information on roadway dust control programs to achieve 95+% dust control of the treated areas while eliminating the use of water for roadway dust control of these areas. The dramatic emissions "cycling" associated with water-only dust control programs is eliminated and consistent results are achieved.

Products:
RoadPro-NT (RPNT) is a patented polymeric infused asphalt emulsion chemistry blended 10:1 with water delivering with proven durability to handle heavier equipment and traffic volumes and would be applied to haul roads. When cured, this product is non-water soluble and will not follow storm drainage. Material cures in 1-3 hours in typical AZ climate.

SoilSement is a polymer-based program blended 10:1 with water that delivers excellent dust control on light duty access roads. This product is also non-water soluble when cured and will not follow storm drainage. Material cures in 1-3 hours in typical AZ climate

Plan:
For both products, establishing a "base" of material through multiple applications (6-10) over the initial 30-45 days is critical. Targeted "base" building over this period would be 1 Gal:70-90 sq ft. By building a significant base, the fines are bonded to the larger aggregate in the road preventing fugitive dust from forming. Maintenance applications are required over time to deliver 95+% control as the treated surface wears down or is covered up. Reapplication where needed is anticipated every 2-weeks with a target of 1Gal:350-500 sq ft

These applications will be evaluated on an ongoing basis and employ the Midwest "selective" strategy-to maintain 95+% emission control. Weather, traffic volumes, and weak spots in the road that wear down faster are the key factors in determining maintenance application scheduling.

Please let me know if you have any questions or comments.

Thanks

Tim Solberg
Midwest
Mining Dust Control Solutions

Midwest Industrial Supply, Inc.
1101 3rd Street Southeast
Canton, Ohio 44707

www.midwestind.com

Tel 330.456.3121
Fax 330.456.3247
Toll free 1.800.321.0699

APPENDIX F. EMISSIONS INVENTORY (ELECTRONIC)

APPENDIX G. SX/EW EMISSION FACTOR PAPER

PROCEEDINGS OF THE COPPER 99 – COBRE 99
INTERNATIONAL CONFERENCE — VOLUME IV
OCTOBER 10-13, 1999, PHOENIX, ARIZONA, USA

Hydrometallurgy of Copper

Edited by:

S.K. Young
Versitech, Incorporated
Tucson, Arizona, USA

D.B. Dreisinger
University of British Columbia
Department of Metals and Materials Engineering
Vancouver, British Columbia, Canada

R.P. Hackl
Placer Dome Incorporated
Vancouver, British Columbia, Canada

D.G. Dixon
University of British Columbia
Department of Metals and Materials Engineering
Vancouver, British Columbia, Canada

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Investigation of evaporative losses in solvent extraction circuits

M. D. Bishop and L. A. Gray
Phillips Mining Chemicals
1768 Highway 123
Bartlesville, OK 74004

M.G. Greene, K. Bauer and T. L. Young
Versitech, Inc.
1438 W. San Lucas Drive
Tucson, AZ 85704

J. May
BHP Copper Company
200 Reddington Road
San Manuel, AZ 85631

K.E. Evans
EnviroNet, Inc.
7776 S. Pointe Parkway W. Suite 160
Phoenix, AZ 85044

Illa Amerson-Treat
Department of Environmental Science and Engineering
Oregon Graduate Institute
P.O. Box 91000
Portland, OR 97291-1000

ABSTRACT

Loss of organic solvent extraction circuits occurs through several accepted methods. Losses are commonly attributed to entrainment of the plant organic and evaporative loss of diluent. Evaporative losses of diluent have been estimated using various models or by considering all losses over and above entrainment to be due to evaporation. Other possible loss mechanisms are discussed and data on losses during weather conditions are presented.

Accurate estimation of evaporative loss is vitally important to the industry due to both cost factors and environmental concerns. Data for and description of the Diffusive Flux Model are presented as an improved method of estimating evaporative losses.

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Volume IV—Hydrometallurgy of Copper
Edited by S.K. Young, D.B. Dreisinger, R.P. Hackl and D.G. Dixon
The Minerals, Metals & Materials Society, 1999

INTRODUCTION

Currently operational solvent extraction plants use organic compounds to extract copper, nickel, cobalt, zinc, beryllium, and other metals from an impure leach solution, concentrating and purifying it for electrowinning or other recovery techniques. The active chemical in the extraction of the metal, the extractant, is typically dissolved in a non-reactive carrier organic, the diluent, in a 1 to 30% by volume ratio forming the plant organic. The organic phase is lost over time and must be replenished. Yearly organic usage varies with operating conditions and the experience of the operators. In general, operators reduce consumption of organic as they gain experience running their particular operation. Improved plant design has also contributed to reduced organic loss.

The barren or lean (containing low concentrations of metal species) organic phase in a solvent extraction plant is vigorously mixed with the solution containing the species to be extracted (the pregnant solution). Through the process of ion exchange, the extractant exchanges a hydrogen ion with a metal ion from the aqueous phase, chelating the metal of interest. The metal ion is thus extracted into the organic phase. This loaded organic is then contacted with a higher acid content (lower pH) aqueous phase in the stripper section. This reverses the process in the extraction stage, the extractant gives up the metal ion and takes up an hydrogen ion. While individual plants vary the most typical arrangement is two extraction stages and one stripper stage.

Loss of organic in solvent extraction circuits occurs through several accepted methods. Losses are commonly attributed to entrainment of the plant organic and evaporative loss of diluent. Evaporative losses of diluent have been estimated using various models or by considering all losses over and above entrainment levels to be due to evaporation.

All commercial diluents currently used by the industry are hydrocarbons and, as such, are classified as volatile organic compounds (VOCs). Accurate estimation of evaporative loss is vitally important to the industry due to both cost factors and environmental concerns. This paper discusses additional mechanisms of diluent loss and proposes data and models which support an improved method of estimating evaporative losses.

LOSS MECHANISMS FOR EXTRACTANTS

The extractant in copper solvent extraction is based on oxime chemistry (R-CNOH-R' where R' is either H or a short carbon chain). While the chemistry of extractants for other metals varies from diethyl hexyl phosphoric acid (DEHPA) to quaternary amines, the same basic loss mechanisms still apply. The extractant can be lost

---

from chemical attack, entrainment into an aqueous stream, dissolution into an aqueous stream, or evaporation.

Chemical attack mechanisms for oximes include attack from oxygen, acid, nitrates, or ultraviolet radiatoion. Attack by oxygen and ultraviolet will usually leave the oxime as a water-soluble species such as an alcohol, amine, semicarbazone or carboxylic acid. Strongly acid solutions can convert the oxime into an aldehyde or ketone as described in Beyer and Walter (1). The acid strength to do this at a high reaction rate is normally 4 or 6 times the normal operating plant's g/l acid value. However, a small percentage (probably 1% or less) of the oxime can be expected to be converted each year. All of the breakdown products can be surface-active reagents that will either cause a froth, decrease surface tension, or both. Frothiness or decreased surface tension promotes entrainment and increases break times.

Another form of chemical attack is the failure to uncouple from some metal species in the strip stage. Generally, this occurs at some fixed ratio with the metal being extracted. This creates a fixed ratio of "active" to "inactive" extractant. Thus, this ratio will not effect the extractant usage once the plant reaches equilibrium after the initial fill. For some extractants, a contaminant species exists that may tie up the extractant. Unless such contaminants exist in very small amounts, there will probably be excessive extractant usage.

Extractants can also be lost by aqueous entrainment to the depleted aqueous phase (raffinate) or in the strip stage. Extractant entrained in the raffinate will generally separate in the raffinate storage pond. A thin layer of organic is often seen on many raffinate ponds. This layer is very susceptible to chemical attack mechanisms and should be recovered promptly. This layer often contains breakdown products. It should be clay treated prior to introduction to the circuit in order to remove surface-active agents (polar compounds) which contribute to additional losses. In heap leach operations entrained organic not recovered from the raffinate is lost in the heaps.

The solubilities of extractants in water are often less than 1 ppm. Surface active agents from the breakdown of oxime and diluent can promote solubility. Soluble organic will not be recovered in filters or in the organic layer of the raffinate pond. In heap leach operations, molds, fungi or bacteria living in the heaps may utilize such organic species. Extractants may also come out of solution in the heaps due to the change in pH and total dissolved solids that occurs in the leach process. If either is the case, the heaps represent a possible sink for the organic phase over and above that represented by entrainment losses.

Extractants can be lost by being tied up in a solid-organic-aqueous phase that is politely called a "gunk" or "crud" layer. This layer represents a loss of organic to the circuit until it is recovered. Some of the organic loss in this layer may never be recovered. Organic recovered from a gunk layer should be clay treated to remove degradation products before it is returned to the circuit.

Extractants generally have very low vapor pressures at room temperature. Extractant losses from evaporation should be small to negligible.

LOSS MECHANISMS FOR DILUENTS

Losses for diluent are very similar in nature to losses in extractant. All commercially used diluents, regardless of manufacturer, are very similar chemically. They are mixtures of aromatic and aliphatic hydrocarbons having carbon numbers in the range of 8 to 20 (C8 to C20) with the majority of the diluent in the C12 to C16 range. All commercial diluents are hydrogenated to eliminate any reactive double bonds.

Oxygen and strong oxidizing agents will attack many organics including diluents. They can attack the end of alkane chains to form carboxylic acids or alcohols. Bacteria, fungi, and molds are known to feed on and degrade hydrocarbons resulting in shorter chain alkanes, alcohols, ketones, aldehydes, and carboxylic acids as described in Atlas (2). With the exception of shorter alkane chains, all of the products of biological degradation are surface-active agents. Biological degradation is believed to be a significant source of diluent loss. This is evidenced by the large amounts of biological material found in plant crud.

Diluents can be entrained in either the raffinate or the strip phase. Entrainment is not known to be selective to any one component of the organic phase Thus, entrainment should remove organic that is similar in composition to the overall organic phase rather than enrich or deplete any one particular molecule.

The overall solubility of all commercial diluents is typically less than 5 ppm. Shorter alkane chain components of the diluent are more water-soluble than longer chains. As the organic phase ages in a plant, more surface-active agents will be formed by chemical and biological means. This will tend to increase the overall solubility of the organic phase. Also, degradation of diluent can result in shorter alkane chain length.

Diluents are trapped in the solid-organic-aqueous gunk layer along with the extractant. As mentioned above, organic phase material from this layer must be treated before being put back into the circuit. Some losses must be expected.

Diluent is composed of lower molecular weight compounds and has a lower boiling point than an extractant. It has been common practice to assign any losses of diluent above that needed to form a solution with the lost extractant as loss to evaporation. For example, if a plant using a 10% solution of extractant requires an annual make-up of 200,000 gallons of plant organic it would consume 180,000 gallons of diluent and 20,000 gallons of extractant provided there were no differential loss. If it actually consumed 200,000 gallons of diluent and 20,000 gallons of extractant, it would assign 20,000 gallons of diluent to evaporation loss. This assumes that the only other major loss mechanism was entrainment. As already pointed out, chemical attack and solubility mechanisms also exist which can promote differential loss rates between diluent and extractant.

EVAPORATIVE LOSS

All commercial diluents are hydrocarbons and as such are classified as volatile organic compounds (VOCs). Environmental regulations may consider diluents as a source of VOC emissions. Therefore, accurate estimation of evaporative loss is vitally important to the industry due to cost factors and environmental concerns.

Solvent extraction settling tanks appear at first glance to be an ideal situation to promote evaporation. They are large areas with a proportionally thin layer of volatile organic. However, there are some factors that mitigate evaporation. All commercial plants have walls higher than the organic level promoting a relatively still air space layer. This stillness of this air space is enhanced, in most commercial plants, by a cover. The diluent vapors are relatively heavy compared to air and tend to stratify very close to the liquid surface. If the layer of air and vapor immediately over the settler is stagnant VOCs emissions will be minimized.

WEATHER DATA

The simplest model of organic losses says that organics, especially diluent, are lost mainly to evaporation. If this model was true, one would expect that the copper solvent extraction plants of the Southwest would experience significantly higher losses in the hot summer months than in the cool winter months. Data for six major copper SX-EW plants in the southern Arizona – eastern New Mexico region from the year 1995 were examined. Plotting the total diluent usage of these plants along with the average mean temperature and average mean high temperature for each month yielded Figure 1. There is some correlation between the temperature and usage. However, the relatively cool month of December had the third highest usage, while the hot months of June and July were barely over the monthly average usage. The upward spike in the month of May and downward spike in the month of September are also hard to explain.

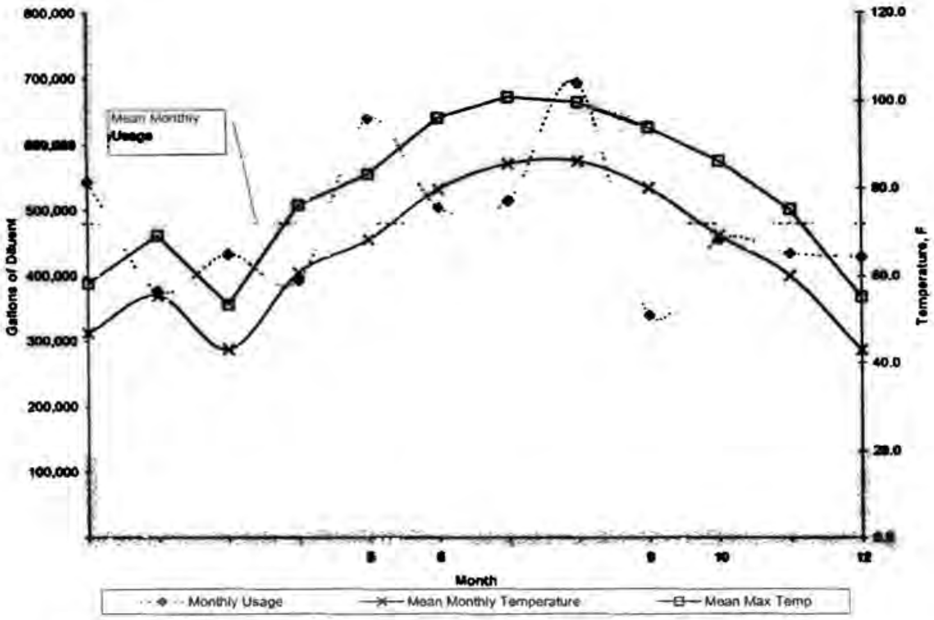

Figure 1 – Monthly Diluent Usage, Mean Temperature and Mean Maximum Temperature for Selected Copper SX-EW Plants

The other possible weather related loss mechanism is the effect of rainfall. Rain can promote organic losses through introduction of solids into the circuit. These solids promote gunk layer formation. The excess water introduced by the rainfall can increase overall aqueous stream flows promoting losses due to entrainment and organic solubility. The monthly diluent usage, total monthly rainfall, and maximum single day rainfall for the same 6 mines are plotted in Figure 2. This graph suggests that some of the high usage is probably due to rainfall. However, the spikes in May and September are still hard to explain. The above data do not appear to support attributing all differential diluent loss to evaporation as higher summer temperatures should increase evaporative losses.

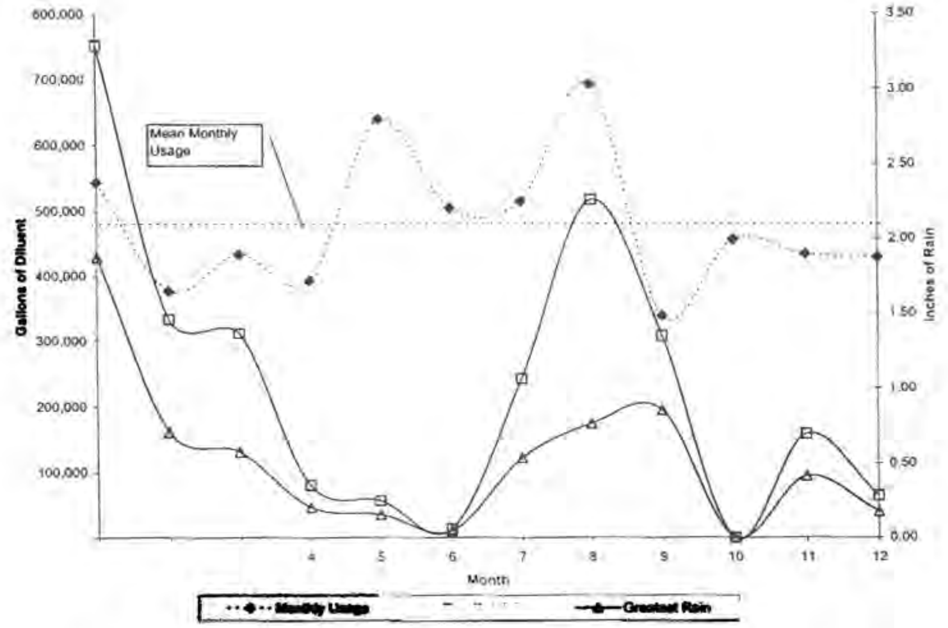

Figure 2 – Monthly Usage, Total Rainfall and Highest Single Day Rainfall for Selected Mines

DIFFUSIVE FLUX MODEL

Various models including the EPA Tanks model have been used to estimate emissions from SX operations. The validity of using these models for SX operations is debatable as the factors used in the model do not necessarily correspond to the factors present in SX operations. For example, the Tanks model is based on losses from closed tanks and incorporates tank breathing losses, tank headspace, tank cycling, etc. These conditions are not found in SX plants. These models tend to overestimate emissions based on plant experience.

Consideration of the above factors led BHP to enlist the services of Emcon to evaluate alternate modeling methods. They determined that a Diffusive Flux Model may be more suitable for modeling SX operations and more accurately reflect evaporative losses.

Phillips Mining Chemicals was concurrently investigating methods to evaluate evaporative losses. A method based on the ASTM Standard Test Method for Evaporation Loss of Lubricating Greases and Oils (ASTM D 972) was evaluated. This method incorporates controlled temperature and airflow over a sample of diluent. The loss per air exchange can be calculated based on the air flow rate. Discussions between representatives from BHP, Emcon, and Phillips indicated general agreement between the Diffusivity model and data obtained using a modification of ASTM D 972. (3)

Diluent left in a open container with some positive airflow over the container will, of course, eventually evaporate. Diluent kept in a closed container will never evaporate. Diluent kept in an open top container with little to no airflow across the surface will slowly evaporate, dependent on the diffusion of the vapor into the open air.

The solvent extraction tanks of most plants are essentially enclosed by a cover, and walls on three sides, while the fourth side (weir side) is normally left open. Most plants' raffinate ponds have high side walls, have a protective berm, or are situated in a natural valley. This minimizes air movement across the surface of the pond. This was confirmed by the measurement of little of no wind speed within the enclosed headspace. Thus, diffusion should be the major factor influencing diluent loss.

The driving force behind diffusion is the concentration gradient between a given VOC at the surface of the liquid and the same vapor at a given height above the surface. Standard chemical calculation techniques can be used to determine the loss due to diffusion if these concentrations are known. Fick's First Law can be written as

$$F_i = (C_i^0 - C_i^H) D_i / H \qquad (1)$$

where:
F_i = Diffusive flux of component 'i' in air (g/m^2-s)
C_i^0 = Component concentration at the surface (g/m^3)
C_i^H = Component concentration at the measured height
D_i = Diffusivity of the chemical 'i' in air (m^2/s)
H = Height at which concentration measurement was taken (m)

The diffusivity of a given species in air (D_i) can be calculated by a number of different methods. The Fuller, Schettler, and Giddings (FSG) method was selected for this project. This method was selected over the more compound-specific Chapman-Enskog model due to a lack of parameter data for several constituents. Diffusivities were calculated using the following formula.

$$Di = 10^{-3} * T^{1.75} * [(M_i + M_A)/(M_i * M_A)]^{1/2} / [P(V_i^{1/3} + V_A^{1/3})]^2 \qquad (2)$$

where:
D_i = Diffusivity of the chemical 'i' in air (m^2/s)
T = Temperature (K)
M_i = Molecular weight of the species (gram/gram-mole)
M_A = Molecular weight of the air (gram/gram-mole)
P = Pressure (atmosphere)
V_i = Sum of atomic diffusion volume increments by atom and structure for species
V_A = Sum of atomic diffusion volume increments by atom and structure for air

Diffusivities (D_i) of components of a diluent can be determined from fundamental considerations. One can use concentration data from the solvent in the solution to generate the C_i^0 numbers for Fick's Law, Equation 1. The C_i^H can be determined by physical measurement and the diffusive flux determined by Equation 1. Yearly emissions can then be estimated by multiplying the diffusive flux (F_i) of a component by the square meters of surface area and by the number of seconds in a year.

PROCEDURE

Given the concentration data, the diffusive flux calculation technique can be used to estimate the amount of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). These were determined at San Manuel over both the settling tanks and raffinate ponds by a combination of Tedlar® bags sampling with offsite gas chromatography-mass spectrometry (GC-MS) and on site analysis by Fourier transform infrared spectrometry (FTIR). The FTIR system employed used an open path configuration consisting of optical components, a computer, special software, and spectral references against which field measurements were compared. FTIR data points were taken at the same time as Tedlar® bag samples for comparison purposes.

Concurrent with the FTIR sampling, climate data was collected. The climate data collected included air temperature (dry bulb), wet bulb temperature, solution temperature, wind speed and direction, and solar radiation. Statistical analyses were performed to determine whether the concentrations of VOCs over the settlers were dependent on climatological conditions. This study indicated no dependence exists.

Assumptions

Several assumptions were made in performing these calculations. The list of potential chemicals that can potentially volatilize from the tanks were limited to those with a significant vapor pressure. A list of concentrations and vapor pressures of HAPs components of the diluent are listed in Table I. Napthalene's low vapor pressure eliminated it from further consideration in this study.

Table I – Concentration and Vapor Pressure of San Manuel Diluent Constituents

Component	Concentration (ppm)	Vapor Pressure (mm Hg)
Benzene	25	77.2
Toluene	350	22.4
Ethylbenzene	1,400	7.5
m-Xylene	410	6.4
o-Xylene	770	4.97
p-Xylene	732	6.9
Octane	2,300	10.6
Heptane	67	36.4
Hexane	67	126.6
Pentane	67	430.7
Napthalene	1,000	0.054
1,2,4 trimethylbenzene	385	2.04
1,3,5 trimethylbenzene	385	7.34

A second assumption was that the initial concentration at the surface of the liquid in the headspace was equal to the initial concentration of the component in the diluent. This is likely to overpredict the flux of VOCs from the surface. This assumption can be tested in future work by careful sampling of the air just above the organic phase. Careful experimental design will be necessary to ensure the exclusion of organic phase droplets in the surface air phase sample.

Calculation of Diffusivities

The diffusivities, calculated by the use of Equation (2) for the selected species, are shown in Table II. Because the GC-MS could not differentiate between higher molecular weight hydrocarbons, these were reported as GC-MS kerosene. For this analysis any constituent component listed by Phillips as being in the diluent but not reported specifically on the GC-MS analysis was in this category. These are noted as 'others' throughout this analysis. The diffusivity for each of these constituents listed by Phillips in this category was calculated, and a weighted average diffusivity for this category was derived, based on the concentration of the component in the diluent. The calculated diffusivities are shown in Table II.

Table II – Calculated Chemical Diffusivities

Component	Molecular Weight (M_i)	Diffusion Volume (V_i)	Diffusivity (D_i)
Air	28.97	20.1	
Benzene	78.11	90.68	0.0894
Toluene	92.13	111.14	0.0804
Ethylbenzene	106.16	131.6	0.0736
m-Xylene	106.16	131.6	0.0736
o-Xylene	106.16	131.6	0.0736
p-Xylene	106.16	131.6	0.0736
Octane	114.22	167.64	0.0656
Heptane	100.2	147.18	0.0705
Hexane	86.17	129.72	0.0758
Pentane	72.15	106.26	0.0846
1,2,4 trimethylbenzene	120.19	172.26	0.0645
1,3,5 trimethylbenzene	120.19	172.26	0.0645
Others			0.07

Typically, single components will behave differently in a mixture than they do in a binary system. The diffusivities for three chemicals were calculated to determine the effects of the mixture on the binary system calculations. The diffusivities in the mixture were not significantly different than those for the binary system. Thus, the binary calculated diffusivities were used.

Calculation of Diffusive Fluxes

The calculated diffusivities shown in Table II above were then plugged into Equation (1) along with the average concentrations by GC-MS of the constituents at one meter. This gave the diffusive flux for each constituent as shown in Table III for the solvent extraction settlers. Table IV shows the diffusive fluxes for the raffinate pond.

Table III – Settler Tanks Concentration Data and Calculated Chemical Diffusive Fluxes

Component	cm^2/s Diffusivity (D_i)	ppmv Concentration at Surface (C_i^0)	ppmv Concentration at 1-meter (C_i^1)	G/m^2-s Diffusive Flux (F_i)
Benzene	0.0894	25	0.0018	7.15×10^{-7}
Toluene	0.0804	350	0.0668	1.06×10^{-5}
Ethylbenzene	0.0736	1400	0.0568	4.48×10^{-5}
Xylenes	0.0736	1912	0.0371	6.12×10^{-5}
1,2,4 trimethylbenzene	0.0645	385	0.0230	1.22×10^{-5}
1,3,5 trimethylbenzene	0.0645	385	0.0101	1.22×10^{-5}
Others	0.07	2500	16.921	7.98×10^{-5}

Table IV – Raffinate Pond Data and Calculated Chemical Diffusive Fluxes

Component	cm^2/s Diffusivity (D_i)	ppmv Concentration at Surface (C_i^0)	ppmv Concentration at 1-meter (C_i^1)	G/m^2-s Diffusive Flux (F_i)
Benzene	0.0894	25	0.0011	7.15×10^{-7}
Toluene	0.0804	350	0.0645	1.06×10^{-5}
Ethylbenzene	0.0736	1400	0.001	4.48×10^{-5}
Xylenes	0.0736	1912	0.00198	6.12×10^{-5}
1,2,4 trimethylbenzene	0.0645	385	0.0022	1.22×10^{-5}
1,3,5 trimethylbenzene	0.0645	385	0.00103	1.22×10^{-5}
Others	0.07	2500	3.983	8.02×10^{-5}

These calculated annual fluxes would produce the emissions shown in Table V per year for San Manuel. The emissions per year for the settler ponds are calculated for 12 ponds of 298.8 square meters. In considering the effect of partial enclosure on the evaporative loss rate of VOCs from the settler tanks, it was conservatively estimated that approximately 66 percent of the headspace in each tank is affected by the enclosure. It was also assumed that the enclosure allows only 50 percent of the affected headspace to vent to the atmosphere. Thus, it was assumed that only 33 percent of the potential-to-emit occurs from the partially enclosed tanks. The raffinate pond has a surface area of 447 square meters.

Table V – Yearly Emissions at San Manuel

Component	G/m^2-s Diffusive Flux (F_i)	Settler Tanks Uncontrolled Tons/Year	Settler Tanks Controlled Tons/Year	Raffinate Pond Uncontrolled Tons/Year
Benzene	7.15×10^{-7}	0.09	0.03	0.011
Toluene	1.06×10^{-5}	1.32	0.44	0.164
Ethylbenzene	4.48×10^{-5}	5.31	1.77	0.662
Xylenes	6.12×10^{-5}	7.25	2.42	0.904
1,2,4 trimethylbenzene	1.22×10^{-5}	1.42	0.47	0.177
1,3,5 trimethylbenzene	1.22×10^{-5}	1.42	0.47	0.177
Others	8.02×10^{-5}	9.94	3.31	1.246
	Total:	26.74	2.23	3.341

The raffinate pond, since it is an uncontrolled source, would appear to be a major source of emissions. However, the number shown above may be an overstatement of the raffinate pond emissions since it assumes that the diluent in the raffinate pond has the same composition as fresh diluent. This may not be the case since it is known that raffinate reclaim must be treated before it can be reused. Analyses for the constituents of interest on representative samples of raffinate organic could be conducted to test the hypothesis.

CONCLUSIONS

There are many possible loss mechanisms for organic phases from SX plants besides evaporative losses. Chemical and biological degradation will not only destroy diluent and extractant molecules but also enhance losses due to entrainment and solubility of the organic phase into the aqueous phase. Formation of the solid-aqueous-organic gunk phase is also a loss mechanism.

From the examination of monthly use versus weather data, evaporative losses do not appear to be a linked to climatological changes. This suggests that diluent losses are not linked to evaporation. Despite an approximately 30° C (60° F) difference in temperature between the average temperature from winter to summer, no obvious trend between usage and mean daily temperature appears to exist for dessert Southwest SX plants. Nor did air samples taken from above the settlers show a correlation between temperature and quantity.

The Diffusive Flux Model should be considered as a method to quantify evaporative losses for any VOC. With diffusivity numbers and concentration data, diffusive fluxes can be determined for chemical species of interest. Such methods as the Fuller, Schettler, and Giddings Method can derive the diffusivity for a particular chemical from fundamental numbers. Careful sampling and analyses of the air above a settler tank can provide the needed concentration data. The Diffusive Flux number obtained can then be used to calculate emissions for a given chemical.

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APPENDIX H. REGULATORY APPLICABILITY

Appendix H. Verification of Applicable Regulations

Unit	Control Device	Rule	Discussion
Metallic Mineral Processing Equipment	Cartridge Filters, Electrostatic Precipitator, Scrubber & Water sprays	40 CFR 60.382(a) 40 CFR 60.382(a)(2) 40 CFR 60.382(b) 40 CFR 60.386(a) 40 CFR 60.386(b)(1) 40 CFR 60.386(b)(2) P.C.C Section 17.16.490 AZ SIP R9-3-521 A.A.C. R18-2-702 40 CFR 60, Subpart A PSIP Rule 316	The crushers, screens, conveyor belt transfer points, storage bins and truck unloading are affected facilities located in a metallic mineral processing plant as defined in NSPS Subpart LL. The non-NSPS equipment are subject to the state regulations.
Tailings Dewatering and Placement Tailings Storage Precious Metals Refinery Miscellaneous Sources – Silos, Lime Storage Bins, Sodium Metasciliate Storage Bins, Flocculant Storage Bins, Guar and Cobalt Sulfate Feeders	Water sprays Dust suppressants Dust Collector	A.A.C. R18-2-730 A.A.C. R18-2-702 P.C.C. Section 17.16.430 P.C.C. Section 17.16.120	The opacity standards from A.A.C R18-2-702 apply to existing stationary point sources. The standards from A.A.C. R18-2-730 apply to unclassified sources.
Internal Combustion Engines	N/A	40 CFR 60, Subpart IIII 40 CFR 60, Subpart A	These standards apply to internal combustion engines manufactured after 2006. New engines subject to Subpart IIII meet the requirements of NESHAP Subpart ZZZZ by complying with the requirements of NSPS Subpart IIII.
Fugitive dust sources	Water Trucks Dust Suppressants	A.A.C. R18-2 Article 6 A.A.C. R18-2-702 PSIP Rule 316	These standards are applicable to all fugitive dust sources at the facility.
Petroleum Liquid Storage Tanks - Gasoline	Submerged filling device; Pump/ compressor seals	A.A.C. R18-2-710 40 CFR 63 Subpart CCCCCC 40 CFR 63 Subpart A PSIP Rule 314	This standard applies to the gasoline storage tanks. NESHAP Subpart CCCCCC applies to gasoline dispensing facilities.
Diesel Storage Tanks	N/A	A.A.C. R18-2-730 PSIP Rule 314	These standards apply to unclassified sources.

Unit	Control Device	Rule	Discussion
Laboratory Dust Collector	Dust Collector	A.A.C. R18-2-721, 702 AZ SIP Provision R9-3-521	The PM limits from A.A.C. R18-2-721 and AZ SIP apply.
Abrasive Blasting	Wet blasting; Dust collecting equipment; Other approved methods	A.A.C. R-18-2-702 A.A.C. R-18-2-726	These standards are applicable to any abrasive blasting operation.
Spray Painting	Enclosures	A.A.C. R18-2-702 A.A.C. R-18-2-727	This standard is applicable to any spray painting operation.
Demolition/renovation operations	N/A	A.A.C. R18-2-1101.A.12	This standard is applicable to any asbestos related demolition or renovation operations.
Mobile sources	None	A.A.C. R18-2-801	These are applicable to off-road mobile sources, which either move while emitting air pollutants or are frequently moved during the course of their utilization. A number of these requirements are preempted by the Clean Air Act.
Solution Extraction/Electrowinning (SX/EW)	Scrubbers, use of covers, foam, dispersion balls, surfactants	A.A.C. R18-2-730 A.A.C. R18-2-702 P.C.C Section 17.16.430	These standards are applicable to unclassified sources. The opacity standards from Article 702 apply.
Acid Plant Waste Heat Recovery Boiler	Acid Plant Scrubber	40 CFR 60.82(a) 40 CFR 60.84(a),(b),(c),(d),(e) 40 CFR 60.85(a),(b)(1)-(3)(4),(c) 40 CFR 60.83(a)(1),(2) A.A.C R18-2-306 A.A.C R18-2-331 P.C.C Section 17.16.200 40 CFR 60, Subpart A 40 CFR 60, Subpart Dc	The acid plant is subject to 40 CFR 60 Subpart H The waste heat recovery boiler is subject to 40 CFR 60 Subpart Dc