



**TECHNICAL REVIEW AND EVALUATION
OF APPLICATION FOR
AIR QUALITY PERMIT No. 95025**

I. INTRODUCTION

Class II Air Quality Permit No. 95025 is issued to Freeport-McMoRan Miami, Inc. for the continued operation of the Miami Mine. Permit No. 95025 renews and supersedes Permit No. 66619. The Miami Mine operation consists of mining of copper ore, heap leaching, and a solvent extraction/electrowinning plant to produce copper cathode. A Class II permit is required because the Miami Mine's maximum capacity to emit with any elective limits exceeds the significant emission level for nitrogen oxides.

A. Company Information

Facility Name: Freeport-McMoRan Miami Mine
Mailing Address: P.O. Box 4444, Claypool, Arizona 85532
Facility Location: Highway 60, Claypool, Arizona 85532

B. Attainment Classification

The Miami area is currently designated non-attainment for particulate matter less than 10 microns (PM₁₀) and sulfur dioxide (SO₂, 75 ppb 1-hour standard).

II. PROCESS DESCRIPTION

A. Open Pit Mining

Open pit mining is conducted using large-scale mining equipment such as rotary blast hole drills, mining shovels, front end loaders, off-highway haul trucks, crawler dozers, rubber tire dozers, graders, and off-highway water trucks. Active mining operations at the Miami Mine have been suspended. Open pit mining operations result in the fugitive emission of particulate matter (PM), particulate matter with nominal aerodynamic diameter less than 10 microns (PM₁₀), and particulate matter with nominal aerodynamic diameter less than 2.5 microns (PM_{2.5}).

B. Drilling and Blasting

Ore and overburden are generated from the Miami Mine by drilling pre-established patterns to be filled with ammonium nitrate and fuel oil (ANFO) in order to achieve the desired fragmentation. Resulting material is loaded into haul trucks by mining equipment and transported to dedicated stockpiles. Blasting may occur three times a day at several different mining pits.

Drilling operations result in the fugitive emission of PM, PM₁₀, and PM_{2.5}. Fugitive emissions from drilling operations are controlled by shrouds and water injection, as necessary. Blasting using ANFO results in fugitive emissions PM, PM₁₀, and PM_{2.5} and

products of combustion, including carbon monoxide (CO), nitrogen oxides (NO_x), and sulfur dioxide (SO₂).

C. Loading

Ore and overburden generated through blasting operations is loaded into off-highway haul trucks by mining shovels for transport to overburden storage areas and leach pads. Loading and unloading operations also take place during reclamation activities conducted on-site. Loading operations result in the fugitive emissions of PM, PM₁₀, and PM_{2.5}, which are inherently controlled by the high moisture content of the resulting ore and overburden.

D. Hauling and On-Site Traffic

The hauling of ore, overburden, and material for reclamation activities utilize haul trucks for material transportation over unpaved roadways. Additionally, unpaved roadways are used for heavy mining equipment, acid plant tanker trucks, and light-duty vehicle traffic. Fugitive emissions containing PM, PM₁₀, and PM_{2.5} are generated through the hauling operations and on-site traffic on unpaved roads, and are controlled by the application of dust suppressants and/or water to the road's surface.

E. Heap Leaching

Ore is transported by haul truck and loaded into heap leach pads to extract copper from the ore. The leach pad is irrigated with a weak sulfuric acid solution (raffinate), which dissolves and separates copper from the ore. The resulting copper-containing leachate is known as pregnant leach solution (PLS). PLS is then captured at the base of the leach pad and transported to the solvent extraction process for further processing by pipeline.

Fugitive emissions of PM, PM₁₀, and PM_{2.5} emissions are generated by the unloading of material from haul trucks to the heap leach pads. Negligible quantities of sulfuric acid mist (H₂SO₄) are generated during the irrigation process.

F. Solvent Extraction

PLS from heap leach pads is transported by pipeline to the feed ponds/tanks for storage prior to processing. Copper is extracted from the PLS using an organic ion-exchange reagent, and the resulting loaded organic solution is stripped of the copper by an acidic electrolyte. The resulting raffinate solution from the initial extraction of copper is recycled to the heap leach pads to continue extracting copper from ore, while the copper-rich electrolyte strip solution is transferred to the electrowinning tankhouse for further processing.

Emissions of VOCs and hazardous air pollutants (HAPs) result from the solvent extraction process and storage tanks containing solution extraction products, diluent, and grungees.

G. Electrowinning Tankhouse

Copper-rich electrolyte strip solution is pumped from the solvent extraction process to the electrowinning tankhouse for recovery of copper. Copper starter sheets are suspended in

the tanks, and an electric current is applied through the strip solution, which causes the copper in solution to plate out on the blanks to produce copper cathode. The resulting stripped electrolyte is diverted back to the solvent extraction process to strip copper from the loaded organic solution. The solution is heated by the natural-gas fired tankhouse boilers to promote the plating of copper.

Emissions of H₂SO₄ result from oxygen bubbles generated during the electrowinning process burst on the surface of the tank, with a fraction of these emissions being released out the open sides of the tankhouse building. Operation of the tankhouse boilers results in the emission of PM, PM₁₀, PM_{2.5}, VOCs, and products of combustion, including CO, NO_x, SO₂.

H. Reclamation

The Miami Mine performs reclamation activities on certain closed facilities to restore these areas to their natural state. Associated operations include drilling and blasting, material loading/unloading, hauling, and grading. Cover materials utilized include overburden, which is typically sourced from stockpiles near reclamation activities to minimize emissions resulting from vehicle traffic on unpaved roads.

I. Tailings

Tailings ponds associated with previous crusher and concentrator operations, which ceased at the Miami Mine in 1986, are undergoing reclamation activities including capping and revegetation.

J. Miscellaneous Equipment

The Miami Mine operates various emergency generators, non-emergency pumps, heaters, and boilers to support operations. Spray painting, abrasive blasting, and other ancillary activities also take place as necessary.

III. COMPLIANCE HISTORY

Freeport-McMoRan Miami, Inc. submitted five (5) annual compliance certifications and received two (2) full inspections during the permit term. The Miami Mine was not subject to any enforcement actions resulting from the inspections or compliance certification reviews.

IV. EMISSIONS

The Miami Mine's potential to emit was evaluated using the AP-42 Compilation of Air Pollutant Emission Factors, emission standards from New Source Performance Standards (NSPS) Subpart III "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines," manufacturer's specifications, and calculation methodologies and test data obtained from similar emission units.

Emissions from the natural gas and propane heaters and boilers were calculated using emission factors from AP-42 Chapter 1.4 "Natural Gas Combustion and AP-42 Chapter 1.5 "Liquified Petroleum Gas Combustion" as appropriate. Internal combustion engines emissions were evaluated

using emission factors from AP-42 Chapter 3.3 “Gasoline and Diesel Industrial Engines”, Table 2 to NSPS Subpart IIII, and manufacturer’s specifications.

Hazardous Air Pollutant (HAP) and volatile organic compound (VOC) emissions from the solvent extraction process were estimated according to “Quantification of Volatile Organic Compound Emissions from the Solution Extraction Process” from the BHP Copper San Manuel Operations using 43% control efficiency due to solvent extraction tank covers. Particulate Matter (PM) and sulfuric acid mist (H₂SO₄) emissions from the electrowinning tank house were estimated based on total electrowinning cell area according to measurements from another tankhouse operation in Arizona.

Emissions of particulate matter from delivery and handling of ammonium nitrate prill are evaluated using emission factors for bulk loading from AP-42 Chapter 8.3 “Ammonium Nitrate”. VOC emissions from storage tanks were developed using the TankESP storage tank emission calculation software, which incorporates procedures from AP-42 Chapter 7.1 “Organic Liquid Storage Tanks” in order to determine emissions from the diluent, grungee, and solvent extraction surge tanks at the Miami Mine.

Fugitive dust emissions from drilling, blasting, unpaved road traffic, truck loading/unloading, and wind erosion were estimated using emission factors and calculation procedures from AP-42 Chapters 11.9.2 “Crushed Stone Processing and Pulverized Mineral Processing” for wet drilling – unfragmented stone, 11.9.1 “Western Surface Coal Mining” for blasting, 13.2.2 “Unpaved Roads”, 13.2.4 “Aggregate Handling and Storage Piles”, and 13.2.5 “Industrial Wind Erosion”, respectively. Fugitive emissions of combustion products from blasting operations were evaluated using the following methodologies: (1) NO_x emissions from blasting were evaluated using “NO_x emissions from blasting operations in open-cut coal mining” by Elsevier Ltd., (2) CO and NH₃ emissions were evaluated using “A Technique for Measuring Toxic Gases Produced by Blasting Agents” developed by NIOSH, and (3) SO₂ emissions were evaluated using the diesel fuel sulfur content, ratio of fuel oil in ANFO, diesel fuel density, and fuel usage for blasting operations.

The facility has a maximum capacity to emit with any elective limits nitrogen oxides greater than the significant emission level, therefore a Class II air quality permit is required in accordance with A.A.C. R18-2-302.B.2.a.. The facility’s potential to emit PTE is provided in Table 1 below:

Table 1: Potential to Emit¹ (tpy)

Pollutant	PTE
NO _x	68.2
PM ₁₀	3.5
PM _{2.5}	3.4
CO	49.9
SO ₂	0.23
VOC	8.01
HAPs	10.9

¹Potential to emit only includes fugitive emissions for HAPs at the Miami Mine

V. APPLICABLE REGULATIONS

Table 2 identifies applicable regulations and verification as to why that standard applies. The table also contains a discussion of any regulations the emission unit is exempt from.

Table 2: Applicable Regulations

Unit & year	Control Device	Rule	Discussion
Solvent Extraction, Electrowinning Tankhouse, and Miscellaneous Storage Tanks, and Other Unclassified Operations	Solvent Extraction: Covers Electrowinning Tankhouse: Foam, Blankets, Surfactants, and/or Thermal retention balls	A.A.C. R18-2-730 A.A.C. R18-2-614	Solvent extraction, electrowinning, miscellaneous storage tanks, and other unclassified point sources are subject to “Standards of Performance for Unclassified Sources”. Non-point sources associated with Solvent extraction, electrowinning, miscellaneous storage tanks, and other unclassified sources are subject to “Evaluation of Nonpoint Source Emissions”.
Boilers and Heaters	N/A	A.A.C. R18-2-724 40 CFR 60 Subpart Dc 40 CFR 63 Subpart DDDDD	These standards are applicable to all boiler and heater operations that have a rated capacity of less than 10 MMBtu/hr and are constructed before June 9, 1989, and are therefore not subject to New Source Performance Standards (NSPS) requirements under 40 CFR 60 Subpart Dc. Tankhouse Boilers No. 1 and 2 have a rated capacity exceeding 10 MMBtu/hr and were constructed after June 9, 1989, therefore they are subject to 40 CFR 60 Subpart Dc. Tankhouse Boilers No. 1 and 2 are industrial, commercial, or institutional boilers located at a major source of HAPs for the purposes of the National Emission Standards for Hazardous Air Pollutants (NESHAP) program, and are therefore subject to 40 CFR 63 Subpart DDDDD. The Propane Water Heater is exempt from the requirements of 40 CFR 63 Subpart DDDDD under 40 CFR 63.7491(d) because it meets the definition of hot water heater as defined in 40 CFR 63.7575.

Unit & year	Control Device	Rule	Discussion
Internal Combustion Engines	N/A	A.A.C. R18-2-719	Internal combustion engines constructed after July 11, 2005 where the stationary CI ICE are manufactured after April 1, 2006 are subject to NSPS under 40 CFR 60 Subpart III, and are therefore exempt from “Standards of Performance for Existing Stationary Rotating Machinery.” Engines constructed and manufactured prior to the above dates are subject to these requirements.
		40 CFR 60 Subpart III	Internal combustion engines constructed after July 11, 2005 where the stationary CI ICE are manufactured after April 1, 2006 are subject to NSPS under 40 CFR 60 Subpart III.
		40 CFR 63 Subpart ZZZZ	Internal combustion engines constructed before June 12, 2006 are considered existing engines subject to the requirements of 40 CFR 63 Subpart ZZZZ. Engines constructed after June 12, 2006 are considered new engines subject to 40 CFR 63 Subpart ZZZZ. For the purposes of the NESHAP program, the Miami Mine and Miami Smelter are collectively considered a major source.
Fugitive dust sources	Water Trucks, Dust Suppressants	A.A.C. R18-2 Article 6 A.A.C. R18-2-702	These standards are applicable to all fugitive dust sources at the facility.
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	These standards are 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.

VI. PREVIOUS PERMIT REVISIONS AND CONDITIONS**A. Previous Permit Revisions**

Table 3 provides a description of the permit revisions made to Permit No. 66619 during the previous permit term.

Table 3: Permit Revisions to Permit No. 66619

Permit Revision No.	Permit Revision Type	Brief Description
75121	Minor Permit Revision	Installation and operation of required tank covers on mixer-settler tanks, except for portions used for operation and maintenance.
77117	Minor Permit Revision	Removal of Tankhouse Boilers #1 and #2 and installation of Tankhouse Boiler #4. Boilers #3 and #4 have been re-named as #1 and #2.
93444	Minor Permit Revision	Designation of the 35 Reservoir Engine as an emergency stationary internal combustion engine.

B. Changes to Current Renewal

Table 4 addresses the changes made to the sections and conditions from Permit No. 66619.

Table 4: Previous Permit Conditions

Section No.	Determination			Comments
	Added	Revised	Deleted	
Att. "A"		X		General Provisions: Revised to represent the most recent template language
Att. "B" Section I		X		Facility Wide Requirements: Revised to represent the most recent template language
Att. "B" Section II		X		Boilers and Other Fuel Burning Equipment: Removed fuel limitations for fuel burning equipment, included applicability statement for fuel burning equipment requirements, and minor revisions to language.
Att. "B" Section III		X		Solvent Extraction, Electrowinning, Miscellaneous Storage Tanks, and Other Unclassified Operations: Minor revisions to formatting and language.
Att. "B" Section IV		X		Internal Combustion Engines: Removed fuel limitations, revised emergency and non-emergency internal combustion engine requirements such that they have been split under Section IV, and other minor revisions to the formatting and language.
Att. "B" Section V			X	Internal Combustion Engines – Non-Emergency: Combined with Section IV to have a single section for internal combustion engine requirements.
Att. "C"		X		Equipment List:

Section No.	Determination			Comments
	Added	Revised	Deleted	
				Revised to reflect the most recent equipment operating at the facility and to include equipment information provided.

VII. MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

Table 5 contains an inclusive but not an exhaustive list of the monitoring, recordkeeping and reporting requirements prescribed by the air quality permit. The table below is intended to provide insight to the public for how the Permittee is required to demonstrate compliance with the emission limits in the permit.

Table 5: Permit No. 95025

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
Solvent Extraction, Electrowinning, Miscellaneous Storage Tanks, and Other Unclassified Sources		Point Source: 20% Opacity Non-Point Source: 40% Opacity	Conduct quarterly opacity monitoring of visible emissions emanating from the solvent extraction and electrowinning process.	Maintain records of all control measures used to limit emissions from the solvent extraction and electrowinning process.	
Tankhouse Boilers No. 1 and 2			Annual tune-up of boilers no more than 13 months after the previous tune-up.	Record and maintain records of the amounts of fuel combusted during each calendar month, and maintain these records for 2 years following the date of such record. Maintain records of each notification and report submitted to comply with 40 CFR 63 Subpart DDDDD, including supporting documentation.	Submit an annual compliance report including company and facility name and address, process unit information and operating parameters, dates the report covers, and the date of the most recent tune-up for each applicable unit.
Propane Water Heater and	PM	15% Opacity	Conduct quarterly opacity monitoring of the stacks of all boilers.	Records of the fuel used in all the boilers.	

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
Miscellaneous Heaters					
Engines Subject to 40 CFR 60 Subpart IIII	CO, NO _x , PM		<p>Emergency Engines:</p> <p>Install a non-resettable hour meter prior to startup of the engines.</p>	<p>Emergency Engines:</p> <p>Keep records of emergency and non-emergency operation as recorded through the non-resettable hour meter, including time and reason the engine was in operation.</p> <p>Non-Emergency Engines:</p> <p>If the stationary CI internal combustion engine is equipped with a diesel particulate filter, keep records of any corrective action taken after the backpressure monitor has notified that the high backpressure limit of the engine is approached.</p>	
Engines Subject to 40 CFR 63 Subpart ZZZZ	PM	40% Opacity – for any period greater than 10 seconds	Conduct monthly opacity monitoring of the stacks of all engines.	Maintain records of the lower heating value of the fuel.	Report all 6-minute periods which the opacity exceeded 15%.

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
	SO ₂	1.0 lb/MMBtu		Record the daily sulfur content of the fuel used in the engines.	Report to the Director any daily period in which the sulfur content exceeds 0.8%.
	HAPs		<p>Non-Emergency Engines:</p> <p>Change oil and filter every 1,000 hours of operation or annually, whichever comes first.</p> <p>Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first.</p> <p>Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.</p> <p>An oil analysis program can be utilized in order to extend the specified oil change requirements.</p>	<p>Non-Emergency Engines:</p> <p>Keep records of maintenance conducted on engines in order to demonstrate that the facility operated and maintained the engine and after-treatment control device (if any) accounting the maintenance plan.</p> <p>Keep records of parameters analyzed under the oil analysis program, the results of the analysis, oil changes, and replacement of hoses and belts.</p>	<p>Non-Emergency Engines:</p> <p>Report all deviations from applicable requirements of 40 CFR 63 Subpart ZZZZ in the annual monitoring report.</p>
Fugitive Dust	PM	40% Opacity	Conduct biweekly opacity monitoring of fugitive dust emissions.	Record of the dates and types of dust control measures employed, and if applicable, the results of	

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
				any Method 9 observations, and any corrective action taken to lower the opacity of any excess emissions.	
Abrasive Blasting	PM	20% Opacity		Record the date, duration and pollution control measures of any abrasive blasting project.	
Spray Painting	VOC	20% Opacity Control 96% of the overspray		Maintain records of the date, duration, quantity of paint used, any applicable MSDS, and pollution control measures of any spray painting project.	
Demolition/ Renovation	Asbestos			Maintain records of all asbestos related demolition or renovation projects including the “NESHAP Notification for Renovation and Demolition Activities” form and all supporting documents	

VIII. ENVIRONMENTAL JUSTICE ANALYSIS

The EPA (Environmental Protection Agency) defines Environmental Justice (EJ) to include the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of completing an EJ assessment in permitting is to provide an opportunity for overburdened populations or communities to allow for meaningful participation in the permitting process. Overburdened is used to describe the minority, low-income, tribal and indigenous populations or communities that potentially experience disproportionate environmental harms and risks due to exposures or cumulative impacts or greater vulnerability to environmental hazards. The renewal permit does not allow or permit any increases in emissions and will not result in any additional impacts.

IX. LIST OF ABBREVIATIONS

A.A.C.	Arizona Administrative Code
A.R.S.	Arizona Revised Statutes
ANFO	Ammonium Nitrate and Fuel Oil
CFR	Code of Federal Regulations
CI	Compression Ignition
CO	Carbon Monoxide
EPA	Environmental Protection Agency
EJ	Environmental Justice
HAP	Hazardous Air Pollutant
H ₂ SO ₄	Sulfuric Acid Mist
MMBtu	Million British Thermal Units
NESHAP	National Emission Standard for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NO _x	Nitrogen Oxides
NSPS	New Source Performance Standards
PLS	Pregnant Leach Solution
PM	Particulate Matter
PM ₁₀	Particulate Matter less than 10 µm nominal aerodynamic diameter
PM _{2.5}	Particulate Matter less than 2.5 µm nominal aerodynamic diameter
PTE	Potential to Emit
SO ₂	Sulfur Dioxide
TPY	Tons per Year
VOC	Volatile Organic Compound