TECHNICAL REVIEW AND EVALUATION OF APPLICATION FOR AIR QUALITY SIGNIFICANT PERMIT REVISION NO. 114492 TO OPERATING PERMIT NO. 96653

I. INTRODUCTION

This Class I Significant Permit Revision (SPR) authorizes South32 Hermosa Inc. (South32), the Permittee, to make the following changes to Permit No. 96653:

- Reduce the number of 2,600 kW natural gas engines with Equipment IDs: ENGINE 0013 – 0071 from 58 with 1 additional backup natural gas engine to 40 with 4 additional backup natural gas engines (44 total, only 40 operating);
- Authorize up to 14 of the natural gas engines previously mentioned operating in the 50%-100% load range rather than the 75%-100% load range; and
- Clarify the number of diesel engines in each CAT XQ1140 genset with Equipment IDs: ENGINE 0007 – 0012.

In addition, the moisture content for the tailings was updated to 11.8% to align with the latest Mine Plan of Operations (MPO). Road configurations and emissions were also updated.

A. Company Information

Facility Name: South32 Hermosa Inc.

Mailing Address: 1860 E. River Road, Suite 200, Tucson, Arizona 85718

Facility Location: 749 Harshaw Road, Patagonia, Arizona 85624

B. Attainment Classification

This facility is located in Santa Cruz County which is designated as attainment or unclassified for all criteria air pollutants.

II. PROCESS DESCRIPTION

A. Process Description

1. **Changes to Natural Gas Engines**

DRAFT

South32 is currently authorized to use up to 58 natural gas engines (plus 1 backup) (2,600 kW CAT 3520 DSL with Equipment IDs: ENGINE 0013 - 0071) with an operating range limit of 75% to 100% load and a requirement to interlock all engines and operate the selective catalytic reduction (SCR) and oxidation catalyst units at all times, exclusive of startup and shutdown. Operations at the facility have shown that these conditions may create safety risks and result in unnecessary emissions. South32 proposes the following changes to reduce emissions while providing necessary operational flexibility and reducing safety risks.

First, South32 proposes to replace the “interlock” requirement with “operate” requirement. The interlock requirement could force engines off-line while the facility is hoisting personnel or material from underground operations. Power interruption could result in personnel being trapped below ground or in the hoist. Additionally, abrupt termination of an engine increases the risk of tripping other units or engines. If any engine, oxidation catalyst or SCR unit malfunctions while in service, the facility will promptly shut the affected engine down or replace it with another engine, then shut down the affected engine immediately once the replacement engine is online. This allows for smoother power transitions and reduces the number of startups and shutdowns.

Second, South32 proposes to reduce the number of engines from 58 with 1 additional backup engine to 40 with 4 additional backup engines (44 total, only 40 operating), and expand the operating range of up to 14 natural gas engines to 50% to 100% load instead of the current 75% to 100% load range. Certain operations, such as hoisting, require considerable power upon startup. Under the current permit, the facility must use load banks to increase demand to bring the engines online and hold them above the 75% load range during startup. The net result is that the facility must operate multiple engines on load banks – burning fuel and generating emissions – solely for the purpose of maintaining the 75% load range. The facility has determined that the engines will be fully controlled within a wider operating range of 50% to 100% load and if 14 engines can operate in this wider operating range 50% to 100% load, the total number of engines can be reduced from 58 with 1 backup to 40 with 4 backups. If this change is made, the facility will be able to eliminate substantial time running load banks to balance load swings and reduce emissions over time including system interruptions with corresponding startups and shutdowns. As part of this SPR, the Equipment IDs of the natural gas engines that will operate in 50% to

100% load range are: ENGINE 0013, 0014, 0015, 0016, 0020, 0021, 0022, 0023, 0024, 0025, and 0026, with an allowance to add an additional three engines in the future for a total of 14 engines. If there is any change to this list, South32 will notify ADEQ the date and time the change is effective.

Third, South32 proposes to test at 50%, 75%, and maximum achievable load and use these tests to set emissions factors in pound per megawatt-hour (lb/MWh) that will be used with the monitoring of engine power percent load (in MWh) to calculate emissions more accurately to ensure that the emissions are not underestimated.

2. **Changes to Diesel Engines**

South32 proposes the following changes to the diesel engines:

a. The six (6) Diesel CAT XQ1140 gensets (Equipment IDs: ENGINE 0007 – 0012) will be updated to account for the two (2) Caterpillar C18 engines in each genset. This configuration was reflected in the application. The nomenclature is being changed because the focus is on the engines and not the genset as a unit. No change is proposed to the voluntarily accepted emission limits.

b. The mechanical engine rating of C200D2RE (Equipment ID: ENGINE 0001) will be updated from 218 kW to 213 kW. The EPA Tier 4 engine emission factor for VOCs will be used in the VOC emissions calculations for the C200D2RE engine.

3. **Change to Tailings Moisture**

The tailings moisture content was updated to 11.8% to reflect the latest data from the MPO.

4. **Changes to Road Configurations and Road Emissions**

The road emissions will be updated due to the following proposed changes to road configurations:

a. The number of natural gas truck trips will be updated to reflect the reduced number of engines onsite.

b. Consistent with changes noted in Minor Permit Revision (MPR) No. 109292, trips associated with the East Ore Stockpile (EOS) will be updated to reflect the reduced number

DRAFT

of trips from the shaft area to the stockpile. An additional route from the EOS to the milling area will be added.

c. Road configurations will be updated based on the latest site layouts in MPR No. 109292.

B. Control Devices

No new control device is being proposed in this SPR.

C. Process Flow Diagram

The process flow diagram of the emission sources affected by this SPR can be found in the application, Figure 5-17 on Page 5-2.

III. COMPLIANCE HISTORY

A. Physical Inspections and Compliance Certification Reviews

During this permit term, South32 received five (5) physical inspections and submitted four (4) compliance certification reviews. No deficiencies were noted during the compliance certification report reviews. No formal enforcement actions resulted from the physical inspections.

B. Performance Tests

During this permit term, the performance tests conducted, and results are shown in Table 1:

Table 1: Performance Test Results

Emission Unit	Pollutant	Date of Test	Results of Performance Test
Caterpillar G3520 Unit ENGINE 0013, ENGINE 0014, and ENGINE 0015	NO_x, CO, VOCs	01/30-/2024 – 01/31/2024	Pass
Caterpillar G3520 Unit ENGINE 0014	NO_x, CO, VOCs	04/03/2024	Pass

DRAFT

Emission Unit	Pollutant	Date of Test	Results of Performance Test
Caterpillar G3520 Unit ENGINE 0013, ENGINE 0014, and ENGINE 0015	NO_X, CO, VOCs	01/21/2025 – 01/22/2025	Pass
Caterpillar G3520 Unit ENGINE 0023 and ENGINE 0024	NO_X, CO, VOCs, formaldehyde	08/20/2025 – 08/21/2025	Pass
Caterpillar G3520 Unit ENGINE 0013, ENGINE 0014, ENGINE 0015, ENGINE 0020, and ENGINE 0022	NO_X, CO, VOCs, formaldehyde	10/22/2025 – 10/24/2025	Pass
Caterpillar G3520 Unit ENGINE 0013, ENGINE 0014, ENGINE 0015, ENGINE 0021, ENGINE 0022, ENGINE 0023, ENGINE 0024, and ENGINE 0025	NO_X, CO, VOCs, formaldehyde	03/10/2026 – 03/14/2026	Pass
Caterpillar G3520 Unit ENGINE 0013 and ENGINE 0014	NO_X, CO, VOCs, formaldehyde	04/09/2026	Pass

I. EMISSIONS

The potential to emit (PTE) changes associated with this SPR were calculated based on EPA's Compilation of Air Pollution Emission Factors, AP-42 Sections 3.2, 11.9, 13.2.2, 13.2.4, and 13.2.5, and 40 CFR 1039.101, manufacturer's guarantees and recommendations, and engine performance test results. This facility is a non-categorical source as it is not listed in Arizona Administrative Code (A.A.C.) R18-2-101.23 and thus, the potential to emit (PTE) does not include fugitive emissions, except that hazardous air pollutant (HAP) emissions include both non-fugitive and fugitive emissions. The facility's PTE changes are provided in Table 2, Table 3, and Table 4 for the Primary Operating Scenario (POS), Alternate Operating Scenario No. 1 (AOS 1) and Alternate Operating Scenario No. 2 (AOS 2), respectively. AOS 1 in Table 3 is the Line Power Alternative, and AOS 2 in Table 4 is the second Tailing Storage Facility Alternative.

Table 2: PTE Changes (Tons per Year) for Primary Operating Scenario (POS)

Pollutant	PTE (tons per year)			Permitting Exemption Threshold	Minor NSR Triggered ?
	Pre-Revision (317 Change LTF No. 118533)	Post-Revision (LTF No. 114492)	Difference		
NO_X	206.51	155.64	–50.88	20	No
PM	212.76	227.15	+14.39	N/A	N/A
PM_{10}	92.70	107.09	+14.39	7.5	Yes
$PM_{2.5}$	54.96	69.35	+14.39	5	Yes
CO	222.21	172.40	–49.81	50	No
SO_2	6.90	7.95	+1.05	20	No
VOCs	108.39	82.56	–25.82	20	No
Pb (Only non-fugitive)	1.04	1.04	0.00	0.3	No
Pb (Total)	1.83	1.83	0.00	N/A	N/A
Manganese	5.09	5.09	0.00	N/A	N/A
Single HAP (Acetaldehyde)	39.84	27.51	–12.33	N/A	N/A
Total HAPs	81.51	54.56	–26.95	N/A	N/A
H_2S	10.12	10.12	0.00	N/A	N/A
GHG (CO_2e)	1,176,986	832,231	–344,755	N/A	N/A

DRAFT

Table 3: PTE Changes (TPY) for AOS 1

Pollutant	PTE (tons per year)			Permitting Exemption Threshold	Minor NSR Triggered ?
	Pre-Revision (317 Change LTF No. 118533)	Post-Revision (LTF No. 114492)	Difference		
NO_X	42.64	42.62	–0.02	20	No
PM	174.63	174.73	+0.10	N/A	N/A
PM_{10}	54.57	54.67	+0.10	7.5	No
$PM_{2.5}$	16.83	16.93	+0.10	5	No
CO	149.37	149.21	–0.16	50	No
SO_2	5.68	5.19	–0.49	20	No
VOCs	24.05	24.40	+0.35	20	No
Pb (Only non-fugitive)	1.04	1.04	0.00	0.3	No
Pb (Total)	1.83	1.83	0.00	N/A	N/A
Single HAP (Manganese Compounds)	5.09	5.09	0.00	N/A	N/A
Total HAPs	13.51	13.53	+0.02	N/A	N/A
H_2S	10.12	10.12	0.00	N/A	N/A
GHG (CO_2e)	43,193	50,305	+7,112	N/A	N/A

Table 4: PTE Changes (Tons per Year) for Alternate Operating Scenario No. 2 (AOS 2)

Pollutant	PTE (tons per year)			Permitting Exemption Threshold	Minor NSR Triggered ?
	Pre-Revision (317 Change LTF No. 118533)	Post-Revision (LTF No. 114492)	Difference		
With Natural Gas Engines					
NO_X	206.51	155.64	–50.88	20	No

DRAFT

Pollutant	PTE (tons per year)			Permitting Exemption Threshold	Minor NSR Triggered ?
	Pre-Revision (317 Change LTF No. 118533)	Post-Revision (LTF No. 114492)	Difference		
PM	212.76	227.15	+14.39	N/A	N/A
PM_{10}	92.70	107.09	+14.39	7.5	Yes
$PM_{2.5}$	54.96	69.34	+14.39	5	Yes
CO	222.21	172.40	–49.81	50	No
SO_2	6.90	7.95	+1.05	20	No
VOCs	108.39	82.56	–25.82	20	No
Pb (Only non-fugitive)	1.04	1.04	0.00	0.3	No
Pb (Total)	2.07	2.07	0.00	N/A	N/A
Manganese	7.47	7.47	0.00	N/A	N/A
Single HAP (Acetaldehyde)	39.84	27.51	–12.33	N/A	N/A
Total HAPs	84.18	57.23	–26.95	N/A	N/A
H_2S	10.12	10.12	0.00	N/A	N/A
GHG (CO_2e)	1,176,986	832,231	–344,755	N/A	N/A
Line Power Alternative (without Natural Gas Engines)					
NO_X	42.64	42.62	–0.02	20	No
PM	174.63	174.73	+0.10	N/A	N/A
PM_{10}	54.57	54.67	+0.10	7.5	No
$PM_{2.5}$	16.83	16.93	+0.10	5	No
CO	149.37	149.21	–0.16	50	No
SO_2	5.68	5.19	–0.49	20	No
VOCs	24.05	24.40	+0.35	20	No
Pb (Only non-fugitive)	1.04	1.04	0.00	0.3	No
Pb (Total)	2.07	2.07	0.00	N/A	N/A

DRAFT

Pollutant	PTE (tons per year)			Permitting Exemption Threshold	Minor NSR Triggered ?
	Pre-Revision (317 Change LTF No. 118533)	Post-Revision (LTF No. 114492)	Difference		
Single HAP (Manganese Compounds)	7.47	7.47	0.00	N/A	N/A
Total HAPs	16.18	16.11	–0.07	N/A	N/A
H_2S	10.12	10.12	0.00	N/A	N/A
GHG (CO_2e)	43,193	50,305	+7,112	N/A	N/A

II. MINOR NEW SOURCE REVIEW (NSR)

Minor NSR is required if the emissions of any physical change or change in the method of an operation of an emission unit or stationary source that increases the PTE of any regulated minor NSR pollutant by an amount equal to or greater than the permitting exemption threshold (PET) in Table 2 and Table 4 above. PTE increase of PM_{10} and $PM_{2.5}$ exceed the PET thus, the facility is subject to minor NSR requirements.

The facility has the option to either implement reasonably available control technology (RACT) or conduct screen modeling to satisfy the requirements of minor NSR. The facility elected to undergo air dispersion modeling to demonstrate compliance with minor NSR Requirements. A detailed discussion of the air dispersion modeling analysis can be found in Section IX.

III. VOLUNTARILY ACCEPTED EMISSION LIMITATIONS AND STANDARDS

The new voluntarily accepted emission limitations and standards added for the natural gas engines, CAT 3520 DSL, with Equipment IDs: ENGINE 0013 – ENGINE 0056 during this SPR are shown in Table 5. Existing voluntary emission limits on these units are unchanged.

Table 5: New Voluntarily Accepted Emission Limitations and Standards

Pollutant	lb/hr	tons/year
$PM_{10}/PM_{2.5}$	7.72	33.8

IV. APPLICABLE REGULATIONS

DRAFT

Table 6 identifies applicable regulations associated with the emission units of this SPR, including the verification as to why that standard applies. The table also contains a discussion of any regulations the emission unit is exempt from.

Table 6: Applicable Regulations

Unit	Control Device	Rule	Discussion
Natural Gas Engines CAT 3520 DSL	Selective catalytic reduction (SCR) and oxidation catalysts (OxCat)	40 CFR Part 60 Subpart JJJJ	40 CFR Part 60 Subpart JJJJ "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines" is applicable to stationary spark ignition (SI) internal combustion engines (ICE) – the natural gas engines.
		40 CFR Part 63 Subpart ZZZZ	40 CFR Part 63 Subpart ZZZZ "National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines" is applicable. For the new non-emergency natural gas engines, if operating under POS or AOS 2 with Natural Gas engines (major HAP source), 40 CFR Part 63 Subpart ZZZZ requirements need to be met; if operating under AOS 1 or AOS 2 without Natural Gas engines (area HAP source), 40 CFR Part 63 Subpart ZZZZ requirements can be met by complying with 40 CFR Part 60 Subpart JJJJ.

V. PREVIOUS PERMIT REVISIONS AND CONDITIONS

A. Previous Permit Revisions

Table 7 provides a description of the permit revisions made to Permit No. 96653 during the previous permit term.

Table 7: Permit Revisions to Permit No. 96653

DRAFT

Permit Revision No.	Permit Revision Type	Brief Description
106420	MPR	This was to clarify the throughputs for certain equipment in Attachment "C" for process units subject to Condition VII of Attachment "B", and add monitoring, recordkeeping and reporting requirements to Condition VII.E of Attachment "B" to provide assurance of compliance with A.A.C. R18-2-730.J and A.A.C. R18-2-730.K requirements for cyanide compounds.
110322	SPR	This was to reopen Permit No. 96653 to address the EPA's directions in response to the petition to object to the issuance of Permit No. 96653.
109292	MPR	This was to update ore handling system design and associated dust collectors, wet ore beneficiation, engines, and reagent storage.
115431	MPR	This was to add two emergency engines and two storage tanks.

B. Changes to Current Renewal

Table 8 addresses the changes made to the sections and conditions from Permit No. 96653:

Table 8: Previous Permit Conditions

Section No.	Determination			Comments
	Added	Revised	Deleted	
Att. "B" Section IV.B		X		Internal Combustion Engines (ICEs) - New Non-Emergency Natural Gas Engines Subject to New Source Performance Standards (NSPS) Subpart JJJJ Requirements: Revised to authorize up to 14 of the natural gas engines to operate in the 50% to 100% load range and associated emission standards, compliance requirements, testing requirements, and recordkeeping requirements.

VI. MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

Table 9 contains an inclusive but not an exhaustive list of the monitoring, recordkeeping and reporting requirements prescribed by this SPR. The table below is intended to provide insight to the public for how the facility is required to demonstrate compliance with the emission limits in the permit. Records are required be kept for a minimum of 5 years as outlined in Section XII of Attachment "A" of the permit.

Table 9: Permit No. 114492

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
New Non-Emergency Natural Gas (NG) Engines (NSPS Subpart JJJJ)	PM_{10} and $PM_{2.5}$	7.72 lb/hr and 33.8 tons/year	Conduct annual performance tests.	Keep records of notifications and maintenance. If certified, keep the engine certification document. If not certified, keep documentation that the engine meets the emission standards. Keep performance test results. Keep hourly loads for each operating engine	If not certified, submit initial notification. Submit performance test results.

VII. COMPLIANCE ASSURANCE MONITORING (CAM)

The CAM rule applies to pollutant-specific emission units (PSEU) at a major Title V source if the unit meets all of the following criteria:

A. The unit is subject to an emission limit or standard for the applicable regulated air pollutant;

B. The unit uses a control device to achieve compliance with the emission limit or standard; and

C. The unit has "potential pre-control device emissions" of the applicable regulated air pollutant equal to or greater than 100% of the amount (tons/year) required for a source to be classified as a major source. "Potential pre-control device emissions" means potential to emit (PTE, as defined in Title V) except emissions reductions achieved by the applicable control device are not taken into account.

The general purpose of monitoring required by the CAM rule is to assure compliance with emission standards by ensuring that control devices meet and maintain the assumed control efficiencies. Compliance is ensured through requiring monitoring of the operation and maintenance of the control equipment and, if applicable, operating conditions of the pollutant-specific emissions unit. For the PSEUs that have post control potential to emit equal to or greater than 100 percent of the amount, in tons per year, required for a source to be classified as a major source, for each parameter monitored, the facility shall collect four or more data values equally spaced over each hour. Such units are defined as “large” PSEUs. For all other PSEUs (“small” PSEUs), the monitoring shall include some data collection at least once per 24-hour period. For this SPR, no new PSEUs were added and thus, the facility is not subject to the CAM rule.

VIII. LEARNING SITE EVALUTATION

In accordance with ADEQ’s Environmental Permits and Approvals near Learning Sites Policy, ADEQ is required to conduct an evaluation to determine if any nearby learning sites would be adversely impacted by the facility. Learning sites consist of all existing public schools, charter schools and private schools in the K-12 level, and all planned sites for schools approved by the Arizona School Facilities Board. The learning sites policy was established to ensure that the protection of children at learning sites is considered before a permit approval is issued by ADEQ.

ADEQ did not identify any learning site within two (2) miles of the facility.

IX. AMBIENT AIR IMPACT ANALYSIS

DRAFT

While the Ambient Air Impact Analysis necessarily addresses all aspects of the Hermosa Mine's operations, this permit revision is limited to the changes discussed above in this TSD and other aspects of the mine are not reopened for public comment despite their inclusion in the following discussion.

This section summarizes ADEQ's findings regarding the ambient assessment submitted by South32 in support of this Class I Significant Permit Revision (SPR). As discussed in Section V, the SPR triggers a minor New Source Review for PM_{10} and $PM_{2.5}$ under A.A.C. R18-2-334 because the PTE increases exceed their corresponding permitting exemption thresholds. Therefore, ADEQ required South32 to conduct an ambient air quality assessment via air dispersion modeling. This must demonstrate that potential impacts from the facility due to this SPR will not interfere with attainment or maintenance of National Ambient Air Quality Standard (NAAQS) for PM_{10} and $PM_{2.5}$.

The NAAQS are maximum concentration "ceilings" measured in terms of the total concentration of a pollutant in the atmosphere. For a new or modified source, compliance with any NAAQS is based upon the total estimated air quality, which is the sum of the background concentrations and the estimated ambient impacts of the applicant's proposed emissions.

Guidance for performing air quality dispersion modeling analyses is set forth in the EPA's Guideline on Air Quality Models (40 CFR Part 51 Appendix W)[1], and in the Air Dispersion Modeling Guidelines for Arizona Air Quality Permits, November 1, 2019.[2] The modeling methodologies for this SPR align with those approved in the previous Class I permit application.

A. Model Selection

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) model is the EPA-preferred model for estimating impacts at receptors located in simple terrain and complex terrain (within 50 kilometers of a source) due to emissions from industrial sources. South32 Hermosa used AERMOD for the ambient impact analysis.

The AERMOD modeling system consists of three major components: AERMAP, used to process terrain data and develop elevations for receptors; AERMET, used to process the meteorological data; and the AERMOD dispersion model, used to estimate the ambient pollutant

1 US. EPA. 2017. Guidelines on Air Quality Models.
https://www.epa.gov/sites/default/files/2020-09/documents/appw_17.pdf
2 Arizona Department of Environmental Quality. 2019. Air Quality Modeling Guidelines for Arizona Air Quality Permits. http://static.azdeq.gov/aqd/modeling_guidance.pdf

concentrations. South32 used AERMAP version 18081; AERMET version 22112; and AERMOD version 24142. ADEQ has reviewed the recent updates to AERMOD, dated July 9, 2026, and has determined that these updates will not impact on the modeling analysis for this SPR.

B. Source Inputs

This section provides a discussion on source characterization to develop appropriate source inputs, including modeling scenarios, modeled emission rates, source configuration and source types, and off-site sources.

1. SPR Overview

The South32 Hermosa facility involves the development of two separate deposits, Taylor and Clark, each with its dedicated access infrastructure. Taylor will utilize a vertical shaft for access, while Clark will rely on a decline. Tailings and rock management will be a joint effort, whereas ore handling will be distinct for each deposit. Beneficiation processes will be carried out, with Taylor involving underground crushing, milling, screening, froth flotation, and regrind to produce a zinc/lead concentrate. Clark will undergo above-ground crushing, yielding crushed ore. All resulting products will be shipped off-site for further processing. Tailings from Taylor will be thickened, filtered, and either used as cemented paste backfill or dry stacked in a potential on-site or nearby lined tailings storage facility (TSF).

The current Class I permit authorizes the use of 58 natural gas engines (2,600 kW each) at operational loads of 75% to 100%. This SPR proposes reducing the number of permitted engines from 58 to 40 and widening the operating load range of 14 engines from 75% - 100% to 50% - 100%. Additionally, South32 has updated the following elements to reflect the proposed revisions in this SPR and prior MPRs:

- Updated Plan II Boundary to align with the latest Mine Plan of Operations (MPO);
- Update the moisture content for the tailings and associated sources to align with MPO; and
- Updated building structures and road configurations based on latest South32 site layouts.

2. Sources of Emissions

Emissions are produced throughout underground mining activities, encompassing drilling, blasting, loading, hoisting, and hauling, as

DRAFT

well as during ore processing operations, which involve crushing, milling, flotation, concentrate and tailings filtration/management. Additional sources of emissions include natural gas and diesel engines, dust collectors, vehicles operating on unpaved roads, wind erosion from tailings storage facilities and stockpiles, loading/unloading and conveying transfer points, cooling towers, and mechanical evaporators.

3. Modeled Emission Rates

South32 calculated the maximum potential daily emission rates in pounds per day (lb/day) based on either the maximum equipment design rates or the highest daily activity rates specified in the permit conditions. The maximum 24-hour average emission rates were modeled to demonstrate compliance with 24-hour PM_{10} and $PM_{2.5}$ standards.

South32 calculated the maximum potential annual average emission rates using the highest annual activity rates as stipulated in the permit conditions. The annual average emission rates were modeled to demonstrate compliance with the annual standards $PM_{2.5}$.

4. Source Characterization

a. Point Sources

Vent raises/shafts, natural gas and diesel engines, dust collector exhausts, and cooling towers were modeled as individual point sources. Release parameters (stack height, stack diameter, gas temperature, and volumetric flow rate) for these point sources were derived from a combination of testing data, vendor specifications, or engineering estimations. Additional considerations associated with the point sources are discussed below.

Natural Gas Engines for Power Generation: As discussed previously, South32 is proposing to operate 14 2.6 MW natural gas engines between 50-100% loads and 26 2.6 MW natural gas engines between 75-100% loads. As these engines may operate under a variety of conditions that could affect emission rates and dispersion characteristics, South32 conducted a load analysis at 100%, 75% and 50% capacity to determine which combination leads to the highest modeled impact. The stack parameters of various load levels that result in the highest impact are used in compliance demonstrations.

DRAFT

The results of the loading analysis indicate that PM impacts are greater at lower loads for the natural gas engines. Therefore, PM_{10} and $PM_{2.5}$ modeling applies 50% load emission rates and stack parameters to 14 engines, and 75% load parameters to the remaining 26 engines.

Although the permit requires South32 to submit a notice of change regarding natural gas engine range assignments, it does not specify which engines will operate at the 50%–100% load range and which at the 75%–100% load range. ADEQ performed a sensitivity analysis to investigate how various load range configurations (e.g., engines 01–14 at 50% and engines 15–40 at 75%, or engines 27–40 at 50% and engines 01–26 at 75%) affect modeled concentrations for PM_{10} and $PM_{2.5}$. The results indicate that the differences under these varied configurations were marginal.

Vent Raises/Shafts: The emissions from the ventilation shafts and raises include underground emissions associated with blasting, drilling, material transfer, hauling/underground traffic, and underground crushing for Taylor Deposit**.** A fixed gas temperature was modeled based on the estimate from South32 engineering.

Cooling Towers: Cooling towers are modeled as a series of point sources, one for each cooling cell. The cooling tower stack parameters were based on the characteristics of the cooling tower fan. Because the plume is released at ambient temperature, a stack exit temperature of 0 K is used so that the model adjusts the hourly exit temperature to be equal to the ambient temperature.

b. Volume Sources

South32 characterized the emissions from roadways, material loading/unloading, material transfer points, concrete batch plants, dozers, pebble crusher, mechanical evaporators and rock breaker as volume sources. The volume source parameters, including initial lateral dimension (σy_0), initial vertical dimension (σz_0) and release height, were estimated based on the horizontal and vertical dimensions of the volume source, following the guidance from ADEQ and the AERMOD User's Guide. Additional considerations associated with the volume sources are discussed below.

DRAFT

Roadways: To appropriately allocate the calculated emissions for different trucks using these plant roads, the roads were divided into segments. Each road segment represents a portion of the road that accommodates the transportation of at least one type of material. To determine a representative vehicle height for each segment, a weighted average was computed based on the frequency of trips made by different vehicles on these road segments.

Dozers: For short-term NAAQS, South32 conducted a sensitivity study to identify the worst-case dozer volume source locations by running a model with six to seven source locations around the perimeter of the piles. The source locations with the highest offsite impacts were used in the site wide modeling.

c. Area Sources

The tailings storage facilities and stockpiles were modeled as area sources. South32 performed a sensitivity model run with various base elevations for the piles representing the pile height changes over time. Tailings and rock piles used a worst-case base elevation for modeling purposes as these piles will grow and rise in height over time.

Road segments that were within the exclusion zone of a defined volume source were modeled as an area source. Emissions for the area source segment were calculated as the total of the emissions from the volume source segments within that area source zone. In accordance with the ADEQ's recommendation, receptors situated within 1 meter of an area source were relocated to a distance of 1 meter away from the area source.

5. Off-site Nearby Sources

The EPA recommends that all nearby sources that are not adequately represented by background ambient monitoring data should be explicitly modeled as part of the NAAQS analysis. To determine which nearby sources should be explicitly modeled in the air quality analysis, the EPA has established "a significant concentration gradient in the vicinity of the source under consideration" as the sole criterion for this determination. There are no off-site stationary sources near South32 Hermosa that would cause a significant concentration gradient within the vicinity of the

DRAFT

project site. Therefore, there are no nearby sources that should be explicitly modeled. The impact from distant off-site sources are represented by background ambient monitoring data as discussed in Section IX.G.

C. Meteorological Data

1. Meteorological Data Selection

For regulatory dispersion modeling analyses, 5 years of National Weather Station (NWS) meteorological data, or at least 1 year of site-specific meteorological data, or at least 3 years of prognostic meteorological data should be used. Per Appendix W Section 8.4.2.d, "*If 1 year or more, up to 5 years, of site-specific data are available, these data are preferred for use in air quality analyses*".

South32 collected site-specific meteorological data from 2018 to 2022 at the Trench meteorological station, located within the Hermosa Project area. For this analysis, data collected at the Trench Station from January 1, 2019, to December 31, 2021, was utilized. This selection was made due to the Trench Station's exposure to localized meteorological conditions and its alignment with the criteria of being "representative" and in close proximity to the emission sources. It's worth noting that the site sitting, data collection methods, and quality assurance/quality control (QA/QC) procedures were approved by ADEQ as part of the Quality Assurance Project Plan (QAPP) submission. The meteorological data collected from the site-specific station adhered to EPA recommendations for instrumentation and data completeness.

2. Meteorological Data Processing

South32 used the most recent version of AERMET meteorological preprocessor (v22112) to process three-years of site-specific data along with cloud cover data from the U.S. National Climatic Data Center (NCDC) for the Nogales International Airport (KOLS), and upper air radiosonde data from the Tucson station within the NWS Rawinsonde Network. South32 Hermosa also used the EPA's AERSURFACE tool (v20060) to calculate surface characteristic parameters (albedo, Bowen ration and surface roughness) required by AERMET.

AERSURFACE requires the users to specify whether the project site is in an arid region or a non-arid region. Considering precipitation and land cover at the project area, the designation "non-arid" was

chosen. To assess moisture conditions (dry, wet, or normal), South32 compared the annual precipitation for each modeled year (2019, 2020, or 2021) to the 30-year climatological record of annual precipitation for Nogales, Arizona (KOLS).

South32 implemented the adjusted surface friction (ADJ_U*) option when processing meteorological data. South32 Hermosa provided justification for the use of the ADJ_U* option in AERMET and also justified the exclusion of partial turbulence data to prevent the underestimation of impacts. ADEQ reviewed this justification and found it sufficient, thus granting approval for the utilization of the ADJ_U* option.

The processed meteorological dataset was used in the previous Class I permit application and was also used in this SPR modeling analysis. ADEQ has reviewed the recent updates to AERMET, dated July 9, 2026, and has determined that these updates will not impact on the outputs of AERMET.

D. Ambient Air Boundary and Receptor Network

The applicants are required to demonstrate modeled compliance with NAAQS at receptors spaced along and outside the ambient air boundary (AAB). According to the EPA's revised policy on exclusion from "Ambient Air", "*the atmosphere over land owned or controlled by the stationary source may be excluded from ambient air where the source employs measures, which may include physical barriers, that are effective in precluding access to the land by the general public*".[3] The general public may not include mail carriers, equipment and product suppliers, maintenance and repair persons, as well as persons who are permitted to enter restricted land for the business benefit of the person who has the power to control access to the land.[4]

The Hermosa Project site is situated in a remote area, enclosed by ridges and hills, which poses limitations on access. The primary entry point is via Harshaw Road, and the segment of this road passing through the Hermosa Project will be considered "ambient air". Apart from the section of Harshaw Road passing through the property, all publicly accessible areas of the Hermosa Mine are, or will be, fenced and/or posted with no trespassing

3 U.S. EPA. 2019. Revised Policy on Exclusion from "Ambient Air"
https://www.epa.gov/sites/default/files/2019-12/documents/ambient_air2019.pdf
4 U.S. EPA. 2007. Interpretation of "Ambient Air" In Situations Involving Leased Land Under the Regulations for Prevention of Significant Deterioration (PSD). Stephen D. Page Memorandum dated June 22, 2007. Research Triangle Park, North Carolina 27711.

signs and will be monitored for site security. The current Public Access Restriction Plan describes the access restriction implementation currently in place at the mine, which aligns with the ambient air boundary of Plan I. South32 will amend the Public Access Restriction Plan to represent Plan II operations once implemented.

Following ADEQ's recommendations, South32 Hermosa set up a receptor network, encompassing a region extending up to 10 km from AAB and covering the town of Patagonia. The grid spacing utilized for the receptors are as follows:

- AAB set at 25 m intervals;
- Fine receptor grid of 100 m extending from AAB to 1 km and 200 m extending from 1 km to 3 km;
- Medium receptor grid of 400 m, extending from 3 km to 5 km; and
- Coarse grid receptor grid of 800 m, extending from 5 km to 10 km.

Discrete receptors at 25 m intervals were also placed along Harshaw Road within the AAB. South32 used the AERMAP terrain processor to process the National Elevation Data (NED) data to generate the receptor elevations and hill heights.

E. Downwash and Good Engineering Practice (GEP)

All the facility stacks are subject to downwash. All stacks are also below the minimum 65-meter allowable GEP height, therefore all stack heights are fully creditable for air quality modeling. South32 Hermosa evaluated building downwash effects based on building and stack location and dimensions, and the EPA's Building Profile Input Program Plume Rise Model Enhancements (BPIP-PRME).

F. Land Use Classification

The rural/urban classification of an area is determined by either the dominance of a specific land use or by population data in the study area. The land-use procedure specifies that the land-use within a three-kilometer radius of the source should be determined using the typing scheme developed by Auer.[5] South32 determined the project site area as "Rural" based on the land use method.

G. Background Concentration

5 Auer, A.H. 1978. Correlation of Land Use and Cover with Meteorological Anomalies, Journal of Applied Meteorology, 17:636-643.

DRAFT

Background concentrations should be representative of regional air quality in the vicinity of a facility. Typically, background concentrations should be determined based on the air quality data collected in the vicinity of the proposed project site. However, if there are no monitors located in the vicinity of the project, a "regional site" may be used to determine background concentrations. Per Appendix W Section 8.3.2 b, a regional site is "*one that is located away from the area of interest but is impacted by similar or adequately representative sources*." There is no cutoff of distance between the project site and the regional monitor. The key criterion is that the project site and the regional monitor should have a similar source impact.

Consistent with the previous Class I permit application, this SPR modeling selected the Saguaro East monitor from the Interagency Monitoring of Protected Visual Environments (IMPROVE) program for assessing background levels of PM_{10} and $PM_{2.5}$. "Using the most recent and complete three years of monitoring data, South32 calculated background concentrations following the methods described in Table 7 in ADEQ's Guidance.[6]

H. Methodology for Secondary $PM_{2.5}$ Impacts Analysis

Per Appendix W, Section 5.3.2 and Section 5.4.2, the EPA recommends a two-tiered demonstration approach for addressing single-source impacts on ozone and secondary $PM_{2.5}$. The first tier involves use of technically credible relationships between precursor emissions and a source's impacts that may be published in the peer-reviewed literature; developed from modeling that was previously conducted for an area by a source, a governmental agency, or some other entity and that is deemed sufficient; or generated by a peer-reviewed reduced form model. The second tier involves application of more sophisticated case-specific chemical transport models (e.g., photochemical grid models) to be determined in consultation with the EPA Regional Office and conducted consistently with new EPA single-source modeling guidance. It is anticipated that the case for using a full quantitative chemical transport model is rare.

One of the first-tier demonstration tools is Model Emissions Rates for Precursors (MERPs). The MERPs can be described as an emission rate of a precursor that is expected to result in a change in fine particulate matter

6 Arizona Department of Environmental Quality. 2019. Air Quality Modeling Guidelines for Arizona Air Quality Permits. http://static.azdeq.gov/aqd/modeling_guidance.pdf

($PM_{2.5}$) that would be less than a specific air quality concentration threshold such as a significant impact level (SIL).

The EPA has established empirical relationships between individual sources and their impacts on $PM_{2.5}$ for hundreds of hypothetical sources, including three sources in Arizona and fifteen sources in the Southwest region (including Arizona, Colorado, New Mexico, and Utah)[7]. During their assessment, South32 examined the three hypothetical sources in Arizona and concluded that Source 17 in La Paz County best represents the Hermosa site. Table 10 summarizes these MERP values.

Table 10: MERP Values for Source 17

Pollutants	Precursors	Modeled Emission Rates	Modeled Concentrations (µg/m3)
Annual $PM_{2.5}$	SO_2	500	0.00320
Annual $PM_{2.5}$	NO_X	500	0.000411
Daily $PM_{2.5}$	SO_2	500	0.313
Daily $PM_{2.5}$	NO_X	500	0.0393

South32 conducted secondary $PM_{2.5}$ impact analysis following the EPA July 2022 Guidance.[8] The methods are briefly discussed below.

The project emissions for SO_2 and NO_X are 7.92 tpy and 154.74 tpy, respectively. The secondary impact for 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ are calculated as follows.

Secondary Impact for 24-hour $PM_{2.5}$:

$$= \left(\frac{0.313}{500} \times SO_2\ typ\right) + \left(\frac{0.0393}{500} \times NO_x\ tpy\right)$$

$$= 0.017\ \mu g/m^3\ PM_{2.5}$$

Secondary Impact for Annual $PM_{2.5}$:

$$= \left(\frac{0.0032}{500} \times SO_2\ typ\right) + \left(\frac{0.000411}{500} \times NO_x\ tpy\right)$$

7 U.S. EPA. MERPs View Qlik. https://www.epa.gov/scram/merps-view-qlik
8 U.S. EPA. 2022. Guidance for Ozone and Fine Particulate Matter Permit Modeling. https://www.epa.gov/system/files/documents/2022-07/Guidance_for_O3_PM25_Permit_Modeling.pdf

= 0.0002 µg/m^3 $PM_{2.5}$

The secondary impacts above were incorporated with the primary impacts from the AERMOD NAAQS modeling and the background concentrations. The resulting total concentrations were subsequently assessed against the NAAQS.

I. Model Results

Table 11 and Table 12 summarizes the modeled results for PM_{10} and $PM_{2.5}$. As shown, this SPR will not interfere with attainment or maintenance of the NAAQS for PM_{10} and $PM_{2.5}$.

Table 11: NAAQS Impact Analysis for Plan I

Pollutant	Averaging Period	Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m^3)	NAAQS (µg/m^3)
PM_{10}	24-hour	105.60	29	134.60	150
$PM_{2.5}$	24-hour	16.56	7.3	23.86	35
	Annual	4.74	3.65	8.39	9

Table 12: NAAQS Impact Analysis for Plan II

Pollutant	Averaging Period	Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m^3)	NAAQS (µg/m^3)
PM_{10}	24-hour	100.1	29	129.1	150
$PM_{2.5}$	24-hour	11.93	7.3	19.23	35
	Annual	5.02	3.65	8.67	9

X. LIST OF ABBREVIATIONS

AAB ..... Ambient Air Boundary
A.A.C. ..... Arizona Administrative Code
ADEQ .....Arizona Department of Environmental Quality
AERMAP ..... Terrain data preprocessor for AERMOD
AERMET ..... Meteorological data preprocessor for AERMOD
AERMOD..... AMS/EPA Regulatory Model
AERSURFACE ..... Surface characteristics preprocessor for AERMOD
ADJ_U*..... Adjusted Surface Friction
AMS..... American Meteorological Society
AOS..... Alternate Operating Scenario

AQD ..... Air Quality Division
A.R.S. ..... Arizona Revised Statutes
BPIP-PRME ..... Building Profile Input Program Plume Rise Model Enhancements
CAM ..... Compliance Assurance Monitoring
CFR ..... Code of Federal Regulations
CO ..... Carbon Monoxide
CO_2 ..... Carbon Dioxide
CO_2e ..... CO_2 equivalent basis
EPA ..... Environmental Protection Agency
g ..... Gram
GEP ..... Good Engineering Practice
GHG ..... Greenhouse Gases
HAPs ..... Hazardous Air Pollutants
ICE ..... Internal Combustion Engine
IMPROVE ..... Interagency Monitoring of Protected Visual Environments
KOLS ..... Nogales International Airport
kW ..... Kilowatt
lb/day ..... Pounds per day
lb/hr ..... Pound per hour
lb/MWh ..... Pound per megawatt-hour
MERPs ..... Model Emissions Rates for Precursors
MPO ..... Mine Plan of Operations
MPR ..... Minor Permit Revision
MW ..... Megawatts
NAAQS ..... National Ambient Air Quality Standard
NCDC ..... National Climatic Data Center
NO_X ..... Nitrogen Oxides
NSPS ..... New Source Performance Standards
NSR ..... New Source Review
O_3 ..... Ozone
OxCat ..... Oxidation Catalysts
Pb ..... Lead
PET ..... Permitting Exemption Threshold
PM ..... Particulate Matter
PM_{10} ..... Particulate Matter no larger than 10 µm nominal aerodynamic diameters
$PM_{2.5}$ ..... Particulate Matter no larger than 2.5 µm nominal aerodynamic diameters
POS ..... Primary Operating Scenario
PSD ..... Prevention of Significant Deterioration
PSEU ..... Pollutant-Specific Emission Units
PTE ..... Potential to Emit
QAPP ..... Quality Assurance Project Plan
QA/QC ..... Quality Assurance/Quality Control
RACT ..... Reasonably Available Control Technology
SCR ..... Selective Catalytic Reduction

DRAFT

SIL ..... Significant Impact Levels
SO_2 ..... Sulfur Dioxide
SPR ..... Significant Permit Revision
TPY ..... Tons per Year
TSF ..... Tailings Storage Facility
VOCs ..... Volatile Organic Compounds
yr ..... Year

DRAFT