2021 Regional Haze Four Factor Initial Control Determination

Facility: ASARCO Mission Complex

Air Quality Division
November 23, 2020

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1.1 ADEQ Initial Control Determination for ASARCO Mission

ADEQ's initial determination is to find that it is reasonable not to require additional controls on ASARCO Mission during this planning period.

1.2 ADEQ Control Determination Finalization Timeline

In order to meet the State rulemaking process timeframe for proposed rule inclusion in the July 31st, 2021 Regional Haze state implementation plan (SIP) submittal, ADEQ must finalize all four factor analyses as expeditiously as possible. To provide an opportunity for interested stakeholders to review and comment on ADEQ's initial decision prior to finalization, the department intends to post initial decisions on the agency webpage along with the original source submitted four factor analyses. Once ADEQ has reviewed relevant stakeholder comments, the agency will revise its initial decisions if necessary and post final decisions (see Figure 1). ADEQ welcomes feedback on these initial decisions and invites any interested party to send their comments by **December 31st, 2020** to:

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Please note that this review and feedback opportunity does not constitute an official state implementation plan or state rulemaking comment period. The agency intends to provide an official 30 day comment period on any proposed SIP or rulemaking action in accordance with Arizona Revised Statutes §§ 41-1023, 49-425, and 49-444.

Figure 1: Four Factor Control Determination Process Map

2 ADEQ Four Factor Analysis

2.1 Summary

ADEQ identified two processes that are subject to the four factor analysis for ASARCO LLC (Asarco) Mission Complex: (i) haul trucks hauling ore and waste rock; and (ii) rubber rigs traveling on unpaved roads. Asarco completed and submitted a four factor analysis report for the two processes in December 2019. As requested by ADEQ, Asarco further provided additional information in February 2020. Following Guidance on Regional Haze State Implementation Plans for the Second Implementation Period[1], ADEQ reviewed the Asarco's submittals and performed additional analyses. ADEQ's initial determination is that the emission controls Asarco is implementing for the two processes reflect current best management practices for mining industry, and that it is reasonable not to require additional controls during this planning period.

2.2 Facility Overview

2.2.1 Process Description

Asarco Mission Complex is located in Sahuarita, Arizona. The facility operates an open-pit copper mine and two concentrators where the ore is mined, crushed, ground and concentrated using froth flotation techniques. The facility also operates a by-products molybdenum plant.

Emissions from the facility consist primarily of fugitive and non-fugitive particulate matter (PM) from mining and concentration operations, nitrogen oxide and carbon monoxide from portable and stationary combustion sources and volatile organic compounds from organic liquid storage activities. The facility controls PM by a combination of methods including, but not limited to, retention of native vegetation, application of dust and erosion chemical suppressants, road watering, use of wet scrubbers and dry dust collectors.

The nearest Class I area is Saguaro National Park West, which is located approximately 42 km from the facility.

2.2.2 Emissions Inventory

Table 1 summarizes the facility-wide emissions during 2015-2018.

[1] https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf

Table 1 Emission Inventory for Years 2015-2018

Year	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_x (tpy)	SO_2 (tpy)	CO (tpy)	VOC (tpy)
2015	586.49	149.88	66.04	7.76	259.03	2.01
2016	781.06	159.16	49.83	5.85	195.78	1.70
2017	983.71	104.76	34.81	4.10	137.21	0.00
2018	1,220.61	169.57	36.66	4.28	144.68	1.33

2.3 ADEQ Screening Methodology

ADEQ applied a screening process to determine which emission units would undergo four-factor analysis. Any processes that were identified as being effectively controlled were deferred from consideration for the current implementation period. A four-factor analysis would be conducted on the remaining processes that make up the top 80% of NOx, SO_2, and PM_{10} emissions at the source. The detailed screening methodology is presented in ADEQ 2021 Regional Haze SIP Planning website.[2]

In September 2019, ADEQ informed Asarco that a four-factor analysis must be performed for the following processes and pollutants at the Mission Complex:

- PM_{10} emissions from trucks hauling ore and waste rock; and
- PM_{10} emissions from rubber tire rigs traveling on unpaved roads.

2.4 Existing Controls and Baseline Emissions Projection

2.4.1 Baseline Control Scenario (Projected 2028 Emissions Profile)

Baseline emissions represent a realistic depiction of anticipated annual emissions for the source. Per the EPA's Guidance on Regional Haze Implementation Plans for the Second Implementation Period, the projected 2028 emissions can be a reasonable and convenient choice for use as the baseline emissions. ADEQ has developed a framework for projecting the 2028 emissions for selected permitted facilities in Arizona.[3]

To project the 2018 emissions for the Mission Complex, ADEQ used the emissions data from 2015 - 2017 and the throughput data from 2016 - 2018. A complete review of the 2018 emission data was not finalized prior to the August 31st deadline for ADEQ to provide modeling inputs to the Western Regional Air Partnership (WRAP). ADEQ determined that the source's operation and emissions during 2015-2017 were representative.

[2] https://static.azdeq.gov/aqd/haze/4_factor_screening_approach.pdf
[3] https://static.azdeq.gov/aqd/haze/2028_emission_project_methodology.pdf

A scaling factor was determined for each pollutant and emission unit by dividing the annual emissions by the annual throughput. Then the average scaling factor over the three-year period (2015-2017) was calculated. In addition, the average process throughput for the three-year period (2016-2018) was calculated. The projected annual emissions for each unit process was determined by multiplying the average scaling factor (2015-2017) by the average process throughput (2016-2018).

Table 2 summarizes the 2028 projected emissions for two processes that are subject to a four-factor analysis.

Table 2 Emissions for Baseline Control Scenario (2028 Projected Emissions) for Haul Roads and Rubber Rigs Travel on Unpaved Roads

Emission source	Vehicle Miles travelled (VMT)	PM_{10} emissions (tpy)	Scaling Factor tons/VMT	2016-2018 Average miles	2028 Projected Emissions (tpy)
Haul roads					
2015	272,275	220.6	0.000774	92,0428	713
2016	590,319	439.6			
2017	1,039,961	799.3			
2018	1,131,005	862.2			
Rubber rigs travel on unpaved roads					
2015	356,502	123	0.000376	27,8971	105
2016	173,547	78			
2017	117,437	39			
2018	545,928	173			

2.4.2 Existing Controls and Control Efficiencies

As discussed in the AP-42 Section 13.2.2, a wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

- Vehicle restrictions that limit the speed, weight or number of vehicles on the road;
- Surface improvement, by measures such as (i) paving or (ii) adding gravel or slag to a dirt road; and
- Surface treatment, such as watering (wet suppression) or treatment with chemical dust suppressants (chemical stabilization/treatment).

The air permit issued by Pima County Department of Environmental Quality (PCDEQ) for the Mission Complex requires Asarco to control emissions from unpaved roads by watering, applying chemical dust suppressants, limiting vehicular speeds, or other equivalently effective controls.[4]

According to Asarco, the speed limit for haul trucks and other vehicles such as rubber tire rigs at the Mission Complex is 35 miles per hour (mph). Although the vehicle speed restriction is one of the control options, the AP-42 Section 13.2.2 does not take the vehicle speed into account for estimating the PM_{10} emissions for vehicles traveling on unpaved surfaces at industrial sites.

Watering in combination with chemical dust suppressant is currently applied to both haul roads and unpaved non-haul roads at the Mission Complex. A control efficiency of 80% has been used in Asarco's emissions inventories. As indicated in the AP-42 Section 13.2.2, watering may achieve up to 95% control efficiency, depending on the resulting increase in surface moisture. The AP-42 Section 13.2.2 also reports that chemical dust suppressants provide a control efficiency of about 80% when applied at regular intervals of 2 weeks to 1 month. In general, ADEQ accepts a control efficiency of up to 90% for the use of water to suppress dust from unpaved roads.

2.5 Four Factor Analysis Review

2.5.1 Technical Feasibility and Emission Reductions

2.5.1.1 PM_{10} Emissions from Trucks Hauling Ore and Waste Rock

Asarco has identified the following PM_{10} control technologies based on a review of the RACT/BACT/LAER Clearinghouse ("RBLC") database, technical literature, practices and engineering experience at open-pit copper mines:

- Reduce the speed limit for haul trucks;
- Apply additional water to haul roads;
- Increase freeboard in the haul trucks;
- Apply chemical dust suppressant to haul roads;
- Apply and maintain surface gravel on haul roads;
- Require haul trucks to be covered; and
- Paving the haul roads and maintain the pavement.

2.5.1.1.1 Reduce the speed limit for haul trucks from 35 mph to 25 mph

[4] https://webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Environmental%20Quality/Air/AQ%20Operating%20Permits/All%20Current%20Permits/Class%20I/2026/2026-Permit.pdf Pg. 77

Speed reduction for haul trucks will result in reduction of haul road emissions. However, reducing the speed limit for haul trucks would significantly impact overall operations, considering that haul truck travel is critical to the ore throughput. If a stricter speed limit were to be enforced, then Asarco would deploy additional haul trucks to maintain the same level of operations. This control option is technically feasible.

As previously discussed, the AP-42 Section 13.2.2 does not take the truck speed into account for estimating the PM_{10} emissions for vehicles traveling on unpaved surfaces at industrial sites. ADEQ used a historical unpaved road emission factor equation in AP-42 to evaluate the control efficiency resulted from the truck speed reduction. [5] As indicated in this equation, emission is linearly proportional to truck speed. Currently, the speed limit for haul trucks and other vehicles at the Mission Complex is 35 mph. If the speed for haul trucks reduces from 35 mph to 25 mph, the control efficiency would be 28.6%, resulting in an emission reduction of 203.7 tpy for PM_{10}.

Due to the complexity, ADEQ is unable to evaluate the changes in fuel consumption and tailpipe emissions associated with additional haul trucks. It is likely that adding more haul trucks would increase the fuel consumption and tailpipes emissions (such as $PM_{2.5}$ and NOx emissions), which could compromise the benefits from the truck speed restrictions.

2.5.1.1.2 Apply additional water to haul roads

According to Asarco, additional watering to the haul roads outside the pit is feasible. However, additional watering to the haul roads inside the pit is considered technically infeasible. Too much watering could lead to traction problems between the haul trucks and the haul roads. Asarco has concerns that the application of additional water to the haul roads inside the pit would pose safety concerns due to slippage over inclines/declines inside the pit. Contrary to the Asarco's concerns, Freeport-McMoRan consider additional watering as a technically feasible control regardless of whether haul roads are inside or outside the pit in their four-factor analysis for two open-pit copper mines. For this reason, ADEQ has examined two scenarios for the Mission Complex: (i) only haul truck emissions outside the pit can be reduced from additional watering, and (ii) haul truck emissions both inside and outside the pit can be reduced from additional watering.

A control efficiency of 80% for watering in combination with chemical dust suppressant has been used in Asarco's emissions inventories. Based on the air permits from existing open-pit copper mines in Arizona, a control efficiency of 90% is achievable for the use of water to suppress dust from haul roads. Asarco estimates that 20% of haul truck traffic occurs on haul roads outside the pit. Therefore, an increase in the control efficiency from 80% to 90% by additional watering would result in an emission reduction of 71 tpy for PM_{10} outside the pit. Comparatively, assuming that haul truck emissions both inside and outside the pit can be reduced from additional watering, an increase in the control efficiency from 80 to 90% would reduce the PM_{10} emissions by 356.5 tpy.

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[5] https://www3.epa.gov/ttn/chief/ap42/ch13/bgdocs/b13s02-2.pdf Equation 2-1

AP-42 Figure 13.2.2-2 provides a relationship between the control efficiency and the moisture ratio for unpaved travel surfaces. [6] In order to increase the control efficiency from 80% to 90%, the moisture ratio should increase from 2.5 to 4.2 (68% increase in water moisture). ADEQ assumed that the amount of additional water needed was proportional to the increase in moisture ratio.

2.5.1.1.3 Increase freeboard in the haul trucks

Increasing freeboard could potentially reduce the amount of spillage onto haul roads, which can be a source of PM_{10} emissions from vehicular traffic. This control option is technically feasible. Per email communications between ADEQ and the EPA Region 9, no data is available for the PM_{10} control efficiency for this measure.[7] Since the emissions reductions could not be quantified, this control option is not considered further in the cost of compliance analysis.

2.5.1.1.4 Application of additional chemical dust suppressant to haul roads

Chemical dust suppressant is already applied in combination with water to the haul roads. However, the force of the haul trucks, along with other vehicles, substantially decreases the effectiveness of the magnesium chloride. In addition, chemical dust suppressants cause tire slippage, especially when the haul trucks make turns or travel on inclines/declines. Therefore, applying additional chemical dust suppressant to the haul roads, beyond that which is already applied, in an effort to achieve a control efficiency above the 80% that is currently achieved by the existing combination of dust suppressant and water, would be technically infeasible.

2.5.1.1.5 Application of surface gravel on haul roads

The haul trucks weigh from 300,000 pounds to 800,000 pounds. As per Asarco, the force of the trucks will either quickly obliterate the gravel to dust or push the gravel to the side of the roads. Constant application of new gravel would be needed to replace the gravel destroyed by the trucks. Therefore, this control measure would be technically infeasible.

2.5.1.1.6 Covering of haul trucks

Haul truck covers are not commercially available to accommodate the size of the haul trucks. Covers would either have to be made in-house or a new type of cover would have to be prototyped and sourced. In addition, covering and uncovering loaded haul trucks could be accomplished only with manual labor and would pose unacceptable safety risks that could not be harmonized with applicable Mine Safety and Health Act ("MSHA") rules. For these reasons, covering haul trucks would be technically infeasible.

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[6] https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf Pg. 13.2.2-12

[7] Email communication between Ryan Templeton (ADEQ) and Panah Stauffer (EPA Region 9)

2.5.1.1.7 Paving haul roads

Paving unpaved roads in an effort to reduce PM_{10} emissions from haul truck traffic would require a substantial capital investment. Moreover, paving is not feasible for industrial roads subject to very heavy vehicles and/or spillage of material in transport. Due to the weight of the haul trucks at the Mission Complex, which ranges up to 800,000 pounds, constant replacement of the pavement would be required, since the pavement would quickly be degraded by the weight and movement of the trucks. Therefore, paving the haul roads and maintaining the pavement would be technically infeasible.

Table 3 provides a summary of the technically feasible controls for PM_{10} emissions from trucks hauling ore and waste rock.

Table 3 Technically Feasible Control Options for PM_{10} Emissions from Truck Hauling Ore and Waste Rock

Control Options	PM_{10} Emissions Reduction (tpy)	Note
Reduce the speed limit for haul trucks from 35 mph to 25 mph	203.7	Tailpipe emissions were not estimated
Apply additional water to haul roads (increasing the control efficiency from 80% to 90%)	71	Apply additional water to haul roads outside the pit only
	356.5	Apply additional water to haul roads both inside and outside the pit
Increase freeboard in the haul trucks	Emissions reductions could not be quantified	This control option is not considered further in the cost of compliance analysis

2.5.1.2 PM_{10} Emissions from Rubber Tire Rigs Traveling on Unpaved Roads

Asarco has identified the following PM_{10} control technologies based on a review of the RACT/BACT/LAER Clearinghouse ("RBLC") database, technical literature, practices and engineering experience at open-pit copper mines:

- Reduce the speed limit for rubber tire rigs;
- Apply additional water to unpaved non-haul roads;
- Apply chemical dust suppressant to unpaved non-haul roads;
- Apply and maintain surface gravel on unpaved non-haul roads; and
- Paving the unpaved non-haul roads and maintain the pavement.

2.5.1.2.1 Reduce the speed limit for rubber tire rigs from 35 mph to 15 mph

According to Asarco, even though the speed limit for all vehicles at the Mission Complex is 35 mph, the average traveling speed of rubber tire rigs is 15 mph. Therefore, lowering the speed limit to 25 mph for rubber tire rigs is technically feasible.

2.5.1.2.2 Apply additional water to unpaved non-haul roads

Applying more water to unpaved non-haul roads would require Asarco to deploy additional water trucks, as there are often summer months when the current fleet is used at full capacity. Too much watering could also lead to traction problems between the rubber tire rigs and the roads, thus reducing the fuel economy of each rig. Applying more water to unpaved non-haul roads is technically feasible.

A PM_{10} control efficiency of 80% has been used in Asarco's emissions inventories for unpaved non-haul roads. Additional watering can increase the control efficiency from 80% to 90%, which would yield an emission reduction of approximately 52.9 tpy for PM_{10}.[8]

2.5.1.2.3 Apply chemical dust suppressant to unpaved non-haul roads

Chemical dust suppressant is already applied in combination with water to the unpaved non-haul roads. The force of the rubber tire rigs substantially decreases the effectiveness of the magnesium chloride. In addition, chemical dust suppressants cause tire slippage, especially when the rubber tire rigs make turns or travel on inclines/declines. Therefore, applying additional chemical dust suppressant to the unpaved non-haul roads, beyond that which is already applied, would be technically infeasible.

2.5.1.2.4 Apply and maintain surface gravel on unpaved non-haul roads

Application and maintenance of surface gravel on the unpaved non-haul roads is technically feasible. However, the rubber tire rigs would still degrade the gravel over time at a rate faster than normal vehicle traffic, due to the weight of the rubber tire rigs. This would necessitate periodic replacement of the gravel.

Per AP-42 Section 13.2.2 Equation 1(a), surface material silt content (%) is one of the key variables for estimating PM_{10} emission factor.[9] Asarco currently utilizes a silt content of 6.9% in its emission inventories for the unpaved roads. A silt content of 6.4% could be achieved by adding more gravel to the unpaved roads.[10] A decrease in the silt content from 6.9% to 6.4% would reduce the PM_{10} emission by 5.5 tpy.

2.5.1.2.5 Paving unpaved non-haul roads

It has been reported that certain other copper mines in the United States have paved some of their non-haul roads. Paving the unpaved non-haul roads for the Mission Complex would be technically feasible. However, paving unpaved roads in an effort to reduce PM10 emissions from rubber tire rig traffic would require a substantial capital investment. Additionally, Asarco anticipates that the non-haul roads, once paved, would be covered fairly quickly by dust, which

[8] Additional watering for unpaved non-haul road would not only reduce the emissions from the travel of rubber tire rigs, but also reduce the emissions from travel of miscellaneous type vehicles. The resulted emission reduction of 52.9 tpy takes both into account

[9] https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf

[10] "Emission Factor Documentation for AP-42 Section 13.2.2, Unpaved Roads, Final Report," U.S. EPA Office of Air Quality Planning and Standards Emissions Factor and Inventory Group (September 1998) at p. 4-29.

would necessitate regular removal of the accumulated dust and make it difficult to attribute with confidence a control efficiency for the pavement.

Paving of unpaved non-haul roads may achieve a control efficiency of 99%. The pavement of the unpaved non-haul roads could yield a reduction of 79.8 tpy for PM10.

Table 4 provides a summary of the technically feasible controls for PM10 emissions from rubber tire rigs traveling on unpaved non-haul roads.

Table 4 Technically Feasible Control Options for PM_{10} Emissions from Rubber Tire Rigs Traveling on Unpaved Non-Haul Roads

Control Options	PM_{10} Emissions Reduction (tpy)	Note
Reduce the speed limit for rubber tire rigs from 35 mph to 25 mph		Currently the average traveling speed of rubber tire rigs is 15 mph
Apply additional water to unpaved non-haul roads (increasing the control efficiency from 80% to 90%)	52.9	
Apply and maintain surface gravel on unpaved non-haul roads (decreasing the silt content from 6.9% to 6.4%)	5.5	
Paving unpaved non-haul roads	79.8	

2.5.2 Cost of Compliance

2.5.2.1 Cost Calculation Methodology

In general, the cost calculation methodologies ADEQ employed follow the recommendations in the EPA Air Pollution Control Cost Manual, specifically the concepts and methodology as discussed in chapter 2 of section 1.[11] ADEQ recognized that the generic cost estimate information for the processes in mining industry is very limited in the EPA documentation. Therefore, ADEQ mainly relied on the source-specific estimates Asarco provided. For example, the capital costs for new haul trucks and water trucks were directly from the vendor budgetary quotes, and the Operation and Maintenance (O&M) cost of trucks were estimated based on the actual costs in the Mission Complex during the most recent years. Interest rates and the useful life for amortization purposes are discussed as follows.

As recommended in the EPA Control Cost Manual, the bank prime rate can be an appropriate estimate for interest rates if firm-specific nominal interest rates are not available. Upon reviewing the most recent years of the bank prime rates, ADEQ selected a bank prime rate of 4.75% as the default value for the cost of compliance analysis for Arizona sources if a source is

[11] https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf

unable to provide a site-specific interest rate[12]. Since Asarco did not provide a site-specific interest rate, the rate of 4.75% was used for the Mission Complex.

The concept of remaining useful life of a source is typically used in the context of a discrete emission unit and new emission control systems. According to Asarco, the remaining useful life of the Mission Complex may be 25 years, possibly longer depending on drill data, ore reserves and the developing market price of copper.

A haul truck or water truck may last 10-12 years without a major refurbish. However, the rebuild process can significantly extend the useful life of trucks.[13] Asarco proposed a useful life of 12 years for both haul trucks and water trucks. ADEQ determined that a useful life of trucks of 20 years would be appropriate, considering the useful life of trucks could be extended through the rebuild process.

For pavement that is regularly traversed by rubber tire rigs, Asarco employed a useful life of 35 years for amortization purposes in the four-factor analysis. This is potentially a conservative estimate given the facility useful life is an expected 25 years. According to Arizona Department of Transportation (ADOT), a minimum 35 years analysis period should be used for a life cycle cost analysis for highway pavement structures.[14] It is expected that pavement that is regularly traversed by heavy industrial vehicles would have a shorter useful life than highway pavement structures.

The useful life of surface gravel applied to the unpaved non-haul roads, before the gravel would need to be replaced, is estimated at 3 years. A document from The U.S. Department of Transportation Federal Highway Administration (FHWA) suggests that re-graveling is necessary every 3 years for cost estimation purposes.[15]

2.5.2.2 Evaluation Criteria for Cost-Effectiveness

ADEQ performed an analysis to determine a reasonable cost-effectiveness ($/ton) threshold for Arizona emission sources that are subject to the four factor analysis in the regional haze second planning period. ADEQ gathered data on Round 1 Regional Haze Best Available Retrofit Technology (BART) and Reasonable Progress determinations through research of previous submittals and EPA determinations and through outreach to EPA, Federal Land Managers (FLMs), Western States, and WRAP. While EPA did not explicitly state whether they used cost and visibility thresholds or not for their determinations on Round 1, EPA generally rejected cases with a cost-effectiveness of greater than 5,000 $/ton regardless of whether a visibility benefit was significant or not. ADEQ found that none of the implemented cost-effectiveness values in Round 1 exceeded 5,300 $/ton. Adjusting the cost for inflation, ADEQ determined that

[12] 4.75% represents the approximate monthly average reported bank prime rate for the three years ending in May 2020 (the time of estimation and implementation).
[13] https://www.cat.com/en_US/campaigns/awareness/mining-truck-rebuilds.html
[14] Pavement Design Manual. (2017). Section 2.4. Arizona Department of Transportation. https://apps.azdot.gov/files/materials-manuals/Preliminary-Engineering-Design/PavementDesignManual.pdf
[15] "Gravel Roads Construction and Maintenance Guide" (2015). Figure 17. The U.S. Department of Transportation Federal Highway Administration (FHWA). https://www.fhwa.dot.gov/construction/pubs/ots15002.pdf

any controls having an average cost-effectiveness of 6,500 $/ton would be cost excessive and could be rejected without further justification.

2.5.2.3 Results of Cost-Effectiveness Analysis

Table 5 provides a summary of cost effectiveness for control options for PM_{10} emissions from trucks hauling ore and waste rock. Table 6 provides a summary of cost effectiveness for control options for PM_{10} emissions from rubber tire rigs traveling on unpaved non-haul roads. For detailed cost-effectiveness estimate, please see the attached spreadsheet.

2.5.2.3.1 Control options for PM_{10} emissions from trucks hauling ore and waste Rock

- As shown in Table 5, the speed reduction option for haul trucks has an average cost-effectiveness of $80,544/ton. ADEQ has determined that this control option was cost excessive.
- The control option of additional water spray on haul roads has an average cost-effectiveness of $8,322/ton, significantly higher than the threshold of 6,500 $/ton as discussed above. As such, ADEQ has determined that this control option was cost excessive.

2.5.2.3.2 Control options for PM_{10} emissions from rubber tire rigs traveling on unpaved roads

- There would be no additional cost since the average traveling speed of rubber tire rigs at the Mission Complex is 15 mph, below the speed limit of 25 mph.
- The other three control options (additional watering, surface gravel, and paving) have an average cost-effectiveness ranging from $13,559/ton to $43,692/ton. ADEQ has determined that all of the three control options were cost excessive.

Table 5 Cost Effectiveness for Control Options for PM_{10} Emissions from Trucks Hauling Ore and Waste Rock

Control option	Capital cost ($)	Annualized capital cost ($/yr)[1]	Annual operating & maintenance cost ($/yr)	Total annual cost ($/yr)	Emission reduction (tpy)	Average Cost-effectiveness ($/ton)
Reduce the speed limit for haul trucks to 25 mph	61,209,440	4,808,030	11,600,000	16,408,030	203.7	80,544
Apply additional water to haul roads outside the pit	1,565,512	122,972	470,414	593,385	71.3	8,322
Apply additional water to haul roads both inside and outside the pit[2]	7,827,558	614,858	2,352,069	2,966,927	356.5	8,322

[1] Capital Recovery Factor = 7.86% based on an interest rate of 4.75% and a useful life of 20 years. ADEQ selected 4.75% as the default value if a site-specific interest rate is not available.

[2]Although Asarco has a concern that the application of additional water to the haul roads inside the pit would pose safety concerns due to slippage over inclines/declines inside the pit, ADEQ re-calculated the average cost-effectiveness assuming that haul truck emissions both inside and outside the pit can be reduced from increasing the water spray control efficiency from 80% to 90%.

Table 6 Cost Effectiveness for Control Options for PM_{10} Emissions from Rubber Tire Rigs Traveling on Unpaved Roads

Control option	Capital cost ($)	Annualized capital cost ($/yr)	Annual operating & maintenance cost ($/yr)	Total annual cost ($/yr)	Emission reduction (tpy)	Average Cost-effectiveness ($/ton)
Reduce the speed limit for rubber tire rigs to 25 mph						0[1]
Apply additional water to unpaved non-haul roads	$1,897,953	$149,085[2]	$570,308	$719,393	52.9	$13,599
Application of surface gravel on unpaved non-haul roads	$322,087	$117,719[3]	$12,884	$130,603	5.5	$23,752
Paving of unpaved non-haul road	$35,161,952	$2,080,109[4]	$1,406,478	$3,486,587	79.8	$43,692

[1] *There is no additional cost since the average traveling speed of rubber tire rigs at the Mission Complex is 15 mph, below the speed limit of 25 mph.*
[2] *Capital Recovery Factor = 7.86% based on an interest rate of 4.75% and a useful life of 20 years*
[3] *Capital Recovery Factor = 36.55% based on an interest rate of 4.75% and a useful life of 3 years*
[4] *Capital Recovery Factor = 5.92% based on an interest rate of 4.75% and a useful life of 35 years*

2.5.3 Time Necessary for Compliance

There is no requirement that controls determined to be necessary under 40 C.F.R. § 51.308 must be installed as expeditiously as practicable; rather, such controls should be in place by 2028, unless ADEQ concludes that the control cannot reasonably be installed and become operational until after 2028. Further evaluation of the time necessary for compliance was not evaluated given the controls identified were either currently implemented or cost excessive.

2.5.4 Energy and Non-Air Quality Impacts

Adding more haul trucks or water trucks may potentially increase the consumption of fuel. Additional water spray on the haul roads or non-haul unpaved roads will increase the water consumption. For other controls options, the energy and non-air quality impacts are considered negligible.

2.5.5 Remaining Useful Life of Source

As previously discussed, the remaining useful life of the Mission Complex may be 25 years, possibly longer depending on drill data, ore reserves and the developing market price of copper. ADEQ has determined the following useful lives for varied equipment/processes:

Haul trucks: 20 years;

Water trucks: 20 years;

Pavement that is regularly traversed by rubber tire rigs: 35 years; and

Surface gravel applied to the unpaved non-haul roads: 3 years.

2.5.6 Visibility Impact

Asarco performed a Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model to determine the probability that emissions from the Mission Complex impact a Class I area when it experiences its 20% worst visibility days. The results of the HYSPLIT model indicate that the probability of emissions from the Mission Complex impacting the Saguaro National Park (West or East) is less than 2.0%.