REGIONAL HAZE 2ND IMPLEMENTATION PERIOD FOUR-FACTOR ANALYSES

Phoenix Cement Company – Clarkdale, Arizona

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Clarkdale Facility Four-Factor Analyses

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TABLE OF CONTENTS

1. INTRODUCTION

The U.S. Environmental Protection Agency ("**EPA**") Regional Haze Program is designed to reduce anthropogenic visibility impairment in national Class I areas. The program includes a requirement to determine the reductions of emissions of visibility-impairing pollutants within Arizona that must be achieved by the year 2028 and a requirement that the State submit for EPA's review a plan to achieve the reductions ("**RH2 SIP**"). This has entailed the development and implementation, by Arizona's Department of Environmental Quality ("**ADEQ**"), of a "Four Factor Screening" methodology to identify the stationary and mobile sources of visibility-impairing pollutants that will be required to participate in the determination. For each source that is required to participate, an analysis must be prepared to assess the additional capture or control technologies or practices ("**controls**" or "**control measures**") that the source may be required to implement, in order to contribute to the State-wide reduction of visibility-impairing emissions. The analyses must consider four statutory factors, and thus are termed four-factor analyses ("**4FAs**").

ADEQ in July 2019 informed Phoenix Cement Company ("**PCC**"), an enterprise division of the Salt River Pima-Maricopa Indian Community ("**SRPMIC**" or "**Community**"), that, based on ADEQ's application of the "Four Factor Screening" methodology, 4FAs must be prepared for PCC's Clarkdale facility. On September 13, 2019, ADEQ e-mailed to PCC a list of the processes and pollutants for which 4FAs must be performed. That list is provided in Table 1-1, below.

Table 1-1. Sources Subject to 4FAs

Emission Unit Identifier	Emission Unit Description	Unit Process Identifier	Unit Process Description	Pollutant
2	Rock Sampling And Storage	17	RAW STORAGE PILES	PM_{10}-PRI
30	Coal/Coke Handling 2	12	COAL/COKE STORAGE PILE	PM_{10}-PRI
29	Gypsum Handling	4	GYPSUM STORAGE PILES	PM_{10}-PRI
21	Cement Storage	1	DC510	PM_{10}-PRI
~~16~~	~~Clinker Handling And Str3~~	~~3~~	~~DC350~~	~~NO_X~~
26	Quarry Rds/Blast/Drill	2	QUARRY BLASTING	NO_X
6	Raw Storage And Homog2	1	DC607	PM_{10}-PRI
17	Finish Milling	9	DC340	PM_{10}-PRI
8	Kiln Feed System	1	DC409	PM_{10}-PRI
16	Clinker Handling And Str3	2	DC352	PM_{10}-PRI
9	Raw Mill	1	DC366	PM_{10}-PRI
22	Cement Storage 2	3	DC512	PM_{10}-PRI
10	Clinker Cooling	1	DC445	PM_{10}-PRI
3	Rock Reclaimer And Tps	9	DC205	PM_{10}-PRI
5	Raw Storage And Homog1	1	DC601	PM_{10}-PRI
11	Clinker Handling And Str1	2	DC447	PM_{10}-PRI
16	Clinker Handling And Str3	3	DC350	PM_{10}-PRI
22	Cement Storage 2	1	DC508	PM_{10}-PRI
16	Clinker Handling And Str3	1	DC312	PM_{10}-PRI
6	Raw Storage And Homog2	6	DC224	PM_{10}-PRI
6	Raw Storage And Homog2	7	DC228	PM_{10}-PRI
6	Raw Storage And Homog2	8	DC615	PM_{10}-PRI
6	Raw Storage And Homog2	9	DC616	PM_{10}-PRI
17	Finish Milling	2	DC341	PM_{10}-PRI
13	Coal/Coke Handling1	2	DC452	PM_{10}-PRI
28	Paved Plant Roads	1	PAVED PLANT ROADS	PM_{10}-PRI

Per communication with ADEQ dated December 5, 2019, one of the processes (DC350—NO_X emissions from clinker handling and storage) has been removed from the list. This report details the method used to complete the 4FAs for the remaining processes and pollutants on the list and discusses the results of the 4FAs.

2. FOUR FACTOR ANALYSES

The 4FAs were conducted in accordance with 40 C.F.R. § 51.308 and the following guidance:

- EPA's Guidance on Regional Haze State Implementation Plans for the Second Implementation Period ("**RH2 Guidance**");[1]
- EPA's Control Cost Manual;[2] and
- Other guidance documents and references cited in this report.

The 4FAs entailed:

→ Consideration of emissions control options, including their effectiveness at reducing the emissions and their energy and non-air quality environmental impacts, and elimination of technically infeasible controls; and

→ Evaluation of the cost to implement each of the remaining control measures taking into account the control measure's useful life for purposes of amortizing capital expenditures (if applicable),[3] the time necessary for the control measure to be implemented,[4] and its potential visibility benefits. [5]

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[1] EPA-457/B-19-003, August 2019.

[2] Final revised chapters of the Control Cost Manual are found at https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.

[3] EPA recommends that, generally, states can consider "the useful life of the control system rather than the source." RH2 Guidance § II.B.4(f). According to EPA, the remaining useful life of the source itself typically "will be longer than the useful life of the emission control system under consideration unless there is an enforceable requirement for the source to cease operation sooner. The presumption is that after the end of the useful life of the emission control system, it will be replaced by a like system. Thus, annualized compliance costs are typically based on the useful life of the control equipment rather than the life of the source, unless the source is under an enforceable requirement to cease operation." *Id.* EPA advises, therefore, that states should "consider remaining useful life by using it to calculate emissions reductions, annualized compliance costs, and cost/ton values." RH2 Guidance § II.B.5(d).

[4] EPA recommends that states "consider the time necessary for compliance as part of their determination of what compliance deadlines for selected control measures are reasonable, rather than as part of their determination whether to adopt the control measures in the first instance." RH2 Guidance § II.B.5(b). 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 the State concludes that the control cannot reasonably be installed and become operational until after 2028. RH2 Guidance §§ II.B.4(d) and II.B.5(b).

[5] EPA recommends that, "[w]hile visibility impacts and/or potential benefits may be considered in the source selection step in order to prioritize the examination of certain sources for further analysis of emission control measures, visibility benefits may again be considered in that control analysis to inform the determination of whether it is reasonable to require a certain measure." RH2 Guidance § II.B.4(g). EPA anticipates "that the outcome of the decision-making process by a state regarding a control measure may most often depend on how the state assesses the balance between the cost of compliance and the visibility benefits, with the other three statutory factors either being subsumed into the cost of compliance or not being major considerations." RH2 Guidance § II.B.5(a).

2.1. PM_{10} EMISSIONS FROM RAW STORAGE PILES

Section 2.1.1 considers control options for PM_{10} emissions from the raw storage piles at PCC's Clarkdale facility, in term of their effectiveness at reducing the emissions and their energy and non-air quality environmental impacts, and concludes that implementing the controls would be technically infeasible.

2.1.1. Consideration of Control Options and Elimination of Technically Infeasible Controls

The following PM_{10} control options were identified based on a review of the RACT/BACT/LAER Clearinghouse ("**RBLC**") database, other technical literature, practices at other cement manufacturing facilities, and engineering experience both generally and at the Clarkdale facility:

- Enclose the raw storage piles
- Increase the moisture of the raw storage piles
- Cover the raw storage piles with tarps

2.1.1.1. Enclose the Raw Storage Piles

The raw storage piles, processing equipment and other surface features in the immediate vicinity are depicted in Figure 2-1.

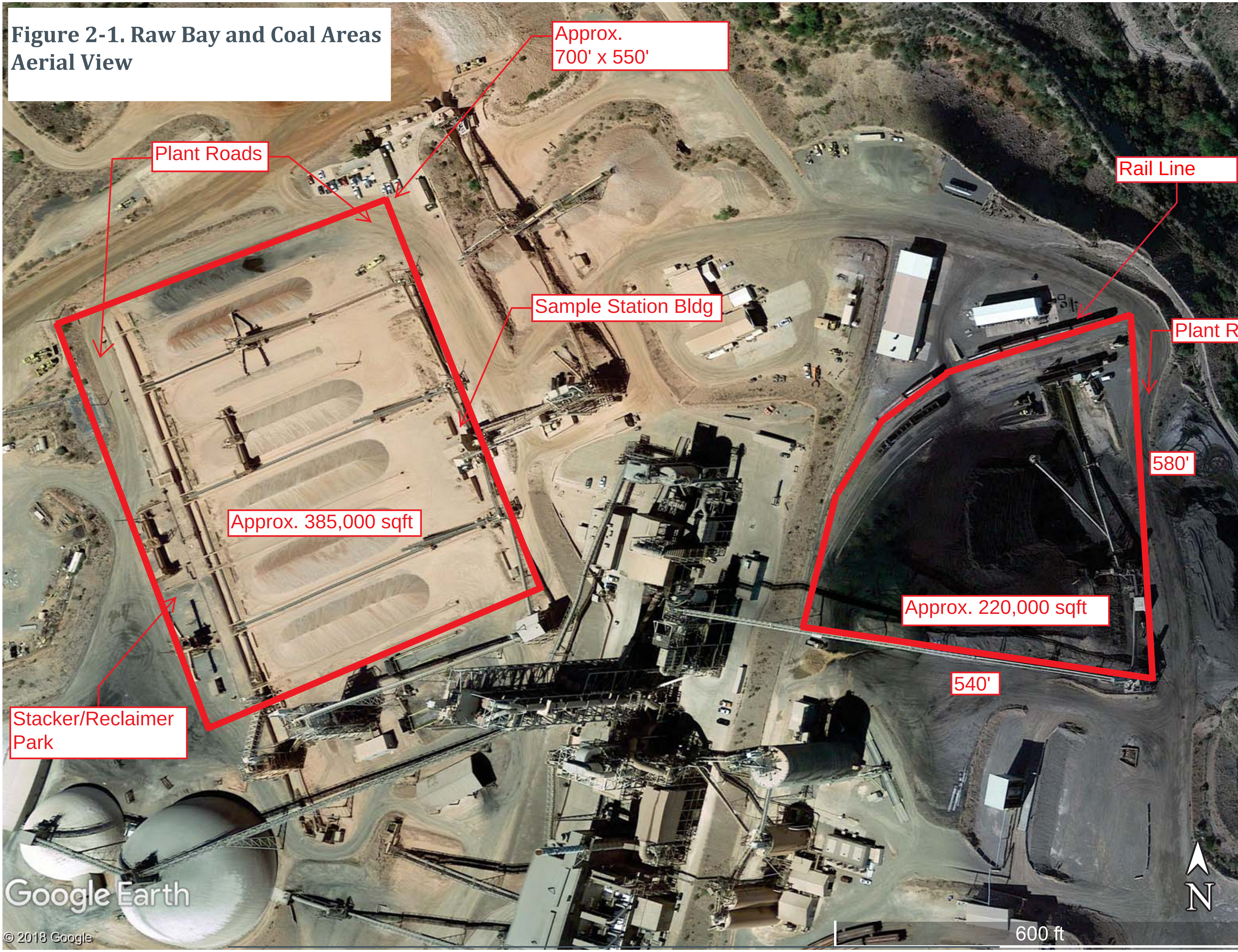
Figure 2-1. Raw Bay and Coal Areas Aerial View
Approx.
700' x 550'
Plant Roads
Rail Line
Sample Station Bldg
Plant Road
580'
Approx. 385,000 sqft
Approx. 220,000 sqft
540'
Stacker/Reclaimer
Park
Google Earth
© 2018 Google
N
600 ft

Enclosing the raw storage piles—whether by erecting a fence or other barrier along some or all sides of the piles, or fully enclosing the piles within a building—would be technically infeasible for several reasons: (1) erecting an enclosure structure along the west edge and/or the east edge of the raw storage piles would prevent the raw material stackers and reclaimers from accessing the rails between the piles and performing their basic functions; (2) erecting an enclosure structure along the southern edge of the raw storage piles would necessitate a complete reconfiguration of the plant's sweetening system, which is integral to the quality of the raw feed; (3) erecting an enclosure structure along the northern edge of the raw storage piles would encroach upon the only access road along that side of the plant to the point of eliminating the access;[6] and (4) erecting enclosure structures on some[7] or all sides of the raw storage piles and reconfiguring the plant to accommodate the structures would halt clinker production for the duration of the construction, thereafter which attempting to operate the structures would substantially impair clinker production, inflicting on the Community a loss of revenue that is incalculable in the federal government's decision-making concerning the RH2 SIP.[8] Erecting enclosure structures and reconfiguring the plant to accommodate the structures would also entail significant energy consumption and: (a) disrupt the operation of the Spill Prevention, Control, and Countermeasure ("**SPCC**") plan and stormwater pollution prevention plan ("**SWPPP**") for the Clarkdale facility; (b) necessitate reconfiguration of certain SPCC- and SWPPP-regulated surface features, including a fuel island containment system that includes a lined catchment pond basin for possible overfilling of fuel spillage from mobile equipment; and (c) lead to difficulty managing stormwater during the reconfiguration.

2.1.1.2. Increase the Moisture Content of the Raw Storage Piles

The moisture content of the raw storage piles needs to be regulated to ensure product quality, energy efficient operations[9] and process efficiency. Any additional moisture that is achieved is strictly as needed to control visible emissions pursuant to the facility's Title V permit no. 69780.[10] Increasing the moisture content of the raw storage piles to a greater level, whether via the use of water sprays or otherwise, would: (1) adversely impact the raw feed chemistry and resulting kiln operation; (2) require the introduction of additional heat and air into the raw mill to drive off the additional moisture, which would increase energy consumption and; (3) cause the raw material from the piles to stick to the conveyor belts and clog the transfer points before the material enters the raw mill system . For these reasons, increasing the moisture content of the raw storage piles would be technically infeasible.

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[6] Use of the haul road immediately to the north of (parallel to) the access road is permitted only for haul trucks, due to safety concerns.

[7] It is anticipated that erecting a partial fence or other barrier along just one or two sides of the raw storage piles would not have a meaningful effect on their PM_{10} emissions rate or dispersion of the emissions toward a Class I area.

[8] *See Merrion v. Jicarilla Apache Tribe*, 455 U.S. 130, 152 (1982) (holding that, consistent with the federal policy of encouraging tribal self-sufficiency and economic development, ambiguities in federal law are "construed generously" in favor of Indian tribes) (quoting *White Mountain Apache Tribe v. Bracker*, 448 U.S. 136, 143-44 (1980)).

[9] PCC has earned EPA's Energy Star certification for 13 consecutive years.

[10] *See* Attachment B "Specific Conditions", Permit Condition VIII.B.

2.1.1.3. Cover the Raw Storage Piles with Tarps

The use of tarp covers to control PM_{10} emissions from the storage piles would necessitate that the tarp covers be continually placed over, and then removed from, the piles as material is continually placed on and removed from the piles using the stackers and reclaimers. This would render the operation of the piles and appurtenant operations highly inefficient and cause safety concerns, including concerns that could not be squared with the MSHA Safe Access Standard,[11] since the tarp covers would need to be placed and removed by manual labor,[12] each of the six piles occupies a surface area of roughly 10,000 square feet and averages 20 feet in height, and the sides of the piles are steep. For these reasons, covering the raw storage piles with tarps would be technically infeasible.

2.2. PM_{10} EMISSIONS FROM COAL/COKE STORAGE PILE

Section 2.2.1 considers control options for PM_{10} emissions from the coal/coke storage pile at PCC's Clarkdale facility, in term of their effectiveness at reducing the emissions and their energy and non-air quality environmental impacts, and concludes that implementing the controls would be technically infeasible.

2.2.1. Consideration of Control Options and Elimination of Technically Infeasible Controls

The following PM_{10} control options were identified based on a review of the RBLC database, other technical literature, practices at other cement manufacturing facilities, and engineering experience both generally and at the Clarkdale facility:

- Enclose the coal/coke storage pile
- Increase the moisture of the coal/coke storage pile

[11] 30 C.F.R. §56.11001.

[12] Automated or mechanical systems to place, remove, and then replace the tarps continuously are not commercially available. According to EPA guidance, a control measure is not technically feasible if: (1) it has not been installed and operated successfully for the type of source under review under similar conditions or (2) the technology cannot be applied to the source under review if the technology cannot be readily obtained through commercial channels; e.g., it has not yet reached the stage of licensing and commercial availability. Draft Guidance on Progress Tracking Metrics, Long-term Strategies, Reasonable Progress Goals and Other Requirements for Regional Haze State Implementation Plans for the Second Implementation Period, EPA-457/P-16-001, July 2016 ("**2016 Guidance**"). EPA has replaced the 2016 Guidance with the RH2 Guidance. However, the 2016 Guidance's measure of technical feasibility as a function of commercial availability is a distillation of positions that EPA has adopted in other technology review programs and specific cases. *See, e.g.*, 78 Fed. Reg. 16452, 16455 (March 15, 2013) ("A technology is available if it can be obtained through commercial channels . . . The BACT analysis for technical feasibility employs the same approach."); *In re Knauf Fiber Glass, GmbH*, 1999 EPA App. LEXIS 45 ("One of the elements of technical feasibility is . . . commercial availability.") (citations omitted); *accord* 40 C.F.R. Part 51 Appendix Y (Guidelines for BART Determinations Under the Regional Haze Rule), § IV.D.2.

2.2.1.1. Enclose the Coal/Coke Storage Pile

The coal/coke storage pile, processing equipment and other surface features in the immediate vicinity are depicted in Figure 2-1.

Enclosing the coal/coke storage pile—whether by erecting a fence or other barrier along some or all sides of the piles, or fully enclosing the pile within a building and ventilating emissions through a control device—would be technically infeasible for several reasons: (1) erecting an enclosure structure along the northwest curve of the coal/coke storage pile would encroach upon the railroad tracks and prevent rail car access on that side of the pile; (2) erecting an enclosure structure along the southern edge of the coal/coke storage pile would prevent truck access to the ammonia storage building; (3) erecting an enclosure structure along the eastern edge of the coal/coke storage pile would encroach upon the access road along that side of the plant, to the point of eliminating it;[13] and (4) erecting enclosure structures on some[14] or all sides of the raw storage piles and reconfiguring or relocating the coal/coke storage pile, associated conveyor system, railroad tracks, ammonia storage building and access road in order to accommodate the structures would halt clinker production for the duration of the construction, inflicting on the Community a substantial loss of revenue.[15] Erecting enclosure structures and reconfiguring or relocating the coal/coke storage pile, associated conveyor system, railroad tracks, ammonia storage building and access road would also entail significant energy consumption and: (a) disrupt the operation of the SPCC and SWPPP for the Clarkdale facility; (b) necessitate reconfiguration of certain SPCC- and SWPPP-regulated surface features, including the mill-scale pile, mill-scale pond, lined coal/coke/mill scale catchment, and lower pond for stormwater catchment; and (c) lead to difficulty managing stormwater and potential discharges to groundwater during the construction.

2.2.1.2. Increase the Moisture of the Coal/Coke Storage Pile

The ability of the coal to sustain an increase in moisture, such as by the use of water sprays, depends on the quality of coal. Lower rank coal, such as bituminous and sub-bituminous coal and coal that is freshly mined, has a heat of wetting which can cause temperature rise when water is added leading potentially to self-ignition if the coal is very dry.[16] PCC regularly employs both bituminous and sub-bituminous coal at the Clarkdale facility. Additionally, feeding moist coal/coke into the in-line raw mill would require a reduction in kiln production or require the introduction of additional heat and air into the coal mill to drive off the additional moisture, which would increase energy consumption. For these reasons, increasing the moisture of the coal/coke storage pile would be technically infeasible.

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[13] Relocating the access road further east would interfere with the mill-scale pile, runoff from which must report to the lined coal/coke/mill-scale pond pursuant to the facility's aquifer protection permit.

[14] It is anticipated that erecting a partial fence or other barrier along just one or two sides of the coal/coke storage pile would not have a meaningful effect on their PM_{10} emissions rate or dispersion of the emissions toward a Class I area.

[15] *See Merrion*, 455 U.S. at 152.

[16] *See, e.g.,* https://www.sciencedirect.com/science/article/pii/0016236183902399.

2.3. PM_{10} EMISSIONS FROM GYPSUM STORAGE PILES

Section 2.3.1 considers control options for PM_{10} emissions from the gypsum storage piles at PCC's Clarkdale facility, in term of their effectiveness at reducing the emissions and their energy and non-air quality environmental impacts, and concludes that implementing one of the controls may be technically feasible.

Section 2.3.2 evaluates the cost to implement the control taking into account the control's useful life for purposes of amortizing capital expenditures (if applicable) and the time that would be necessary for the control measure to be implemented.

2.3.1. Consideration of Control Options and Elimination of Technically Infeasible Controls

The following PM_{10} control options were identified based on a review of the RBLC database, other technical literature, practices at other cement manufacturing facilities, and engineering experience both generally and at the Clarkdale facility:

- Fully enclose the gypsum storage piles
- Increase the moisture of the gypsum storage piles
- Cover the gypsum storage piles with tarps

2.3.1.1. Fully Enclose the Gypsum Storage Piles

The gypsum storage piles are regularly placed in a structure consisting of a concrete floor, three walls and a roof, to which a PM_{10} control efficiency of 85% can be attributed.[17] However, the emission inventories submitted to ADEQ currently do not reflect a control efficiency for that partial enclosure. PCC reserves the right to assign the 85% control efficiency in future emissions inventories and applies this control efficiency to the cost-value determination in Section 2.3.2. Adding a fourth wall to achieve complete enclosure would prevent truck access to the piles. Achieving complete enclosure at the current location would necessitate that the partial enclosure be demolished and replaced with a much larger building to (1) continue to permit truck access to the piles and (2) provide enough space to dry the gypsum so that it can be introduced into the cement manufacturing process (see Section 2.3.1.2). Such a control measure at the same location would necessitate extensive reengineering and reorientation of the gypsum material handling and conveying systems and substantial earthworks, entailing several months of downtime; this would be technically infeasible. On the other hand, complete enclosure could be achieved by demolishing the partial enclosure and constructing a much larger building at a different location, for instance on the other side of the access road to the west of the current location of the piles. Such a measure would be technically feasible. This would result in an attributable PM_{10} control efficiency as high as 90%.[18] Such a measure would also entail significant energy consumption and: (a) disrupt the operation of the SPCC and SWPPP for the Clarkdale facility; (b) may necessitate reconfiguration of certain SPCC- and SWPPP-regulated surface features; and (c) lead to difficulty managing stormwater and potential discharges to groundwater during the demolition of the existing enclosure and construction of the new building.

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[17] Control Factor per Rock Crushing Plants Guidance, Texas Commission on Environmental Quality (TCEQ), February 2002 Draft RG 058, page 16

[18] *Ibid.*; and per RBLC searches for storage pile building enclosures for cement plants in TX.

2.3.1.2. Increase the Moisture of the Gypsum Storage Piles

The gypsum procured by PCC for use in the cement manufacturing process is naturally wet with a moisture of approximately 10%. The gypsum is necessarily dried in order to be introduced into the cement manufacturing process. Making the gypsum wetter would interfere with the process. Therefore, increasing the moisture of the gypsum, such as by the use of water sprays, would be technically infeasible.

2.3.1.3. Cover the Gypsum Storage Piles with Tarps

The need for the gypsum to be dried in order to be introduced into the cement manufacturing process would make covering the gypsum pile with tarps technically infeasible.

2.3.2. Consideration of Technically Feasible Control

Based on the analysis in Section 2.3.1, the following option for enhancing the control of PM_{10} emissions from the gypsum storage piles may be technically feasible, subject to further evaluation:

- Fully enclose the gypsum storage piles

Cost to Implement the Control Measure

The PM_{10} emissions rate attributable specifically to the gypsum storage piles is 1.11 tons per year based on an 85% control efficiency (see Section 2.3.1.1).[19] A PM_{10} emissions control efficiency as high as 90% could be attributed for a much larger building on the other side of the access road to the west of the current location of the piles. This would yield a reduction of 0.37 tons PM_{10} per year for the pile.

The cost of implementing this control measure is calculated in Appendix A using a remaining useful life of 30 years.[20] The calculated cost is $934,626 per ton PM_{10} per year. Based on precedent in the Regional Haze Program, this would be cost-prohibitive.

The Time Necessary for the Control Measure to Be Implemented

The demolition of the existing enclosure of the gypsum storage piles, the construction of a much larger building on the other side of the access road to the west of the current location of the piles, and the relocation of the piles into the new building could theoretically be achieved upon EPA's approval of the RH2 SIP. However, 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.[21] Therefore, whether PCC would need to implement this control measure before 2028

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[19] The 7.38 tons per year indicated by the list of 4-factor processes that ADEQ e-mailed to PCC on September 13, 2019 is multiplied by 0.15.

[20] The useful life of the new building considered in this 4FA is estimated at 30 years. The remaining useful life of the Clarkdale facility is greater than 30 years. Therefore, the cost to implement this control measure takes into account what would be the estimated useful life of the new building for purposes of amortizing capital expenditures. *See* RH2 Guidance §§ II.B.4(f) and II.B.5(d).

[21] RH2 Guidance §§ II.B.4(d) and II.B.5(b).

would bear further consideration, if a determination is made that the control measure is warranted contrary to this 4FA.

2.4. PM_{10} EMISSIONS FROM PAVED PLANT ROADS

Section 2.4.1 considers control options for PM_{10} emissions from the paved plant roads at PCC's Clarkdale facility, in term of their effectiveness at reducing the emissions and their energy and non-air quality environmental impacts, and concludes that implementing any one of the controls would be technically feasible.

Section 2.4.2 evaluates the cost to implement the controls taking into account the control measure's useful life for purposes of amortizing capital expenditures (if applicable) and the time that would be necessary for the control measure to be implemented.

2.4.1. Consideration of Control Options

ADEQ has already determined the control options that could be considered for PM_{10} emissions from paved roads ("**ADEQ's Draft List of Controls**").[22] These controls are evaluated below, in addition to controls that were identified based on a review of the RBLC database, other technical literature, practices at other cement manufacturing facilities, and engineering experience both generally and at the Clarkdale facility.

PCC already implements the following control measures from ADEQ's Draft List of Controls. PCC has never included corresponding control efficiencies in its emissions inventories for the Clarkdale facility, although the literature assigns a control efficiency to at least one of the measures. PCC reserves the right to assign control efficiencies to these already-taken measures in future emissions inventories and, if necessary, in the development of the RH2 SIP:

- Berm Installation (no control efficiency is indicated in the literature)
- Require curbing and pave or stabilize shoulders of paved roads (a 65% control efficiency is indicated in the literature)[23]
- Installation of Curbs with Gutter
- Employ a PM_{10} certified street sweeper
- Provide for traffic rerouting or rapid cleanup of temporary (and not readily preventable) resources of dust on paved roads
- Provide for storm water drainage to prevent erosion of dirt or sand onto paved roads

The following control measures from ADEQ's Draft List of Controls were not evaluated because PM_{10} emissions that would be controlled using these measures are deemed to be negligible or nonexistent at the Clarkdale facility: [24]

- Cover open-bodied vehicles

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[22] ADEQ Agency Bulletin: Air Quality Division Request for Feedback "Draft List of Potential PM10 Controls for Nonpoint Source Sectors - Paved Road Dust and Unpaved Road Dust," October 9, 2019.

[23] *See* Paul Spur/Douglas PM_{10} Nonattainment Area SIP (1993).

[24] *Ibid.*

- Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads

The following control options from ADEQ's Draft List of Controls were also not evaluated due to their inapplicability to operations at the Clarkdale facility:

- Require improved material specification for and reduction of usage of skid control sand or salt – no skid control materials are used at the Clarkdale facility.
- Ensure stabilization of unpaved shoulders of paved roads during weed abatement and vegetation management activities – PCC does not perform weed abatement or vegetation management at unpaved shoulders of paved roads at the Clarkdale facility.
- Stabilize medians of paved roads – no medians are employed at paved roads at the Clarkdale facility.

Based on the foregoing, the only control measure that is relevant and evaluated below is from the review of the RBLC database:

- Periodic watering of paved roads

2.4.1.1. Periodic Watering of Paved Roads

PCC currently applies water to unpaved roads at the Clarkdale facility in order to reduce track-out and associated PM_{10} emissions from vehicle traffic on unpaved roads. Therefore, applying water to the paved roads would be technically feasible. This would result in an attributable PM_{10} control efficiency as high as 90%.[25] (PCC already undertakes significant voluntary measures to control fugitive dust emissions from paved roads, as noted in Section 2.4.1.)

Additional water truck traffic, contact water management and associated energy consumption would be entailed. Also, if reclaimed water is used, then the water's quality would need to be assured and managed. Since the paved roads are adjacent to the equipment and building areas, the use of water would make it challenging to keep the paved roads clean, due to creation of mud that could stick to vehicles and increase track-out. Since there are many passenger vehicles that travel on the paved roads, watering them would pose a safety concern of tire slippage.[26] Wet tires are more prone to puncture because water reduces the friction of cutting, shortening tire life. [27] A PM_{10} control efficiency of 90% would be attributable to the application of water to the paved roads.[28]

2.4.2. Consideration of Technically Feasible Control

Based on the analysis in Section 2.4.1, the following option for enhancing the control of PM_{10} emissions from the paved roads is technically feasible:

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[25] *See* Holcim Genevieve Plant Operating Permit # OP2018-100 (December 12, 2018).

[26] https://www.cat.com/en_US/by-industry/mining/articles/haul-road-maintenance.html

[27] https://news.dustaside.com.au/less-water-haul-roads-improves-tyre-life

[28] *See* Holcim Genevieve Plant Operating Permit # OP2018-100 (December 12, 2018).

- Periodic watering of paved roads

2.4.2.1. Periodic Watering of Paved Roads

Cost to Implement the Control Measure

The PM_{10} emissions rate attributable specifically to road dust generated by vehicles traveling on the paved roads is 1.46 tons per year, as indicated by the list of 4 factor processes that ADEQ e-mailed to PCC on September 13, 2019. As discussed in Section 2.4.1.1, a PM_{10} emissions control efficiency as high as 90% could be attributed to this control measure. Increasing the control efficiency to 90% would yield a reduction of 1.31 tons PM_{10} per year for the Clarkdale facility. The cost of implementing this control measure is calculated in Appendix A.[29] The calculated cost is $76,149 per ton PM_{10} per year. Based on precedent in the Regional Haze Program, this would be cost-prohibitive.

The Time Necessary for the Control Measure to Be Implemented

The application of water to the paved roads to enhance the control of PM_{10} emissions generated by vehicle traffic at the facility could theoretically be achieved upon EPA's approval of the RH2 SIP. However, 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.[30] Therefore, whether PCC would need to implement this control measure before 2028 would bear further consideration, if a determination is made that the control measure is warranted contrary to this 4FA.

2.5. NO_X EMISSIONS FROM QUARRY BLASTING

No control measures are available to decrease NOx emissions from quarry blasting at the Clarkdale facility. This is based on a review of the RBLC database, other technical literature, practices at other cement manufacturing facilities, and engineering experience both generally and at the Clarkdale facility.

2.6. PM_{10} EMISSIONS FROM THE REMAINDER OF THE TOP 80% OF PROCESSES

The remainder of the processes and pollutants for which 4FAs must be performed according to ADEQ's September 13, 2019 list all pertain to PM_{10} emissions from material handling. PCC already employs fabric filters/baghouses with enclosed transfer points for all of these emissions. There is no superior control technology that is commercially available for these emissions. This is based on a review of the RBLC database, other technical literature, practices at other cement manufacturing facilities, and engineering experience both generally and at the Clarkdale facility.

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[29] The remaining useful life of the source and the useful life of the control measure do not play a role in this calculation. *See* RH2 Guidance §§ II.B.4(f) and II.B.5(d).

[30] *See* RH2 Guidance § II.B.4(g).

3. VISIBILITY BENEFITS

The 4FAs discussed in this report are not complete without an assessment of whether or to what extent implementation of the assessed control measures would contribute to visibility improvements in Class I areas.[31] It is, therefore, anticipated that, before the RH2 SIP is finalized for Arizona, the record of these 4FAs will be supplemented based on photochemical grid modeling of potentially associated visibility improvements to Class I areas; and that the modeling will provide an opportunity to assess the unit ($) cost of implementing any control measure that ADEQ deems to be necessary under 40 C.F.R. § 51.308 per unit (Mm^{-1}) of visibility improvement that would result in one or more Class I areas, to reflect the cost per unit of visibility benefit achieved by that control measure.[32, 33] The information derived from the modeling would be relevant to any assessment of whether the cost of a control measure would be adequately beneficial to justify its expenditure.[34]

PCC reserves the right to supplement this report based on such photochemical grid modeling, other modeling, and other information that may be relevant to the development of the RH2 SIP.

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[31] *See* RH2 Guidance § II.B.4(g).

[32] EPA recommends that, "if a state is going to consider a metric defined as the cost per unit of visibility benefit, it [should] use light extinction units in the denominator for quantifying visibility benefits. When visibility benefits are expressed in units of light extinction, the visibility benefit can be calculated from modeling results in multiple ways. The modeled visibility benefit can be calculated by making two air quality modeling runs, with and without the [control] measure assumed to be in place. However, if a source's impacts on ambient PM species under a particular emissions scenario have been determined through source apportionment/attribution, it will generally be appropriate to estimate the reductions in ambient PM species due to pollutant-specific emission reductions from the source by assuming a proportionality between source emissions of the relevant species precursor and the ambient PM species concentration. The PM species concentrations with and without the measure can then be used to estimate the light extinction benefit of the measure." RH2 Guidance § II.B.4(g).

[33] EPA recommends that, if a state uses a cost per unit of visibility benefit metric to evaluate control measures, it should use "a cost/inverse megameter metric rather than a cost/deciview metric because the application of the deciview scale on a source- or measure-specific basis is complicated by the logarithmic nature of the deciview scale. When only one Class I area is affected by a measure under consideration, a state may calculate and consider the cost/inverse megameter metric for that one area. If multiple Class I areas would experience visibility benefits from a measure, a state may calculate and consider a metric defined as the annualized compliance cost divided by the sum of the light extinction benefit across these Class I areas. A state may use reasonable thresholds for these metrics as a way of considering the balance between compliance costs and visibility benefits." RH2 Guidance § II.B.5(a).

[34] EPA anticipates that "the balance between the cost of compliance and the visibility benefits will be an important consideration in a state's decisions" in developing an RH2 SIP. RH2 Guidance § II.B.5(a).

Table A.1. Phoenix Cement - Clarkdale - Gypsum Piles - Cost Analysis - Full Enclosure

Potential PM Reduction			
Control Efficiency of Alternative Control	%	90%	[1]
Baseline Emissions	tpy	1.11	[2]
Post Control Emissions	tpy	0.74	Calculated
Reduction in Emissions	tpy	0.37	Calculated
Capital Implementation Costs			
Total Capital Expenditure	$	$2,860,000	[3]
Capital Recovery Factor	%	8.06%	[4]
Annualized Cost	$/yr	$230,477	Calculated
Admin, Taxes, Insurance	$/yr	$114,400	[5]
Fixed Operating Cost	$/yr	$0	[6]
Total Annual Cost	$/yr	$344,877	Calculated
Cost of Compliance (Statutory Factor 1)			
Cost of Alternative Control	$/ton removed	$934,626	Calculated

[1] Control efficiency per *Rock Crushing Plants* , Texas Commission on Environmental Quality (TCEQ), February 2002 Draft RG 058, page 16 and per RBLC searches for storage pile building enclosures for cement plants in TX.

[2] Based on ADEQ's email to PCC dated September 13, 2019 and updated to include control efficiency of 85% for existing partial enclosure (based on TCEQ guidance noted in footnote 1)

[3] Based on PCC engineering estimates and historic vendor quotes for similar fully enclosed structures.

[4] Capital Recovery factor (CRF) calculated as follows

Interest Rate	7%	Per EPA Air Pollution Control Cost Manual Chapter 2 Cost Estimation: Concepts and Methodology
Remaining useful life of source	30	Conservative assumption
Capital Recovery Factor	8.06%	

[5] Admin, Taxes, Insurance assumed to be: 4.00% Per EPA Air Pollution Control Cost Manual, Sixth Ed., 2002, Sect. 2.5.5.8, pg 2-34

[6] Fixed operating cost conservatively assumed to be $0. PCC reserves the right to update this estimate.

Table A.2. Phoenix Cement - Clarkdale - Paved Roads - Cost Analysis for Periodic Watering

Potential PM Reduction			
Control Efficiency of Alternative Control	%	90%	[1]
Baseline Emissions	tpy	1.46	[2]
Post Control Emissions	tpy	0.15	Calculated
Reduction in Emissions	tpy	1.31	Calculated
Capital Implementation Costs			
Total Capital Expenditure	$	$0	[3]
Fixed Operating Cost	$/yr	$100,059	[4]
Total Annual Cost	$/yr	$100,059	Calculated
Cost of Compliance (Statutory Factor 1)			
Cost of Alternative Control	$/ton removed	$76,149	Calculated

[1] Per Holcim Genevieve Plant Operating Permit # OP2018-100 dated December 12, 2018

[2] Based on ADEQ's email to PCC dated September 13, 2019

[3] Total capital expenditure conservatively assumed to be $0. PCC reserves the right to update this estimate.

[4] Based on historic and current operational cost. This includes estimates on labor cost, fuel cost, administrative cost, and cost of truck rental based on current operational practices associated with watering of unpaved plant roads.