

July 31, 2023

TO: California Air Resources Board

FR: Leilac

RE: Comments on CARB's Community Air Protection Program Draft Blueprint 2.0

Ms. Deldi Reyes,

Leilac would like to thank the California Air Resources Board (CARB) for the opportunity to comment on the Community Air Protection Program's draft Blueprint 2.0.

About Our Company

Leilac is applying a breakthrough decarbonization technology to accelerate a just transition to net-zero cement and lime. The Leilac technology uses a module of calciner tubes to deliver radiative heat to limestone or cement meal. This unique approach simply keeps process CO₂ – emissions released directly from the raw material – separate from air and exhaust gases, enabling unavoidable emissions to be efficiently captured at low cost. This innovation marks a step change from other carbon capture solutions that require additional chemicals and energy-intensive processes to separate gases from gases.

Leilac's technology is designed to be compatible with a variety of energy sources, including electricity, hydrogen, and alternative fuels, to provide a 'future-proof' solution that can avoid emissions resulting from carbon-based fuels. Leilac's modular technology is fully scalable and can be installed as a retrofit with minimal downtime for the host plant. It offers a viable and low-cost solution for the cement industry to reduce emissions and maintain international competitiveness, without changing the composition of cementitious materials used across our economy for decades.

Leilac's technology is unique in that it provides a solution to both climate and local environmental justice concerns. In California, SB 596 requires CARB to develop a strategy to achieve a net zero greenhouse gas (GHG) emissions strategy for cement plants that will be fully implemented by 2045. As part of that strategy, CARB must identify actions that reduce adverse air quality impacts while supporting economic development in communities neighboring cement plants. Leilac believes that our technology can play a crucial role in supporting a holistic solution for the cement sector, as it enables **substantial air quality benefits for communities local to cement production facilities**.

During CARB's May 31, 2023, Cement Sector Net-Zero Emissions Strategy Workshop, CARB identified several potential emissions reduction options associated with clinker production. We believe that our technology provides a solution that addresses many of the opportunities identified, including the following:

- Process change – Our technology is a retrofittable, modular design that separates the source of heat from raw materials without any additional chemicals or processes. Externally heated calciner tubes replace the traditional pre-heater at cement plants.
- Fuel switching – Our technology is flexible; almost any fuel can be used to heat the calciner tubes, including low-carbon fuels (e.g., hydrogen) or electricity. This can replace traditional fuels used at cement plants in California, including tire-derived fuels and coal. Challenges related to scale and infrastructure for fuel switching have limited the solution's viability to date. Climate and air quality efforts, as well as technology innovation, are making these alternatives progressively more attractive.
- Alternatives to clinker – CARB is considering opportunities to replace traditional clinker with zero-to-low emission alternatives as a potential solution for net-zero cement. Our system can be used with these alternative products. Ultimately, while supplementary cementitious materials

(SCMs) are beneficial and should be actively supported and encouraged, there is only so far that substitution by SCMs can take us on the pathway to net-zero cement. Large volumes of clinker production will still be required, and carbon capture and storage will be essential in abating the resulting process emissions and achieving a net zero by 2045 goal.

- Carbon capture without chemical pollutants – Leilac works by keeping the unavoidable process CO₂ pure, enabling its efficient and low-cost capture. Traditionally, CO₂ capture requires chemical solvents, such as in an amine system, to purify CO₂ emissions from the exhaust gas. By removing this step, Leilac’s technology avoids potential local pollutant impacts in communities surrounding cement plants.

Demonstration Projects

The Leilac technology is proven at pilot scale, including through its pilot plant in Lixhe, Belgium (Leilac-1) and three smaller electric units. Leilac-2, a demonstration plant with a design capacity of 100,000 ktpa of CO₂ per year, aims to demonstrate a retrofittable module that can be simply replicated and applied at any scale. Leilac-2 will be built in Hannover, Germany in 2024.

Leilac-1 has been operating since 2019 and has proven the following:

- Effective indirect calcination of limestone and cement raw meal.
- Direct separation of CO₂ process emissions (95% purity), with no air ingress or loss of containment.
- Safe and effective performance at required temperatures.
- No additional chemicals or processing are required for carbon capture.
- Similar energy requirements to a conventional cement plant.
- No negative impacts on the host plant.
- No impact on clinker production.
- No significant ‘coating’ of the inner tube by the processed material.
- No significant operational deterioration of the reactor over time.

Leilac-1 received 12 million Euros in funding from the European Union’s Horizon 2020 program for research and innovation. This program has also provided 16 million Euros to fund Leilac-2. Both Leilac-1 and Leilac-2 are supported by a consortium of industry partners, including Heidelberg Materials, Cemex, and other global cement and lime producers. Leilac-2 is expected to validate the anticipated capital and operational expenditure for full-scale operations and develop the use of alternative and renewable fuel sources.

Blueprint 2.0

Leilac would like to thank CARB for the opportunity to comment on Blueprint 2.0. Although CARB has taken great strides in addressing the cumulative exposure burden experienced in disadvantaged communities through the Community Air Protection Program, we believe that more can be done to address industrial sources of air pollution. This program has created a platform to amplify community voices from the most overburdened areas in California, however little progress appears to have been made on addressing emissions from industrial sources near fence line communities. Our comments today are focused on **encouraging CARB to provide the support necessary to require the consideration and use of alternative processes and technologies at industrial facilities statewide.**

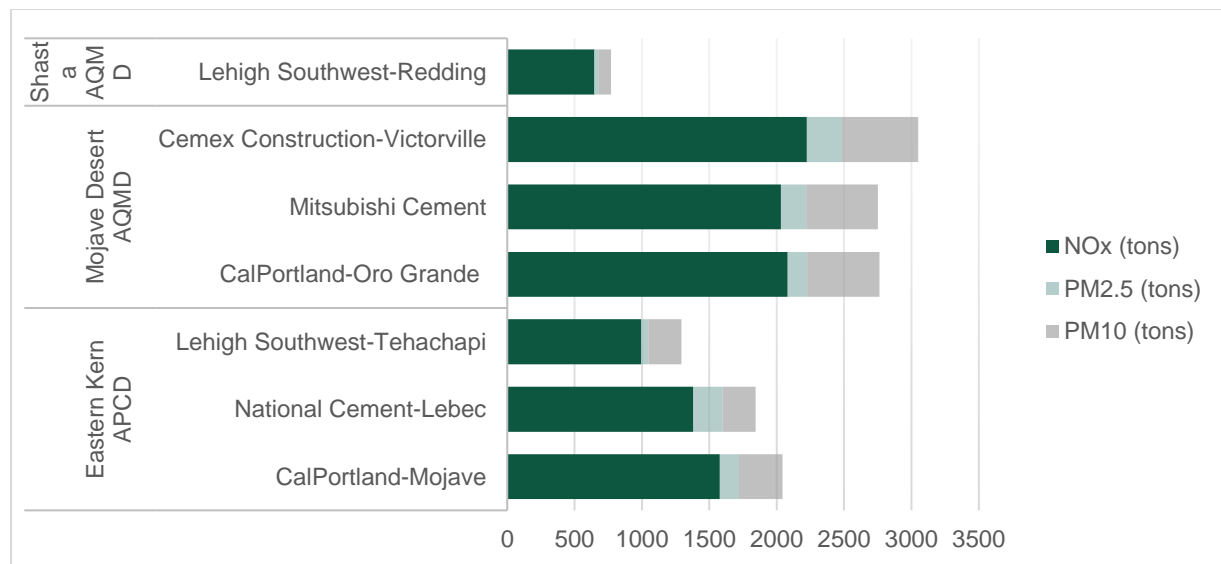
Accelerated Retrofit of Industrial Sources

Assembly Bill (AB) 617 (C. Garcia, 2017), among other requirements, tasks air districts with the implementation of best available retrofit control technology (BARCT). Facilities subject to these requirements include emissions units at sources in non-attainment areas, that are subject to California’s Cap-and-Trade regulation by December 31, 2023. This requirement was intended to directly address criteria pollutant emissions, by requiring equipment upgrades on the dirtiest emissions units at industrial facilities.

The main source of criteria air pollutant and air toxic emissions at cement plants are from the kilns. The kiln is a large high-heat furnace that is typically fueled by coal, oil, gas, coke, tire-derived fuels, or other waste materials. Air toxic emissions are primarily released during the burning of fuels and the heating of feed materials. Common criteria pollutants and air toxics emitted from cement plants include NOx, SOx, VOCs, PM10, PM2.5, metals, mercury, benzene, 1,3-butadiene, hexavalent chromium, formaldehyde, acid gases, and dioxins/furans.

At the time of AB 617’s adoption, 8 cement plants were operating in California within four air districts. In 2022, the only cement plant operating within the Bay Area Air Quality Management District (AQMD), Lehigh Cement, announced that they would be closing the facility. The remaining 7 cement plants are located within the Shasta County AQMD, Mojave Desert AQMD, and Eastern Kern County Air Pollution Control District (APCD). One facility, Cal Portland – Oro Grande is located within a disadvantaged community, and five of the seven facilities are located within 5 miles or less of a community.

2020 Criteria Pollutant Emissions from Cement Plants in California (tons/year)



Source: CARB Air Pollution Mapping Tool

Concerns Identified

In reviewing Blueprint 2.0, the Part Two document contains a section titled “Addressing Emissions from Stationary Sources.” This section describes the requirements of the “Expedited BARCT” program and refers to a webpage that tracks the status of implementation. This webpage revealed that all the cement

plants in California were subject to these requirements. In reviewing the Expedited BARCT documents, the following conclusions were made:

- Shasta County APCD committed to reviewing Rule 3:26 to evaluate NO_x controls on their Portland Cement Kiln. This district is only in non-attainment with state ozone ambient air quality standards. It appears that this district is now evaluating alternatives to clinker for use at their facility, but no information on updated limits or progress on the planned rulemaking was found.
- Eastern Kern APCD and Mojave Desert AQMD are in non-attainment with state and federal ozone standards and with state PM₁₀ ambient air quality standards. Both of these districts were not required to take further action on their Expedited BARCT schedule due to recent rule updates in early 2018, that impacted permitted limits for their kilns. These rules reduced NO_x limits from kilns from 6.4 lb/ton of clinker produced to 3.4 lb/ton of clinker produced. Fuels used at both facilities include coal and tires.

In the rulemaking documents for these actions, only traditional control technologies were considered such as low NO_x burners, combustion controls, staged combustion, and NO_x-reducing fuels (including tire-derived fuels). Advanced controls and process changes, such as Leilac's technology were not considered despite our pilot plant's operation since 2019. Additionally, in reviewing Bay Area AQMD's final Expedited BARCT schedule documentation, it was determined that in establishing updated BARCT limits, the air districts "reviewed available information on current achievable emissions limits and potential controls for each source category" and that this information "included guidelines and recent determinations of best available control technology (BACT), reasonably available control technology (RACT), and lowest achievable emission rate (LAER) from EPA, CARB, and other air districts." Given that these systems do not identify alternative technologies or processes, we have determined that more action is needed from CARB to support additional reductions from industrial sources.

Recommendations

Despite significant advances in technology in the transportation sector over the past few decades, the industrial sector continues to lag behind. New innovative technologies that have the potential to significantly reduce emissions in overburdened communities are often not considered due to a lack of regulatory support. While we are encouraged by the innovative policies at the national level, such as the Section 45Q carbon sequestration/utilization tax credit and a selection of federal funding opportunities, to date, there are very few programs within the United States to support demonstration and commercial deployment of emerging technologies for avoiding CO₂ emissions and criteria pollution from industrial sources. Alternatively, in Europe, the government provides funding to support the advancement of these technologies, yet these efforts are often not considered in local permitting decisions in California.

To address this issue, we recommend that CARB becomes a leader in this space, by defining a path that supports the commercialization of alternative technologies in the industrial sector as a commitment in the final version of Blueprint 2.0. By providing clear signals to the market that CARB is taking action to support the consideration of alternative technologies, we anticipate that CARB's GHG programs, including the Scoping Plan, will become further aligned with the State's leading environmental justice program. The specific actions that we recommend that CARB commits to are outlined below:

- Provide clear information to the public on alternative technologies available for the cement sector, including local emissions impacts and regulatory hurdles to implementation.
- Identify incentive programs and grant funds for major sources of air pollution and GHG emissions, and how these programs will support full-scale commercialization.
- Ensure state and local programs consider alternative technologies and fuels – particularly technologies that avoid CO₂ and 'future-proof' industry for a carbon-neutral economy – during the permitting and rulemaking processes.

- Provide guidance on when demonstrated alternative technologies should be considered reliable and commercially available, and therefore required when BACT is triggered.
- Update cost-effectiveness methodologies to ensure that socioeconomic and health benefits are accounted for when evaluating industrial source controls.
- Rebuild CARB's historical stationary source program, including the source testing program and issuance of CARB determinations of BARCT for major industrial sources to ensure that BARCT controls considered are technology-forcing.
- Develop programs to ensure that alternative technologies are piloted and deployed in the state's most overburdened communities first.
- Create a simple searchable tool that summarizes community concerns over industrial sources and associated processes, so that technology manufacturers can easily identify areas of public interest/opportunities for deployment.

Conclusion

Again, Leilac would like to thank CARB for the opportunity to provide comments on this document and we welcome the opportunity to serve as a resource to the agency throughout this process. We are available to provide further information or answer any questions that may arise.