AQUAHYDREX

1797 Boxelder Street
Louisville, CO 80027

October 21, 2021

Rajinder Sahota
California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: AquaHydrex Comments on September 30 Public Workshop: 2022 Scoping Plan Update – Scenario Inputs Technical Workshop

Dear Ms. Sahota:

AquaHydrex, Inc. (AquaHydrex) is pleased to provide these comments regarding the scenario inputs for the 2022 Scoping Plan Update. AquaHydrex is an American company commercializing an idealized electrolysis technology, really a clean-sheet redesign, for producing the lowest-cost green electrolytic hydrogen from intermittent renewables at scale. We see green electrolytic hydrogen, aided by the dramatic reduction in the cost of renewable energy, practical at scale and as a key component of achieving decarbonization. And we look forward to helping the state transition to 100 percent clean energy and achieve carbon neutrality and net-negative emissions as soon as possible.

In general, we encourage greater ambition on climate outcomes and urge CARB to focus the Scoping Plan scenarios on exploring the key parameters needed to achieve the directive of carbon neutrality as soon as possible. We are pleased to see scenarios that look to achieve greater greenhouse gas reductions than currently required in 2030 and carbon neutrality by 2035. We encourage you to embrace these scenarios and fully explore practical and beneficial ways to achieve these outcomes.

We're quite sure that such an exploration will lead to the conclusion that the European Commission, the International Energy Agency (IEA), and others have reached: green electrolytic hydrogen will play a huge role in achieving climate neutrality across sectors. Deploying green electrolytic hydrogen at scale and in each of the "hard-to-abate" sectors – including the last of the power and road transportation, commercial aviation, rail, marine shipping, industry, agriculture, and even carbon dioxide upgrading to produce carbon negative chemicals and polymers – will be the most practical, cost-effective means to achieving carbon neutrality in any of the proposed alternatives.

Further, with the continued projected drop in the cost of renewable electricity, coupled with idealized electrolysis technologies such as what we've been focused on, we see that green hydrogen will be made inexpensively, minimizing the societal cost to decarbonize, which we feel is critical and has been a guiding focus of our company.

To the extent CARB and the State want to go faster and/or deeper on decarbonization, it should go faster and deeper on green electric hydrogen. The Scoping Plan should fully explore the scale of

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deployment and timelines for this key strategy to achieve the State's climate goals and identify strategies to achieve those outcomes. We further encourage CARB to include in the Scoping Plan a strategic plan for deploying green electrolytic hydrogen at those identified levels and timelines, including specific goals for electrolyzer deployment and green hydrogen use in 2025, 2030 and 2035.

In addition to these high-level recommendations, we offer the following comments on the proposed scenario inputs:

- **Aviation:** CARB should explore a broader set of decarbonization solutions, including electrification (which likely only can support light planes traveling short distances), hydrogen, and synthetic aviation fuels (which themselves will require significant green hydrogen production). There is no reason CARB cannot identify deeper emissions reductions in the aviation sector than contemplated in the proposed alternatives if each of these options are assumed to be available.

- **Ocean-going Vessels (OGV):** Similar to aviation, the assumptions are too narrow here, limiting opportunities to achieve greater emissions reductions. Ocean-going vessels may use hydrogen or hydrogen-derived fuels (such as methanol, ammonia or even ethanol) and at levels much greater than assumed in each of the proposed alternatives. Indeed, the International Maritime Organization itself has committed to reducing greenhouse gas emissions intensity of shipping by 40 percent by 2030 and 70 percent by 2050, and total emissions by at least 50 percent by 2050,[1] which would seem to be an appropriate minimum level of ambition for any of the alternatives in the Scoping Plan modeling.

- **Freight and Passenger Rail:** This parameter is again defined too narrowly. Trains can use hydrogen in an engine or fuel cell, and may use hydrogen-derived fuels including methanol, ethanol, ammonia, synthetic diesel, or perhaps others. The fuel is the driver of greenhouse gas reductions, and trains don't necessarily need to be turned over to fuel cells or lines electrified in order to achieve significant climate benefits.

- **Electricity Generation:** We are pleased to see stronger greenhouse gas planning targets for the electricity sector and encourage CARB to adopt a 23-30 $MMTCO_2e$ target for 2030 and a 0 $MMTCO_2e$ target in 2035. Drop-in renewable fuels, including green electrolytic hydrogen or synthetic methane (derived from green hydrogen) will be key to achieving a zero carbon power sector.

- **Chemicals and Allied Products; Pulp and Paper (as well as other industrial sectors):** There is no reason green hydrogen cannot be deployed at a scale needed to completely decarbonize these

[1] https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx

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sectors by 2035. The difference in assumptions for hydrogen deployment in 2035 and 2045 seems arbitrary, and we encourage you to explore how green electrolytic hydrogen, in conjunction with other strategies identified, can serve to quickly decarbonize the industrial sector over the next 10-15 years.

- **Agricultural Energy Use:** Agricultural fertilizer represents a promising opportunity to decarbonize the agricultural sector, support market growth for green hydrogen production, and create a new, in-state industry. We encourage CARB to explore how green electrolytic hydrogen and green ammonia for fertilizer can contribute to decarbonizing agriculture in California.

- **Low Carbon Transportation Fuels:** This seems to conflict with the aviation, OGV and rail assumptions, which are limited to electricity and fuel cell technologies. We encourage CARB to better align low carbon fuels assumptions broadly with expanded assumptions for those other transportation sectors, and to include hydrogen-derived synthetic fuels as a scalable, low carbon transportation fuel option and input in the scenarios.

- **Low Carbon Fuels for Buildings and Industry:** It's not clear whether the scenarios achieve 7 percent hydrogen in the pipeline by 2030 and increase blending levels to 2040 (or to what level they would do so), or whether they start at some lower level (again, what level?) in 2030 and increase to 7 percent by 2040. Previous E3 scenarios for CARB and CEC often assume 7 percent hydrogen blending in the pipeline by no later than 2030 and we encourage CARB to adopt a similar assumption in the alternatives presented here, with levels increasing beyond 7 percent through 2040.

  We strongly support the idea of industrial decarbonization hubs, and dedicated hydrogen infrastructure to help serve them. We encourage CARB and the state to consider how to deploy those strategies before the 2030s or 2040s, including in and around the Los Angeles region and to support a significantly decarbonized industrial sector before the 2028 Olympics.

  We also encourage CARB to consider hydrogen-derived synthetic methane as an attractive strategy for decarbonizing buildings and industry – in addition to the use of limited biogas supplies and direct or blended use of hydrogen.

- **Carbon Dioxide Removal (CDR) from the Atmosphere:** As CARB further explores required CDR levels and strategies, we encourage you to explore opportunities not just to sequester captured carbon underground, but also to pair it with green electrolytic hydrogen molecules.

  The combination of green hydrogen and CO_2 results in green syngas. Coal-derived syngas is widely used in China to make valuable chemicals such as methanol, ethylene, propylene, and polymers. Syngas was used at huge scale in World War II by Germany to make synthetic aviation fuel and diesel fuel for tanks. These are well-known and long-existing technologies, and practical and economical routes exist to use green syngas to transform the

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entire chemicals and fuels value chains into being climate neutral, or climate negative (polymers derived from green syngas would be carbon negative).

Doing so will create value-added markets for CDR and carbon capture from industrial operations, while avoiding costly and complicated issues associated with geological sequestration of CO_2.

Thank you for your consideration of these comments, and your efforts to help mitigate the impacts of climate change. As a purpose-driven company that's focused on helping to achieve a zero-carbon future in California, we look forward to tackling this challenge with you. Please don't hesitate to reach out if you have any questions.

Sincerely,

Steven Kloos, PhD
Chief Executive Officer
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