5 July 2018

Mr. Sam Wade
Chief, Transportation Fuels Branch
California Air Resources Board
Cal/EPA Headquarters Building
1001 "I" Street
Sacramento, California 95814

Subject: Air Products comments on California Air Resources Board's proposed 15-day modifications to the proposed amendments to the Low Carbon Fuel Standard regulation.

Mr. Wade,

Air Products appreciates the opportunity to provide comments on potential changes to hydrogen infrastructure as part of the 2019 Low Carbon Fuel Standard (LCFS) regulation.

As the leading supplier of hydrogen and fueling station systems to the California market we have been instrumental in working with the State of California, automotive OEM's, suppliers and customers in developing the largest operating retail hydrogen infrastructure network in the world today.

Air Products is pleased that industry stakeholders continue to develop innovative proposals to accelerate the development and build out of hydrogen refueling stations in California. We understand the proposal for Hydrogen Refueling Infrastructure (HRI) Crediting to generate LCFS credits based on hydrogen fueling capacity under the LCFS can possibly accelerate the expansion of hydrogen fueling stations; however, we view key qualification criteria associated with HRI pathway crediting combined with the new Smart Electrolysis Investment Credit as a deviation from CARB's position on neutrality towards hydrogen fuel supply pathways.

In recognizing HRI Crediting is being made late in the regulatory process Air Products recommends additional work in finalizing the HRI Crediting hydrogen pathway eligibility requirements in the following areas:

1) HRI Maximum Carbon Intensity – Section 96486.2(a)(4)(f)1 requiring hydrogen to meet an unadjusted carbon intensity (CI) of 75 g CO_2e/MJ or less will restrict hydrogen supply pathway options in California. For example, steam methane reforming with biomethane from landfill pathway HYB is not eligible for HRI crediting. Even water electrolysis using California grid power pathway (HYEG) with 30% renewable content carries a carbon intensity of 164 gCO_2e/MJ or greater than 2.2X the HRI crediting eligibility requirement. Air Products recommends Section 96486.2(a)(4)(f)1 be revised to allow for all hydrogen supply sources to qualify for HRI pathway crediting. HRI crediting can still be accrued based of the CI reduction of hydrogen supply with the

Energy Economic Ratio (EER) factored in to the calculation of HRI Credits. Alternatively, an EER adjusted carbon intensity (CI) of 75g CO2e/MJ or less could be acceptable.

2) Minimum Renewable Content - Air Products recognizes the requirement of 33 percent renewable energy content of hydrogen supply in SB1505 and is unsure why a renewable content of 40% or greater is required for HRI crediting eligibility. Air Products recommends Section 96486.2(a)(4)(f)2 be consistent with SB1505 renewable content of 33 percent or greater.

3) HRI Crediting for Expanded HRI Refueling Capacity – The proposed scope of HRI Crediting for expanded HRI refueling capacity in section 95486.2(a)(7) applies to hydrogen fueling stations already generating HRI credits. Air Products requests that HRI Crediting for expanded station capacity be extended to the existing California retail stations awarded through the first four CEC awards. Otherwise, early market hydrogen fueling station owners and suppliers will be at a competitive disadvantage to newer larger stations operating in the same retail hydrogen station network. We foresee possible closure of hard earned early market retail fueling stations if HRI Crediting is not available to support refueling station capacity expansions of existing retail hydrogen stations.

4) HRI Crediting equation - The standard LCFS credit equation and the proposed HRI credit equations do not provide same carbon dioxide reduction values for equal amounts of hydrogen. The standard LCFS equation is section 95486.1(a)(1) uses the energy density of California gasoline or diesel displaced whereas the HRI equation in section 95486.2(a)5 uses the energy density of hydrogen. The amount of LCFS credits earned for 1 kg dispensed hydrogen supplied through identical hydrogen supply pathways are not equal under the current equation methodologies.

Additionally, the newly proposed Smart Electrolysis Credits does not support CARB's position on neutrality of LCFS fuels and provides favorable treatment to hydrogen production using water electrolysis. Hydrogen produced through smart electrolysis Smart Charging power in LCFS Table 7-2 carries a time weight average power that results in 25% higher carbon intensity to steam methane reforming with renewable attributes (HYB). Considering there are normally incremental costs but no incremental credits available for steam methane reforming production using renewable natural gas or biomethane the Smart Electrolysis Credit subsidy in section 95486.1(e)(2) favors water electrolysis and should be revised.

Another issue identified with smart electrolysis credits in section 95486.1(c)(2)(b) is that smart electrolysis rewards higher power consumption, or lower efficiency hydrogen production. For example, Company A may offer an alkaline water electrolysis system with nominal energy consumption of 50 kWh/kg produced, and Company B may offer a PEM water electrolysis system with nominal energy use of 60 kWh/kg hydrogen produced. Company B that consumes a greater amount of energy will receive a greater amount of LCFS credits. The Smart Electrolysis Credit is rewarding lower efficiency hydrogen production. We suggest this was not the intent of the parties which developed the credits.

Air Products would like to once again commend the California Air Resources Board to taking the initiative to further evolve innovate programs that support the development of hydrogen infrastructure. We appreciate this opportunity to submit comments concerning the Low Carbon Fuel Standard regulation, and we welcome the opportunity to discuss our comments and

viewpoint further.

Please feel free to contact me at (610)481-5222 if you have any questions or would like to discuss further.

Sincerely,

Brian B. Bonner
Product Manager
Hydrogen Energy Systems