PRAXAIR

October 23, 2013

Steven Cliff, Ph.D.
Chief - Climate Change Market Branch
California Air Resources Board
1001 I Street
Sacramento, CA 95812-2828

Sent Via Email

Dear Dr. Cliff:

Praxair, Inc., (Praxair)[1] provides the following comments on the September 4, 2013, revisions to the Cap-and-Trade Regulation, as well as the ARB's recent October 7, 2013 Refineries and Related Industries Workshop. As discussed below, Praxair requests that the Air Resources Board ("ARB") continue to evaluate the emissions benchmark specified in Table 9-1 for liquefied hydrogen. Liquefied hydrogen is a unique and distinct product from gaseous hydrogen and the ARB's regulations should explicitly recognize that differentiation.

In the initial release of the draft Cap-and-Trade Regulations several years ago, no distinction was made between liquefied hydrogen and gaseous hydrogen. After several meetings and numerous phone conversations between Praxair and ARB staff, the two categories were ultimately recognized as having significant differences that warranted separate allocations. The final Cap-and-Trade Regulation (adopted in 2011) purposefully established a distinction between liquefied and gaseous hydrogen products, but assigned the same benchmark value to both products: 8.85 Allowances / metric ton (See Table 9-1). During the rulemaking, staff said this distinction was made to enable reconsideration of technical details with respect to production (e.g., efficiency factors) that may result in different allowance assignments for the two products. Based on recent meetings between Praxair and the ARB, it was our understanding that an allocation for liquefied hydrogen would be based on the two liquid hydrogen facilities located in California. Given this course of communications, it is puzzling to us that the ARB has gone full circle back to the initial draft position that liquefied hydrogen and gaseous hydrogen should have the same benchmark, since none of the underlying assumptions have changed. As discussed below, there are numerous structural differences between liquefied and gaseous hydrogen plants serving refineries. The products are also handled and reported differently. The ARB should consider the products separate and distinct from one another and develop a benchmark that is specific to liquefied hydrogen plants in California, consistent with the ARB's practice in developing benchmarks in other sectors.

[1] Praxair was founded in 1907 and became an independent publicly traded company in 1992. Praxair is a supplier of atmospheric gases and coating services business, and is globally recognized for its sustainability efforts (Dow Jones Sustainability World Index in each of the last 11 years, and World CDP Leadership Index for six consecutive years). In California, Praxair has 1000 employees at 80 locations and five production facilities: two atmospheric, two carbon dioxide, and one hydrogen.

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DISCUSSION

During the October 7th Workshop, the ARB proposed to give liquid hydrogen the same emissions benchmark as gaseous hydrogen because "liquid hydrogen direct GHG emissions come primarily from producing hydrogen, not from condensing it to liquid", and "therefore it is equitable to provide the same benchmark."[2] Praxair is concerned by this proposal because it diverges from the ARB's practice of setting a benchmark that at least one facility in California could meet. Despite all of the ongoing energy efficiency investments, Praxair's Ontario facility would not be able to meet the gaseous hydrogen benchmark. As a result, California's liquefied hydrogen industry will face greater domestic leakage risks, which will tend to increase GHG emissions due to transportation of the product from out-of-state sources.

While liquefied hydrogen is a more electricity intensive product than gaseous hydrogen, there are also greater direct emissions attributable to liquefied hydrogen due to three general structural differences between liquefied and gaseous hydrogen plants. These structural differences are akin to the distinction the ARB intends to make between "atypical" and "typical" refineries. First, hydrogen plants manufacturing liquefied product are smaller than plants producing gaseous hydrogen for use by refineries. Liquefied hydrogen plants are sized to meet the regional market demands for liquefied hydrogen. As such, liquefied hydrogen plants are typically 5 - 10% of the size of gaseous hydrogen plants serving refineries. Moreover, due to the predictable demand of refineries, gaseous hydrogen plants typically operate closer to their nameplate capacities, resulting in higher operating efficiencies. Liquefied hydrogen plants have less consistent demand, meaning they cannot consistently achieve the same operating efficiencies as gaseous hydrogen plants serving refineries. Thus, due to the completely different customers and demands for their products, liquefied and gaseous hydrogen plants have different GHG emissions intensities.

Second, there are differences in energy intensities of liquefied and gaseous hydrogen plants serving refineries. Liquefied hydrogen plants do not incorporate the same heat recovery technologies that are typically used by the large gaseous hydrogen plants designed to meet the more predictable and steady demands of refineries. Gaseous hydrogen plants are able to market waste steam for various applications in the refinery, whereas liquefied hydrogen plants do not have customers for their waste steam. Liquefied hydrogen plants also have a higher "heat leak unit value" (i.e., how much heat is lost per MT of hydrogen produced). This is because less hydrogen is produced compared to large refineries and liquefied hydrogen plants do not achieve the same operating efficiencies as gaseous hydrogen plants.

Third, liquefied hydrogen plants are structurally different due to the purity requirements for creating liquefied hydrogen. To produce liquefied hydrogen, the hydrogen feedstock from a Steam Methane Reformer ("SMR") must be purified to 10 ppm. By comparison, SMR's that serve refineries only have to have a purity of 1,000 ppm. To achieve the higher purity for liquefaction, the filtering process disposes of both hydrogen and impurities together. The impact of purifying the hydrogen is the loss of approximately 5.6% of the molecules created in the

[2] See Slide 33 from the ARB's October 7th, 2013 Workshop, available at: http://www.arb.ca.gov/cc/capandtrade/meetings/100713/refinery_workshop_presentation_10_7_13.pdf

reforming process. This reduced volume of hydrogen increases the CO2 emissions per unit of hydrogen produced.

Liquefied hydrogen is also a separate and distinct product from gaseous hydrogen due to the handling of liquefied hydrogen after liquefaction, the scope of potential customers, and the manner in which distribution occurs. These distinctions are important because the new Mandatory Reporting Requirements direct liquefied hydrogen producers to report the quantity sold to customers. Since this information will be the basis for allocations, the development of a liquefied hydrogen benchmark must account for the quantity of product sold to customers.

Gaseous hydrogen is typically consumed close to the gaseous hydrogen production facility (such as in a refinery setting) and there are minimal commodity losses between what is produced and what is delivered to customers. On the other hand, there are commodity losses associated with the handling and delivery of liquefied hydrogen. Liquefied hydrogen is transported by truck and there can be losses due to the distance traveled, elevation, temperature and other factors. Since liquefied hydrogen producers must report the volumes sold to their customers under the Mandatory Reporting Regulation (and this information will be the basis for the allowance allocation), the liquefied hydrogen benchmarks must account for the delivered product. Developing a benchmark that is consistent with the reporting requirements is necessary to ensure that liquefied hydrogen is treated consistently with other Emissions Intensive Trade Exposed industries (e.g., glass manufacturing).

Praxair requests that the ARB recognize the distinctions between gaseous and liquefied hydrogen and develop an appropriate benchmark for liquefied hydrogen that is consistent with the ARB's analysis for other products. The ARB should base the liquefied hydrogen benchmark on the best-in-class facility in California, or average the emissions intensities of the California facilities and then multiply the average by a 90% efficiency factor. We appreciate your continued attention to this important issue and look forward to discussing these issues in the next iteration of this rulemaking.

Sincerely,

Gerald L. Miller

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Vice President, West Region
USIG
Praxair, Inc.