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October 14, 2013

Ms. Mary Nichols – Chair, California Air Resources Board
1001 I Street
PO Box 2815
Sacramento, CA 95812

RE: Comments Regarding *Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms* (Released 4 September 2013) and the Workshop Presentation of *Proposed Amendments to the Refinery Allocation Under Cap and Trade* (Presented 7 October 2013) - "capandtrade13" docket
(Submitted electronically to http://www.arb.ca.gov/lispub/comm/bcsubform.php?listname=capandtrade13&comm_period=A *)*

Dear Ms. Nichols:

Air Products is a global, Fortune 250 company that supplies atmospheric, process, medical and specialty gases, specialty chemicals and process equipment serving a diverse range of industries, including primary metals, refining, electronics, food and glass sectors, as well as healthcare and many other general manufacturing industries. Air Products has over 400 employees and 30 locations in California, including numerous atmospheric gases (oxygen/nitrogen/argon) and hydrogen production facilities, electronic specialty gases and materials production and electricity generating facilities. In addition, Air Products serves a fleet of hydrogen fueling stations across the state, facilitating the transition to carbon-free transportation.

Air Products welcomes the opportunity to submit comments regarding the proposed amendments to the overall cap and trade program, and the subsequently proposed revisions to the specific allowance allocation benchmarks for the refinery and hydrogen sectors under the cap & trade program. Air Products hydrogen production facilities are a major component in this sector and materially impacted by this rulemaking. With similar facilities in Europe, subject to comparable regulations under the ETS Phase III program, Air Products also brings a perspective based on significant research and deliberation regarding the methodology employed to establish the allowance benchmarks under this program.

We look forward to a continued working partnership with CARB staff to ensure an equitable and effective allocation program is created which meets the requirements and intent of AB32.

KEY ISSUES & CONCERNS:

Proposed Cap and Trade Amendments – 4 September 2013

1. ***Liquid Hydrogen should be Assigned the High Leakage Risk Designation***

2. ***Air Products Supports Shifting the Scheduled Reduction in Industry Assistance Factors by One Compliance Period***

3. ***Air Products Supports Advancing the Allowance Allocation Date and Expanding the Factors Included under the Annual Allowance True-up***

4. ***Air Products Supports Permitting a Covered Entity to Satisfy its Compliance Obligation with Allowances Allocated Just Before the Surrender Deadlines, Up to the True-up Allowance Amount***

Proposed Amendments to the Refinery Allocation Under Cap and Trade – 7 October 2013

5. ***Air Products Supports "One Product – One Benchmark" Program Design Principle***

6. ***Currently Proposed Hydrogen Benchmark is Not Representative of Actual Production Facilities in California; Benchmark Must be Revised to Represent Total Population of Hydrogen Production Plants***

7. ***CWB Methodology Could be Employed as an Alternative Approach for the Hydrogen Benchmark***

8. ***The Benchmark for Liquid Hydrogen Should be Derived from Just the Specialty Plants that Produce Liquid Hydrogen***

9. ***Self-Produced and Consumed Electricity in EITE Sectors Must Receive Auction Revenue Benefits Comparable to Grid-Electricity Consumption***

DETAILED DISCUSSION Of KEY ISSUES & CONCERNS:

Proposed Cap and Trade Amendments – 4 September 2013

1. ***Liquid Hydrogen should be Assigned the High Leakage Risk Designation*** – Using the methodology articulated in Appendix K of the initial cap and trade rule (ISOR - 28 October 2010) and reiterated in the 30 July 2012 workshop (Slides 12 and 13), liquid hydrogen production is expected to exceed the "High" emission intensity criteria when accounting for both Direct and Indirect emissions.

   Applying the Leakage Risk classification matrix (CARB "Cap and Trade Program: Emissions Leakage Research and Monitoring" Workshop, 30 July 2012, Slide 14), liquid hydrogen would earn a designation of High Leakage Risk, rather than the Medium Risk designation initially assigned to both gaseous and liquid hydrogen.

2. ***Air Products Supports Shifting the Scheduled Reduction in Industry Assistance Factors by One Compliance Period*** – Air Products supports the proposal to shift the Industry Assistance Factors by one compliance period, providing additional time and certainty to industry to make necessary investments in efficiency improvements and emission reduction technologies. This shift will also allow CARB more time to compile the needed data and conduct the necessary analysis on the risks of leakage that EITE industries face under the cap and trade program and make further program adjustments to prevent the loss of industry in the state.

3. ***Air Products Supports Advancing the Allowance Allocation Date and Expanding the Factors Included under the Annual Allowance True-up*** – Air Products supports the proposal to advance the distribution of allowance allocations to October 15th of each year and expanding the definition of the true-up allowance amount to include changes in benchmark, allocation methodology, cap adjustment and assistance factors. These changes ensure the proper allowance allocation adjustment is made, and made in time, to inform a covered entity's compliance instrument procurement strategy prior to the surrender deadline.

4. ***Air Products Supports Permitting a Covered Entity to Satisfy its Compliance Obligation with Allowances Allocated Just Before the Surrender Deadlines, Up to the True-up Allowance Amount*** – Air Products supports the proposal to allow limited "borrowing" by allowing facilities to use up to the amount of true-up allowances provided for meeting the compliance obligation two-years prior to the vintage of allowances provided by the true-up. Combined with the earlier distribution date of the allowance allocation, these provisions will allow covered entities to optimally manage their compliance instrument procurement strategies.

Proposed Amendments to the Refinery Allocation Under Cap and Trade – 7 October 2013

5. ***One Product – One Benchmark Principle Maintained –*** Air Products strongly supports ARB's continued commitment to the principle of defining a single benchmark value for each distinct product – regardless of the many variations in practice (process, feedstock, facility ownership, etc.). This issue has been a particular concern for industrial gas companies which produce hydrogen and must receive an allowance allocation equal to that which would be received by a refinery producing the same quantity of hydrogen product to prevent distorting the marketplace.

   The "one product-one benchmark" program design principle has been repeatedly recognized by CARB and was clearly noted in the 28 August2013 staff presentation (slide 25) when noting that the "Allocation should be independent of ownership structure" and the 7 October 2013 staff presentation (slide 31) when noting "Consistent incentives between on-site and off-site hydrogen production" is a specific CARB policy goal.

   While adherence to this program design principle has been achieved by the current proposal where a common allocation benchmark of 20 allowances/mscf hydrogen applies to both on-site and off-site hydrogen production, we believe alternative allocation approaches, including sharing a common CWB factor and benchmark, would also satisfy

the "one product – one benchmark" principle. Air Products reinforces CARB's commitment to this outcome in any revision to the allocation methodology for hydrogen production.

6. ***Currently Proposed Hydrogen Benchmark is <u>Not</u> Representative of Actual Production Facilities in California; Benchmark Must be Revised to Represent Total Population of Hydrogen Production Plants*** - Air Products marketing research indicates there are 27 "on purpose" gaseous hydrogen production plants in California. However, CARB's current hydrogen production benchmark proposal was derived from only 5-7 "merchant" plants (industrial gas company-owned), a small subset consisting of the newer and more efficient hydrogen production facilities in the state. The result is a benchmark that is biased to a lower value, and therefore not representative of the entire hydrogen production sector.

   A proper benchmark would be derived from the performance curve of **<u>all</u>** 27 *<u>gaseous</u>* hydrogen production facilities in the state, calculated consistent with the methodology employed in the determination of all other product benchmarks. This may require supplementing the data obtained through Mandatory Reporting Rule (MRR), particularly for the on-purpose hydrogen production conducted within refineries. CARB can make a formal data request to fill any data gaps in hydrogen-specific emissions, corrected for steam export, and accounting for only the "on purpose" hydrogen production. [Note: The performance curve for this benchmark derivation would purposefully exclude the performance data of the two liquid hydrogen plants in California; Air Products continues to propose a separate benchmark value for liquid hydrogen production, as discussed below.]

   The benchmark derivation must determine the actual average emission intensity, and then determine the greater of "90% of that average" or the "best of class" of the sector value. The average emission intensity determination can be represented by:

Average Hydrogen Emission Intensity

$$= \frac{\sum_{n=0}^{27} \left(Total\ Hydrogen\ Plant\ Emissions - Export\ Steam\ Emissions - Export\ Power\ Emissions\right)_n}{\sum_{n=0}^{27} \left(On - Purpose\ Hydrogen\ Produced\right)_n}$$

   CARB has stated that is does not have a complete data set for the refinery on-site hydrogen facilities, preventing them from making a determination as noted above. If such a determination directly from California-specific facilities is not feasible, an alternative is to use the Carbon Weighted Barrel (CWB) approach – again for both off-site and on-site hydrogen plants.

7. ***CWB Methodology Could be Employed as an Alternative Approach for the Hydrogen Benchmark*** – Absent the complete and accurate data set of hydrogen plant emissions and production to derive the correct California-specific hydrogen benchmark, the CWB methodology can be employed to yield a benchmark that is

representative of the full population of hydrogen production facilities in the state. This will require treating both refinery on-site and industrial gas company off-site hydrogen production as a CWB production activity, using the CWB values developed by Solomon from the OECD refinery database (e.g. 5.70 CWB/ k scf of SMR-produced hydrogen[1]), and applying a recalculated CWB Benchmark value. Such an approach maintains the "one product – one benchmark" principal, more accurately describes the benchmark curve of gaseous hydrogen production, and avoids redundant allocation of allowances.

While not perfect, use of a common CWB methodology would have the following features:

- The CWB hydrogen factors derived by Solomon from data of approximately 200 OECD refineries represent an un-biased characterization of gaseous hydrogen production – covering a wide range of facility ages, technologies and sizes of plants – more closely reflecting the diversity of California's full 27-plant population. This eliminates the bias of the currently proposed benchmark resulting from using data of the small subset of generally newer and more efficient, off-site hydrogen plants.
- Would properly ***include*** the emissions from raising steam consumed by the refinery in the benchmark calculation while not assigning a production activity (e.g. CWBs) to steam production – consistent with the overall CWB methodology.
- Would properly ***exclude*** the emissions from raising steam which is exported from the refinery, as well as while not assigning a production activity (e.g. CWBs) to steam production – consistent with the overall CWB methodology.
- Would properly exclude the emissions from generating electricity while not assigning a production activity (e.g. CWBs) to electricity generation.
- Would not over-allocate allowances to merchant hydrogen plants. Consistent with all other product-based benchmark development, a benchmark curve should show a distribution of plants – some with efficiency better than their sector average and some with efficiency worse than their sector average. Presuming the benchmark value is set at 90% of that sector average, it is still common that the most efficient plant(s) may receive an allowance allocation approaching their emission compliance obligation, while the least efficient plants may fall well short of their compliance obligation. It is not a flaw, but rather a positive design feature, that a benchmark rewards those entities which made early investments in more efficient process designs and operating methods.
- Would maintain a consistent incentive between on-site and off-site hydrogen production… and all other emission reducing activities. The "cost of carbon", as informed by the market prices of California Compliance Allowances and California Compliance Offsets, ensures there is an equal incentive to increase efficiency for all producers, regardless of ownership.

[1] Solomon Associates, "Report on CWT-CWB for California Regulatory Support", 17 May 2013, page C-3.

Applying the CWB approach to hydrogen production is comparable to combining the refining and hydrogen sectors… where the benchmark includes the combined sum of both their emissions (with appropriate steam and electricity production adjustments) and the combined sum of both their CWB production activity.

The benchmark derivation must determine the actual average emission intensity, and then determine the greater of "90% of that average" or the "best of class" of the sector value. The average emission intensity determination for the combined refining and hydrogen sector can be represented by:

Average Combined Refining and Hydrogen Emission Intensity

$$= \frac{\sum_{n=0}^{n} \ (Adjusted\ Refinery\ CO2\ Emissions)_{\ n} + \sum_{y=0}^{y} \ (Adjusted\ OffSite\ H2\ Plant\ CO2\ Emissions)_{\ y}}{\sum_{n=0}^{n} \ (Refinery\ CWB\ Production)_{\ n} \ + \sum_{y=0}^{y} \ (OffSite\ H2\ Plant\ CWB\ Production)_{\ y}}$$

Where Adjusted Refinery CO2 Emissions =

Total Refinery CO2 Emissions – Refinery Export Steam CO2 Emissions – Refinery Electricity Generation CO2 Emissions

And, Adjusted Offsite Hydrogen Plant Emissions =

Total Offsite H2 CO2 Emissions – Offsite H2 Export Steam CO2 Emissions – Offsite H2 Electricity Generation CO2 Emissions

Export Steam CO2 Emission and Electricity Generation CO2 Emissions can be determined from actual operating/emission data, if available, or estimated using CARB's default Energy-Use Benchmark and Co-generation Emission Distribution values.

And, Refinery CWB Production =

"Process CWB" + "Off-sites and Non-Energy Utilities" + "Non-Crude Sensible Heat"

And, Offsite H2 CWB Production =

Offsite H2 "Process CWB" + Offsite H2 "Off-sites and Non-Energy Utilities" + Offsite H2 "Non-Crude Sensible Heat"

Where "Process CWB", "Off-sites and Non-Energy Utilities" and "Non-Crude Sensible Heat" are as defined in Solomon Report[2]. For Offsite Hydrogen "Process CWB", the CWB factor is 5.70 CWB/k scf. The "Total Input Barrels" and "Non-Crude Input Barrels" terms in the "Off-sites and Non-Energy Utilities" and "Non-Crude Sensible Heat" calculations represent the Fuel Oil Equivalent Barrel[3] of the Offsite Hydrogen Plant feedstock natural gas.

[2] Solomon Associates, "Report on CWT-CWB for California Regulatory Support", 17 May 2013, page 2-10.
[3] Solomon Associates, "Report on CWT-CWB for California Regulatory Support", 17 May 2013, Appendix G, page G-2.

In this manner, all of the relevant emissions from all refining and hydrogen production, and all CWB production from all refining and hydrogen production are included in their respective numerator and denominator to define the combined sector average.

8. ***The Benchmark for Liquid Hydrogen Should be Derived from Just the Specialty Plants that Produce Liquid Hydrogen*** — A separate benchmark should be derived for the production of liquid hydrogen, accounting for the inherent structural differences in the design of production facilities for this product versus gaseous hydrogen production used for refinery application. A benchmark can be derived from historical performance data from the two liquid hydrogen plants in California.

   The market for liquid hydrogen product requires plants be designed at a scale consistent with market demand. Further, plant location will typically be dictated by customer locations and utility pricing (as opposed to gaseous hydrogen plants which are co-located with a "base-load" refinery customer). As such, liquid hydrogen plants do not incorporate the energy integration and heat recovery that is standard in gaseous hydrogen plant designs, reducing the inherent efficiency of the liquid plants.

   Air Products recommends the liquid hydrogen plants be treated as a separate sector when setting the allocation benchmark. This is analogous to CARB's proposed separate treatment of "Atypical Refineries" versus "Typical Refineries". Referencing the 7 October 2013 Workshop slides, comparable considerations are:

   - Liquid hydrogen plants occupy the far tight-hand side of a Benchmark Curve (CARB issued a preliminary benchmark curve for off-site hydrogen production in June 2011), after a recognizable break in the slope of the curve – comparable to the position the Atypical Refineries occupy on the refinery CWB Benchmark Curve (Slide 17).
   - Steam methane reformers serving liquid hydrogen facilities are markedly smaller process units which have less process recycle, crude product recovery and heat integration – comparable to the differences highlighted for Atypical Refineries (Slide 25).
   - Liquid hydrogen production facilities represent a disproportionately small fraction of total emissions from hydrogen production – comparable to the emissions fraction attributed to the Atypical Refineries (slide 26).

   A proper liquid hydrogen benchmark would be derived from the performance data of the two dedicated liquid hydrogen production facilities in the state. This may require supplementing the data obtained through the Mandatory Reporting Rule (MRR). CARB can make a formal data request to fill any data gaps in liquid hydrogen-specific emissions and production.

9. ***Self-Produced and Consumed Electricity in EITE Sectors Must Receive Auction Revenue Benefits Comparable to Grid-Electricity Consumption*** – ARB and California Public Utility Commission (PUC) regulations are intended to return the value of allowances allocated to electricity distribution utilities to designated classes of electricity consumers, inclusive of EITE industries that self-

produce their own power. While details of such a return of allowance value to EITE industries is still under development by the PUC, what is not clear is if such revenue disbursements will be made to EITE industries in the service territories of ***both*** Investor-Owned Utilities (IOUs) ***and*** Publically-Owned Utilities (POUs). If the extent of PUC authority limits revenue disbursements to only those electricity consumers within an IOU service territory, the ARB must make provisions to require the same disbursements from POUs or provide comparable allowances directly to the EITE self-producer.

We stand ready to provide further support to CARB staff in this reconsideration of the refinery and hydrogen benchmark methodologies under the cap and trade program. If you have any questions or need additional information to support Air Products position on these matters, please contact me by phone (610-909-7313) or email adamskb@airproducts.com).

Respectfully,

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