CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

West Los Angeles SmartFuel® Hydrogen Station

Prepared for: California Energy Commission

Prepared by: Air Products and Chemicals, Inc.

Gavin Newsom, Governor

January 2021 | CEC-600-2021-015

California Energy Commission

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Air Products and Chemicals, Inc. would like to acknowledge the following for their support leading to the construction of the West Los Angeles SmartFuel® hydrogen station:

- The California Energy Commission
- The Governor's Office of Business and Economic Development (thanks to Tyson Eckerle for his efforts)
- South Coast Air Quality Management District

Air Products and Chemicals, Inc. also acknowledges the efforts of its engineering and operations teams for their ongoing commitment to safety in the deployment of this hydrogen fueling station.

PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-09-608 to expand the network of publicly accessible hydrogen fueling stations to serve the current population of fuel cell electric vehicles and to accommodate the planned large-scale roll-out of fuel cell electric vehicles commencing in 2015. In response to PON-09-608, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards November 17, 2010 and the agreement was executed as ARV-10-048 on December 21, 2011.

ABSTRACT

Air Products and Chemicals, Inc. designed, engineered, permitted, constructed, and made operational a hydrogen refueling station at 11261 Santa Monica Blvd., Los Angeles, California. The West Los Angeles SmartFuel® hydrogen station was approved for construction on July 11, 2014, and began public fueling in October of 2015. The station receives gaseous hydrogen delivered at elevated pressure from an Air Products and Chemicals, Inc. production facility in southern California. The station is comprised of compression, cooling, and a two-hose dispenser with a customer payment interface are used to refill fuel cell electric vehicles.

Keywords: California Energy Commission, West LA, Air Products and Chemicals, Inc., fuel cell vehicles, hydrogen infrastructure, SmartFuel® hydrogen refueling station

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EXECUTIVE SUMMARY

Hydrogen fuel cell electric vehicles (FCEVs) and hydrogen refueling stations are expected to play key roles in California as the State transitions to lower-carbon and zero-emission vehicle technologies for light-duty passenger vehicles, transit buses, and truck transport fleets. Numerous government regulations and policy actions identify FCEVs as a vehicle technology that will be available to meet the California Air Resources Board's zero-emission vehicle regulation and the Governor's goal of 1.5 million zero-emission vehicles by 2025. More specific actions to bring FCEVs to California markets are specified in the Governor's Zero Emission Vehicle Action Plan.

Hydrogen fuel cell electric drive technology offers tremendous potential for the light-duty passenger vehicle market and medium- and heavy-duty truck and bus markets. FCEV passenger vehicles can drive more than 300 miles on a tank of hydrogen and can be refueled in three to four minutes the way gasoline passenger vehicles are fueled. They have zero tailpipe emissions, while the carbon footprint of these vehicles is nearly the same as plug-in electric vehicles. The technology can be readily scaled up for sport utility vehicles, family passenger vans, pickup trucks, urban package and beverage delivery trucks, and even heavy-duty trucks and buses. Most auto industry analysts and agencies view fuel cell electric drive technology as a complement to battery electric drive technologies rather than as a competing technology. Both battery and FCEV technologies will be needed in California to achieve the zero-emission-vehicle deployment goals.

In contrast to battery electric and plug-in hybrid electric vehicles that can be charged at home, FCEVs require a new network of refueling stations that dispense pressurized hydrogen for consumer use. This has meant that the auto industry and station development industry have had to develop two new technologies in parallel: hydrogen refueling infrastructure and hydrogen FCEVs. FCEVs cannot be widely marketed and sold to consumers without a minimum network of refueling stations available.

Assembly Bill 8 (AB 8, Perea, Chapter 401, Statutes of 2013) reauthorized the original Assembly Bill 118 funding program (Núñez, Chapter 750, Statutes of 2007) and created new legal requirements for the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program. The bill directs the California Energy Commission to allocate up to $20 million per year, or up to 20 percent of each fiscal year's available funding, to develop hydrogen refueling stations "until there are at least 100 publicly available hydrogen-fueling stations in operation in California" (Health and Safety Code 43018.9[e][1]).

The California Energy Commission contributed $844,728 of the total $1,088,848 budget to design, engineer, permit, construct, and make the West Los Angeles SmartFuel® hydrogen station operational.

The site selected for this project is 11261 Santa Monica Blvd., Los Angeles, California (Los Angeles County). A hydrogen refueling station at this location will serve FCEVs in the area. Air Products and Chemicals, Inc. accomplished this goal through the steps outlined below.

Following a period of discussions with the gas station owner, Air Products and Chemicals, Inc. developed a site memorandum of understanding which would enable the company to perform

site design work and to develop permit application packages for siting and operating the hydrogen fueling equipment prior to concluding the lease agreements. This memorandum was executed on December 10, 2012, and the term of the agreement was extended on April 2, 2013. The station lease was then negotiated and formally executed on August 21, 2014.

Air Products and Chemicals, Inc. began the site design efforts with a visit to the station at the end of January of 2012. The site layout evolved from an arrangement where the hydrogen dispenser would be placed in line with one of the gasoline islands to a final design where the dispenser would be located next to the hydrogen equipment. This concept was reviewed and approved by the gas station owner.

Design packages were then completed and submitted to the Los Angeles Department of Building and Safety on June 4, 2013, and discussions began with the Los Angeles Department of Water and Power regarding the process to bring power to the hydrogen station. The Los Angeles Fire Department requested a separate submittal with additional information, and this was provided on June 5, 2013. As part of the permitting process, a review of the California Environmental Quality Act was performed by South Coast Air Quality Management District, and a separate review of the station was required by the City's Department of Transportation. The station design was approved on July 11, 2014.

Air Products and Chemicals, Inc. provided the hydrogen refueling station equipment. Based upon their excellent safety record and prior experience with gas station construction, Air Products and Chemicals, Inc. selected Fueling and Service Technology, Inc. as the construction contractor. Construction started on October 20, 2014. Vent lines (not shown on site drawings) from the existing underground gasoline storage tanks were found in the planned equipment area and had to be relocated. Construction of the West Los Angeles SmartFuel® hydrogen station was completed on April 9, 2015.

The process of making the West Los Angeles SmartFuel® hydrogen station operational began on May 1, 2015 and was completed on October 26, 2015. Approval of the hydrogen dispenser for retail operations by the California Department of Measurements and Standards was received on July 29, 2015. Following automaker testing which concluded in September, initial use of the West Los Angeles SmartFuel® hydrogen station by retail customers occurred in October of 2015.

The West Los Angeles SmartFuel® hydrogen station can dispense 100 kilograms per day with daily deliveries. The station has the potential to contribute to the reduction of greater than 620 metric tons of greenhouse gas emissions and greater than 36,500 gallons of gasoline consumption annually.

CHAPTER 1:
Station Design and Construction

1.1 Project Timeline

This section highlights the most critical items related to the development of the West Los Angeles hydrogen station, provides detail on each, and states the timing required for each step for this particular site.

1.1.1 Site Acquisition (January 2012 – August 21, 2014)

Following the kick-off of Grant Agreement ARV-10-048, Air Products and Chemicals, Inc. (Air Products) began discussions with the gas station owner regarding the hydrogen fueling station project. In November of 2012, Air Products developed a site memorandum of understanding which would enable Air Products to perform site design work and to develop permit application packages for siting and operating the hydrogen fueling equipment prior to concluding the lease agreements. This memorandum was executed on December 10, 2012, and the term of the agreement was extended on April 2, 2013.

A template for a property lease agreement was provided by Air Products on February 25, 2013. The station lease was then negotiated and formally executed on August 21, 2014.

1.1.2 Site Design and Engineering (January 24, 2012 – June 4, 2013)

Air Products began the site design efforts with a visit to the station at the end of January of 2012. A preliminary site layout was then generated and reviewed with planning officials in Los Angeles on April 20, 2012. Feedback from the planning office was positive, and Air Products used this information in the development of an architectural drawing for the station. Figure 1 provides the initial equipment arrangement drawing for the West Los Angeles SmartFuel® hydrogen station.

As additional information on the equipment components became available, Air Products updated the internal basis for the site design for the station. Given these changes, a site visit was held on July 18, 2012 with representatives from Air Products' project management, program management distribution safety teams to assess the means to safely deliver hydrogen while minimizing impacts to the ongoing gas station/convenience store activities.

In October of 2012, the latest revision to the equipment arrangement drawing was prepared for internal review, and changes were made based upon the latest equipment design information. These updated drawings were then reviewed with the operations manager for the gas station. Beginning in December of 2012, two firms were hired to perform the architectural, electrical, and mechanical designs for the hydrogen fueling station. An updated equipment arrangement drawing was then prepared, and this revision was reviewed with the Fire Marshal for the City of Los Angeles on April 17, 2013. The Fire Marshal agreed with the concepts regarding the equipment arrangement and also approved the option of installing the hydrogen dispenser in place of one of the existing gasoline dispensers. During a site visit following this meeting, an alternative layout was then developed which would locate the hydrogen dispenser adjacent to the hydrogen equipment. This option would provide excellent access for fuel cell vehicles and minimize disruption to the gas station during construction. This concept was

reviewed and approved by the gas station owner, and Figure 2 provides the equipment arrangement drawing prepared by S. Gordin Structural Design and Engineering Services, Inc. which includes the updated location for the hydrogen dispenser.

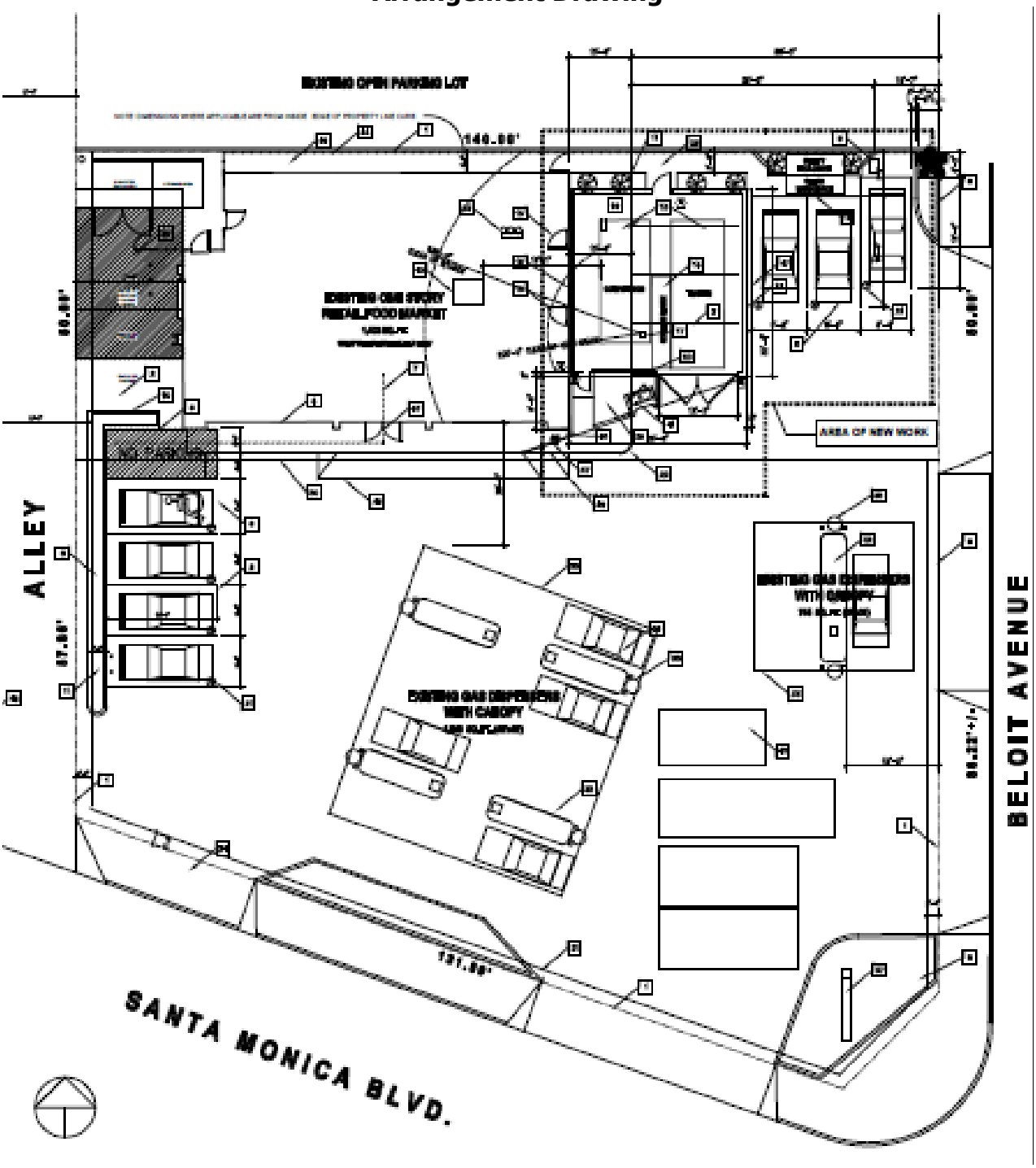
In parallel with these activities, a separate review pertaining to the California Environmental Quality Act was performed by South Coast Air Quality Management District. Documents were filed in February of 2013 and no issues were identified.

Structural and electrical designs were then initiated, and design packages were completed on June 4, 2013. With the completed equipment arrangement drawing, discussions could begin with the Los Angeles Department of Water and Power regarding the process to bring power to the hydrogen station.

Figure 1: West Los Angeles SmartFuel® Hydrogen Station Initial Equipment Arrangement

Source: Air Products and Chemicals, Inc.

Figure 2: West Los Angeles SmartFuel® Hydrogen Station Updated Equipment Arrangement Drawing



Source: Air Products and Chemicals, Inc.

1.1.3 Equipment Procurement (January 2012 – April 2014)

Immediately after execution of the Grant Agreement, Air Products began the equipment design and procurement activities for the eight sets of SmartFuel® hydrogen station equipment that would be deployed as part of the overall project. A draft scope of work for the equipment design efforts was prepared in April of 2012. Purchase orders for long-lead items began to be issued in the summer of 2012, and the design team to fabricate a prototype of

several of the key containerized components; any lessons learned from this effort could then be used in the design and fabrication of the remaining units.

The component with the longest lead time was the high-pressure storage vessels which are critical components to the hydrogen fueling process. At the time of project execution, only one vendor could provide these tubes. The first set of vessels was delivered to Air Products in June of 2013, and the remaining tubes were shipped beginning in April of 2014.

1.1.4 Entitlement Process

The City of Los Angeles did not require a zoning review of the addition of hydrogen equipment to the gas station in West Los Angeles.

1.1.5 Permit Process (June 4, 2013 – July 11, 2014)

Air Products submitted the structural and electrical plans to the Los Angeles Department of Building and Safety on June 4, 2013. The Los Angeles Fire Department requested a separate submittal with additional information, and this was provided on June 5, 2013. Feedback from all agencies was received in September of 2013, and updates were reviewed with the gas station owner to clarify the location of the hydrogen dispenser relative to the convenience store. Air Products and then met with Los Angeles Fire Department on October 22, 2013 and was instructed to file the current drawings for permit review. Separate submittals were then made on November 14, 2013 for structural, electrical and fire department review. During this time, the application for new electrical service was submitted to Los Angeles Department of Building and Safety.

As part of the next phase of permitting, a separate review of the station was required by the City's Department of Transportation. This was completed in late March of 2014. The Los Angeles Department of Water and Power also completed their design for supply of electricity at this time, which allowed for the electrical design to be finalized.

The entire design package for the West Los Angeles station was then updated. The structural plans were approved in May of 2014, and the electrical design was approved in July of 2014. The Los Angeles Department of Building and Safety formally approved the station design on July 11, 2014.

1.1.6 Construction Process (October 20, 2014 – April 9, 2015)

Following a bid process, Air Products executed the construction subcontract to Fueling and Service Technology, Inc. on August 21, 2014. Fueling and Service Technology, Inc. has an excellent safety record and had prior experience in gas station construction. Construction started on October 20, 2014. These included modifications within the convenience store as specified in the approval from the Los Angeles Department of Building and Safety. Vent lines (not shown on site drawings) from the existing underground gasoline storage tanks were found in the planned equipment area; an additional permit was needed from the Los Angeles Fire Department to relocate the lines. Hydrogen compression, cooling, and dispensing equipment was delivered to the site on February 12, 2015. Completion of construction, as reflected by final sign-off of the site by the Los Angeles Department of Building and Safety, took place on April 9, 2015.

1.1.7 Making the Station Operational (April 3, 2015 – April 30, 2015)

Following the completion of construction, commissioning activities were undertaken by Air Products' engineering and operations staff. Initial equipment operation, hydrogen sampling,

and test fills into an Air Products test tank were performed during this time. The initial fills of automaker FCEV's took place on April 9, 2015.

1.1.8 Station Declared Operational (May 1, 2015 – October 26, 2015)

Automakers continued test fills at the West Los Angeles SmartFuel® hydrogen station following completion of initial start-up activities. During this period, Air Products procured and installed a point-of-sale system to allow for fueling transactions to be processed using credit or fleet payment cards. Once this system was installed, final test fills were performed in October of 2015. Notification that the West Los Angeles SmartFuel® station was ready for retail operation was provided by the Governor's Office of Business and Economic Development on October 26, 2015.

1.1.9 Division of Measurement Standards Certification (July 29, 2015)

The California Department of Food and Agriculture's Division of Measurement Standards (DMS) is responsible for enforcing California weights and measures laws and regulations and must certify any device used for metering the sale of commercial items within California. The permanent DMS approval was received for the West Los Angeles SmartFuel® hydrogen station on July 29, 2015. Figure 3 provides a photograph of the dispenser with the DMS stickers in place.

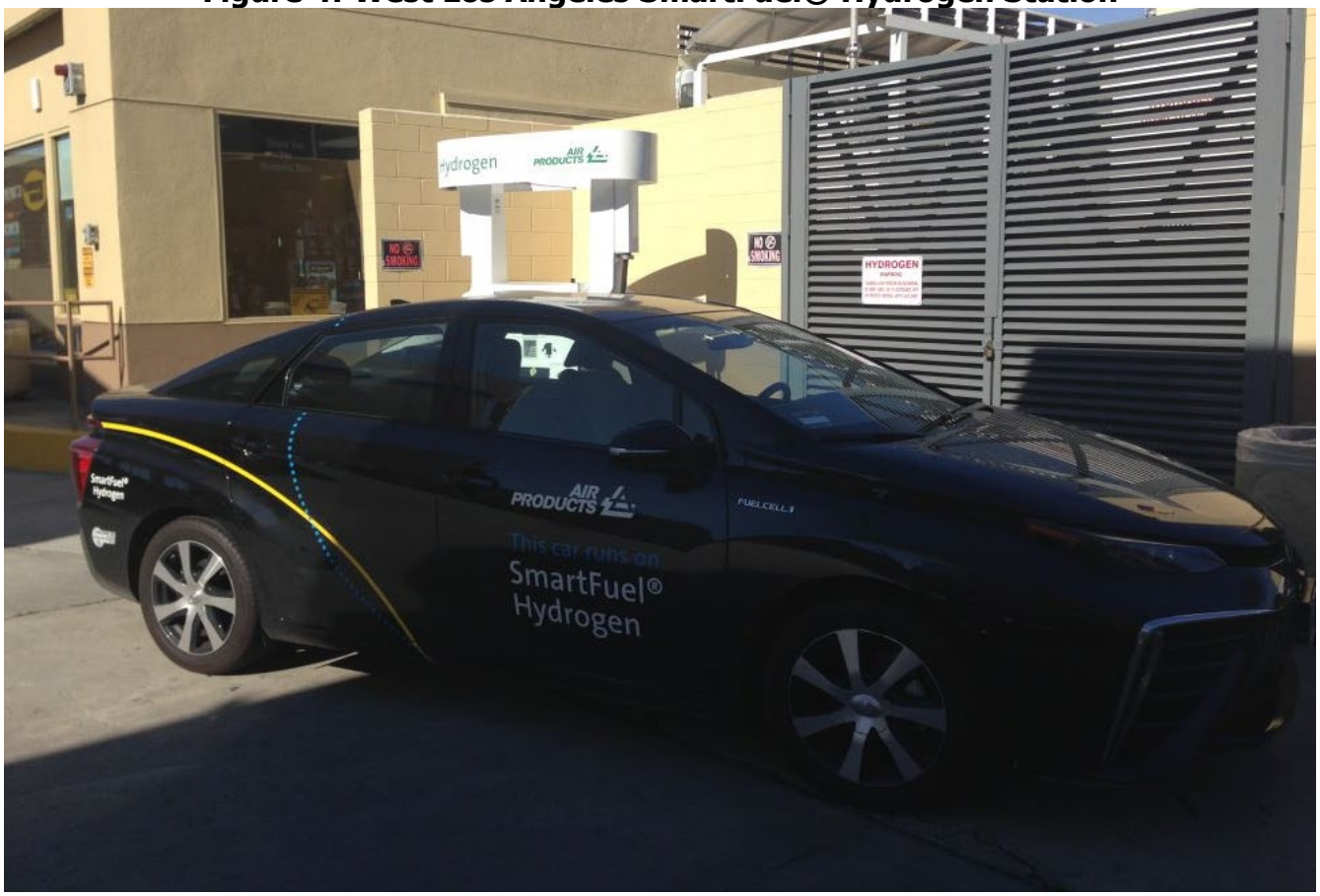
Figure 3: West Los Angeles SmartFuel® Dispenser following DMS Certification

Source: Air Products and Chemicals, Inc.

1.1.10 Customer Usage (October 2015 – Present)

The first public customer fueled at the West Los Angeles SmartFuel® station in late October of 2015, and the station has been used regularly since then. Dispensed volumes totaled 168 kilograms in January of 2016, 281 kilograms in February of 2016, and 230 kilograms in March of 2016. A photograph of a Toyota FCEV fueling at the West Los Angeles SmartFuel® hydrogen station is provided in Figure 4.

Figure 4: West Los Angeles SmartFuel® Hydrogen Station

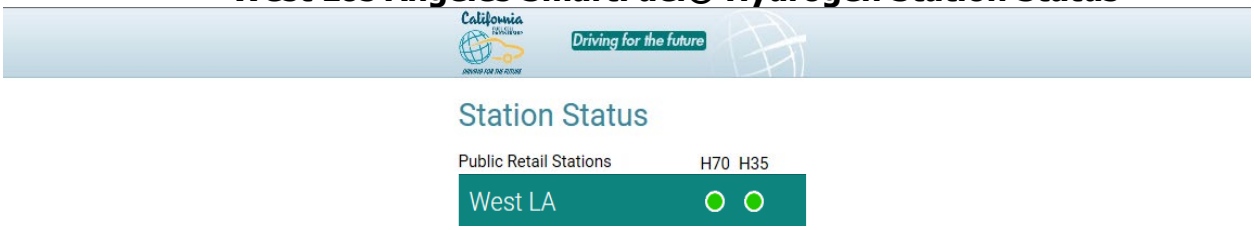


Source: Air Products and Chemicals, Inc.

1.1.11 Station Online Status System Activated (October 29, 2015)

The California Fuel Cell Partnership Station Online Status System provides regularly updated station status information to fuel cell vehicle drivers. Air Products has provided California Fuel Cell Partnership station status information regarding its stations since the inception of Station Online Status System. The West Los Angeles station was added to Station Online Status System on October 5, 2016. A screenshot of the Station Online Status System network that includes the West Los Angeles SmartFuel® hydrogen station is shown in Figure 5.

Figure 5: California Fuel Cell Partnership Station Online Status System Showing West Los Angeles SmartFuel® Hydrogen Station Status



Source: Air Products and Chemicals, Inc.

The station is open and active.

1.2 Environmental Impacts

Hydrogen is stored as a compressed gas in an above-ground tank concealed behind a wall at this station. Hydrogen is nontoxic, colorless, and odorless, so hydrogen station equipment is

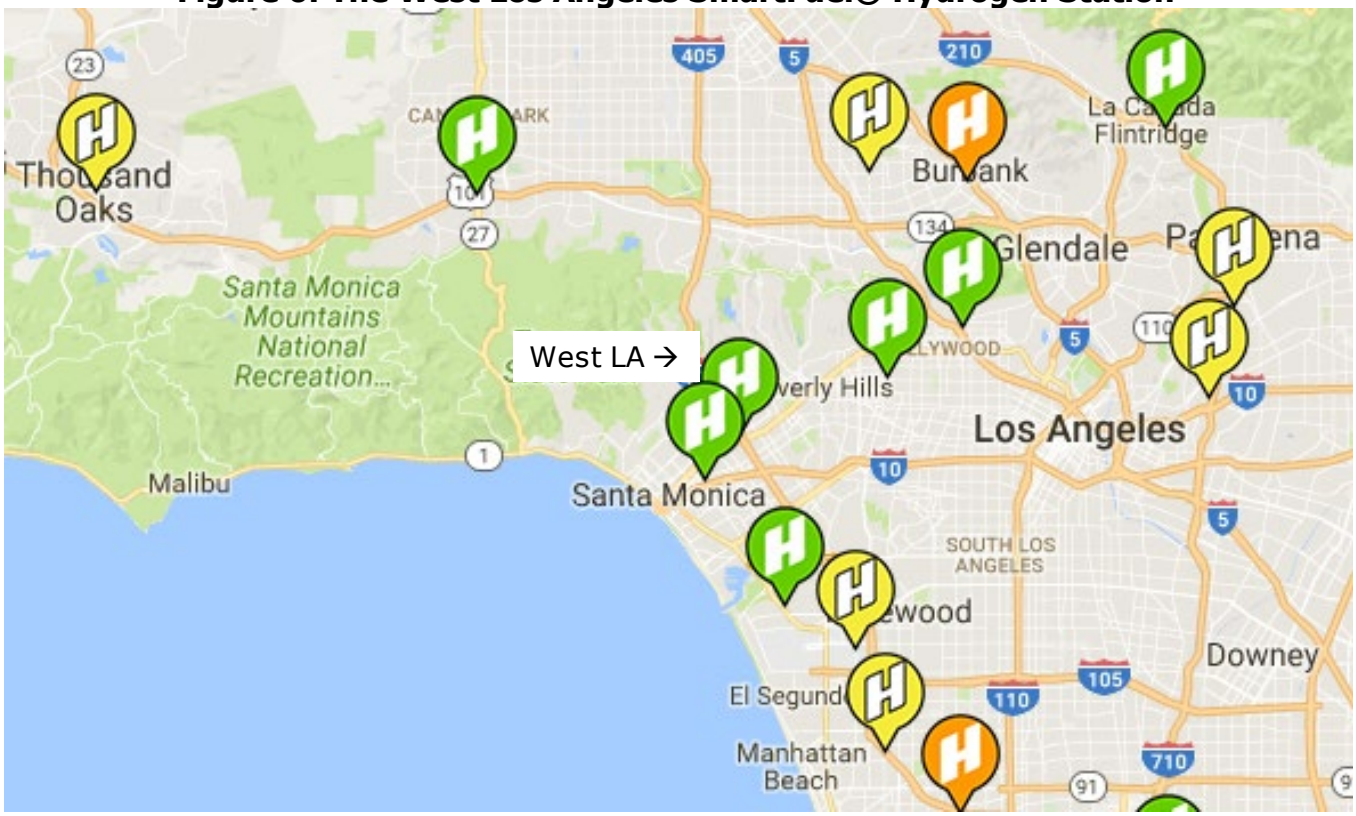
outfitted with appropriate sensors to provide immediate notification in case a leak occurs. No solid or liquid waste will be produced at this site.

There was no additional landscaping added for the construction of the hydrogen refueling station, and, therefore, no additional irrigation water will be consumed.

1.3 West Los Angeles SmartFuel® Hydrogen Station in the Network

Figure 6 shows the location of the West Los Angeles SmartFuel® hydrogen station at 11261 Santa Monica Blvd. in relation to other stations in the Southern California network.

Figure 6: The West Los Angeles SmartFuel® Hydrogen Station

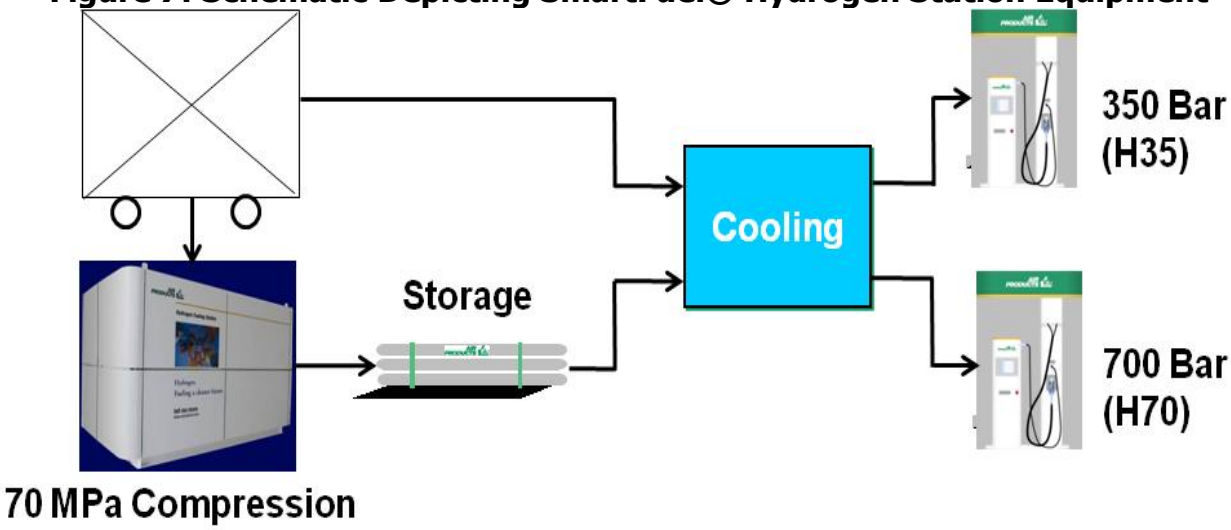


Source: Air Products and Chemicals, Inc. Map courtesy of California Fuel Cell Partnership.

1.4 Schematic Layout of the West Los Angeles SmartFuel® Hydrogen Station

As shown below, Figure 7 depicts an overview of the West Los Angeles SmartFuel® hydrogen station components. Hydrogen is produced by Air Products at a central fill system located in southern California, and the gas is delivered by a high-pressure tube trailer. Hydrogen is compressed as needed to fill the high-pressure storage tubes that are integral in providing a full fill to fuel cell vehicles that use the H70 nozzle. Gas is taken from storage and cooled based on the dispenser programming that meets the Society of Automotive Engineers J2601 fueling protocol; Air Products has patents which cover elements of the station operation and the dispensing process.

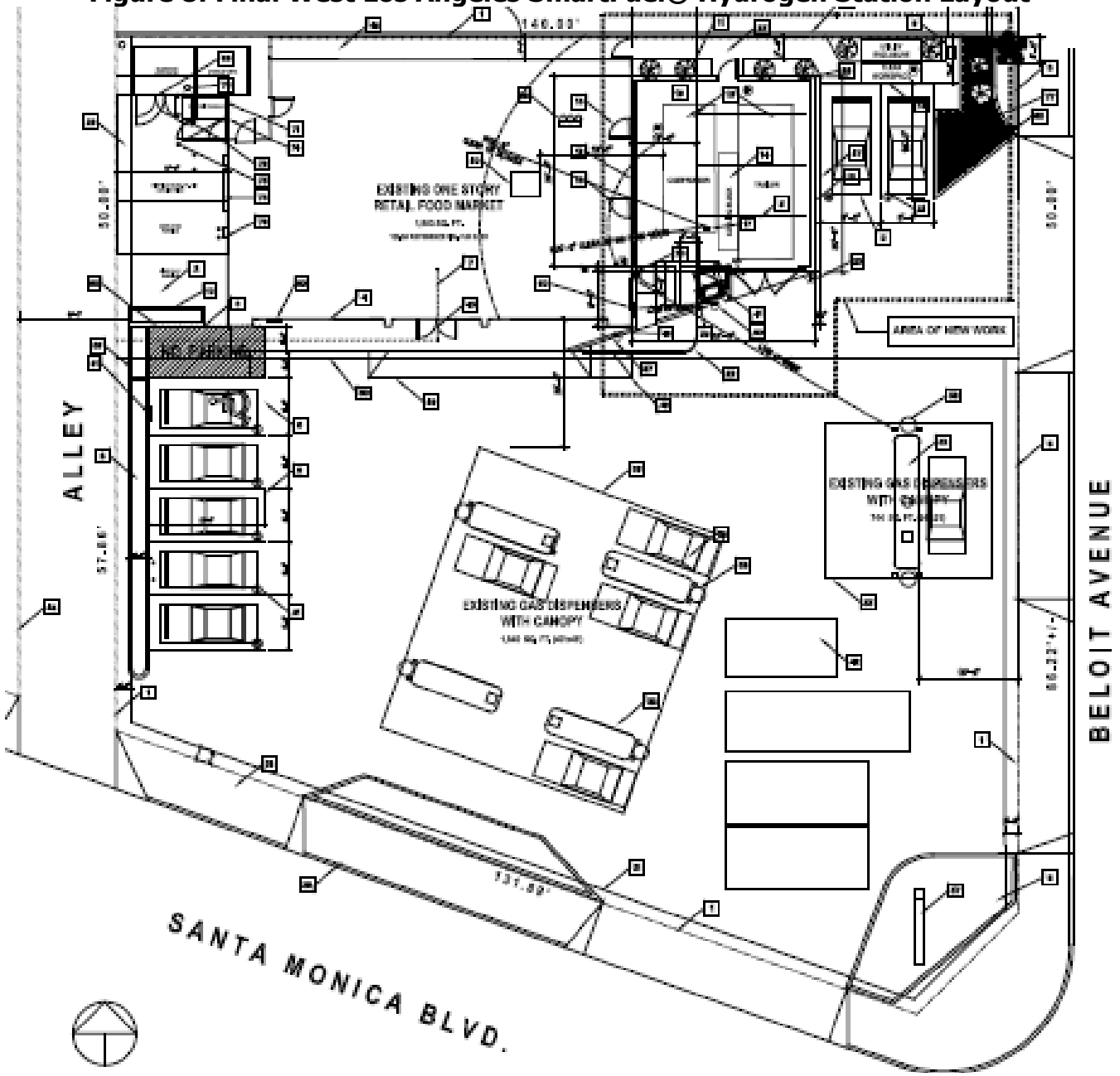
Figure 7: Schematic Depicting SmartFuel® Hydrogen Station Equipment



Source: Air Products and Chemicals, Inc.

Figure 8 shows a detailed view of the actual final, as-built configuration of the West Los Angeles SmartFuel® hydrogen station.

Figure 8: Final West Los Angeles SmartFuel® Hydrogen Station Layout



Source: Air Products and Chemicals, Inc.

Table 1: List of Subcontractors and Grant Agreement Budget

Company / Contribution	Grant Agreement
Air Products and Chemicals, Inc., Allentown, Pennsylvania / H2 Station Equipment	$855,400
Fueling and Service Technology, Inc., Buena Park, California / Construction	$206,040
S. Gordin Structural Design & Engineering Services, Inc., Carson City, Nevada / Design and Permitting Process	$27,408
Total Budget	**$1,088,848**
California Energy Commission Grant	$844,728
Air Products and Chemicals, Inc. Cost Share	$244,120
Total California Energy Commission Cost Share	78%

Source: Air Products and Chemicals, Inc.

CHAPTER 2:
Data Collection and Energy Analysis

The West Los Angeles SmartFuel® hydrogen refueling station is supplied by hydrogen generated via steam methane reformation that converts methane (CH4) and water (H2O) to hydrogen (H2) and carbon dioxide (CO2) and along with an equilibrium amount of carbon monoxide (CO):

Steam/Methane Reforming Reaction $CH_4 + H_2O + Heat \Leftrightarrow CO + 3H_2$

Water-Gas Shift Reaction $CO + H_2O \Leftrightarrow CO2 + H_2 + Heat$

Per California Senate Bill 1505 (Lowenthal, Chapter 877, Statutes of 2006) and PON-09-608, which funded this project, at least one-third of the hydrogen dispensed will be produced from renewable energy sources.

Hydrogen is supplied to the hydrogen fueling station from Air Products' hydrogen production facilities in Wilmington / Carson, California. Renewable biogas is being procured as feedstock for the facilities, resulting in delivered hydrogen product that meets the 33 percent renewable requirements.

Air Products has a contract for sourcing the renewable biogas that meets Public Resources Code Section 2574(b)(1); documentation is provided in Figure 9. Although California has a substantial amount of biogas, local supply cannot be injected into California pipelines under California Health and Safety Cost Section 25420. Air Products' biogas supply for this project is sourced outside California and transported to California with connection to a natural gas pipeline within the Western Electricity Coordinating Council region that delivers gas into California.

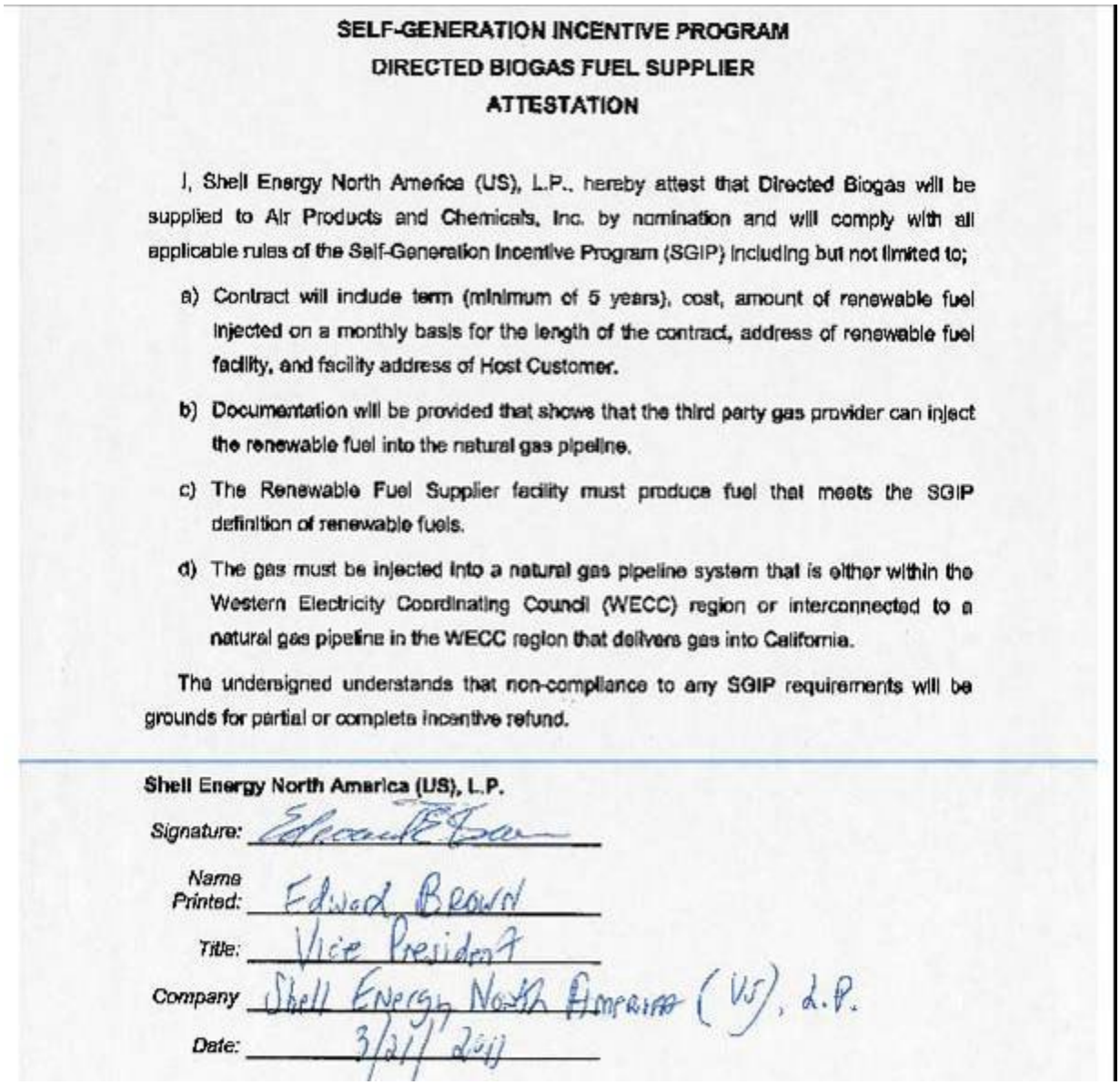
Figure 9: Documentation of Biogas Sources

Exhibit A
RB Supply Sources
Shell Energy North America (US), L.P.

Supply Source	Address	Pipeline/LDC	Receipt	Delivery
Greentree Landfill	635 Toby Road Kersey, PA 15846	National Fuels Gas TETCO NGPL EPNG Socal Gas FAR	Landfill meter Nat Fuel-Bristoria Tetco-Sweet Lake 3825 EPNG Jal 3083 Topock	Bristoria NGPL-Sweet Lake EPNG Jal 3083 Topock Socal Citygate
Imperial Landfill	11 Boggs Road Imperial, PA 15126	National Fuels Gas TETCO NGPL EPNG Socal Gas FAR	Landfill meter Nat Fuel-Bristoria Tetco-Sweet Lake 3825 EPNG Jal 3083 Topock	Bristoria NGPL-Sweet Lake EPNG Jal 3083 Topock Socal Citygate

Source: Air Products and Chemicals, Inc.

Figure 10: Self-Generation Incentive Program Directed Biogas Fuel Supplier Attestation



SELF-GENERATION INCENTIVE PROGRAM

DIRECTED BIOGAS FUEL SUPPLIER

ATTESTATION

I, Shell Energy North America (US), L.P., hereby attest that Directed Biogas will be supplied to Air Products and Chemicals, Inc. by nomination and will comply with all applicable rules of the Self-Generation Incentive Program (SGIP) including but not limited to;

a) Contract will include term (minimum of 5 years), cost, amount of renewable fuel injected on a monthly basis for the length of the contract, address of renewable fuel facility, and facility address of Host Customer.

b) Documentation will be provided that shows that the third party gas provider can inject the renewable fuel into the natural gas pipeline.

c) The Renewable Fuel Supplier facility must produce fuel that meets the SGIP definition of renewable fuels.

d) The gas must be injected into a natural gas pipeline system that is either within the Western Electricity Coordinating Council (WECC) region or interconnected to a natural gas pipeline in the WECC region that delivers gas into California.

The undersigned understands that non-compliance to any SGIP requirements will be grounds for partial or complete incentive refund.

Shell Energy North America (US), L.P.

Signature: Edward E Beard

Name Printed: Edward Beard

Title: Vice President

Company Shell Energy North America (US), L.P.

Date: 3/21/2011

Source: Air Products and Chemicals, Inc.

Hydrogen is delivered to the West Los Angeles SmartFuel® hydrogen refueling station by a Department of Transportation-certified high-pressure delivery trailer.

For an analysis on greenhouse gas emissions, the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model for gaseous hydrogen has been appended with calculations to deliver compressed hydrogen gas with 33.3 percent renewable energy content from a large central hydrogen production facility to a cluster of fuel cell stations in Southern California. For the hydrogen supply pathway and hydrogen fueling station, the lifecycle emission of hydrogen energy supply is estimated at 80.1 grams of carbon dioxide equivalent (CO2e) per megajoule on a full well-to-wheels basis. The California Air Resources Board's Low Carbon Fuel Standard lifecycle emissions estimate for a similar pathway for compressed hydrogen from central reforming of natural gas (Low Carbon Fuel Standard Pathway HYGN005) is 88.3 grams CO2e / megajoule. In factoring in an Energy Efficiency Ratio of 2.5 for FCEV's established under California's Low Carbon Fuel Standard the resulting emissions

performance for FCEVs is 157 grams CO2e / mile. In comparison to a Low Carbon Fuel Standard light-duty gasoline vehicle baseline, the hydrogen supply pathway results in a 61 percent reduction in wheel-to-wheel greenhouse emissions relative to California gasoline.

Relating to the West Los Angeles SmartFuel® hydrogen refueling station, this level of relative greenhouse gas reduction to the Low Carbon Fuel Standard 2016 baseline for gasoline vehicles each FCEV deployed in the market will reduce greenhouse gas emissions by 4.3 metric tons per year. The station has the potential to contribute to the reduction of greater than 620 metric tons of greenhouse gas emissions and greater than 36,500 gallons of gasoline consumption annually. The long-term greenhouse gas and petroleum reduction that could be realized by widespread adoption of FCEVs in the marketplace is enormous.

CHAPTER 3:
Statement of Future Intent

Air Products has executed an initial 3-year lease with the landowner through August 31, 2017, with annual options to extend.

Data on the operation of the station will be collected and reported to the California Energy Commission throughout the term of operations and maintenance under Grant Agreement ARV-15-036.

As part of its ongoing support to hydrogen fueling stations in California, Air Products has a fully staffed operations department which can address station maintenance and emergency situations. Air Products utilizes a 24-hour Equipment Support Team to monitor for alarms from the hydrogen station (in addition to any local alarms at the point of use). Air Products employs technicians in the Los Angeles Basin area that are trained in the specialized requirements for hydrogen fueling stations.

CHAPTER 4:
Findings, Conclusions, and Recommendations

The following is a list of important findings from the West Los Angeles SmartFuel® hydrogen station project:

- Detailed definition of equipment components is needed to complete the site design work.
- In order to shorten the time needed to permit a hydrogen fueling station, both the applicant and the various agencies responsible for review and approval must provide timely and complete responses to correspondence between the parties.
- The hydrogen station equipment at West Los Angeles has common components to other stations supplied by Air Products. This helps to increase the efficiency of the project management process.

GLOSSARY

AIR PRODUCTS AND CHEMICALS INCORPORATED (APCI or Air Products)—Provides industrial gases and related equipment to dozens of industries, including refining, chemical, metals, electronics, manufacturing, and food and beverage. Air Products is also the world's leading supplier of liquefied natural gas process technology and equipment.

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The CEC's five major areas of responsibilities are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.
5. Planning for and directing state response to energy emergencies.

Funding for the CEC's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.

CARBON DIOXIDE (CO2)—A colorless, odorless, nonpoisonous gas that is a normal part of the air. Carbon dioxide is exhaled by humans and animals and is absorbed by green growing things and by the sea. CO2 is the greenhouse gas whose concentration is being most affected directly by human activities. CO2 also serves as the reference to compare all other greenhouse gases (see carbon dioxide equivalent).

CARBON DIOXIDE EQUIVALENT (CO2e)—A metric used to compare emissions of various greenhouse gases. It is the mass of carbon dioxide that would produce the same estimated radiative forcing as a given mass of another greenhouse gas. Carbon dioxide equivalents are computed by multiplying the mass of the gas emitted by its global warming potential.

CARBON MONOXIDE (CO)—A colorless, odorless, highly poisonous gas made up of carbon and oxygen molecules formed by the incomplete combustion of carbon or carbonaceous material, including gasoline. It is a major air pollutant on the basis of weight.

DIVISION OF MEASUREMENT STANDARDS (DMS)—Enforcer of California's weights and measures laws and regulations. The DMS's activities are designed to ensure the accuracy of commercial weighing and measuring devices; verify the quantity of both bulk and packaged commodities; and enforce the quality advertising, and labeling standards for most petroleum products.[1]

[1] California Department of Food and Agriculture (https://www.cdfa.ca.gov/dms/)

FUEL CELL ELECTRIC VEHICLE (FCEV)—A zero-emission vehicle that runs on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.

HYDROGEN (H2)—A colorless, odorless, highly flammable gas, the chemical element of atomic number 1.

METHANE (CH4)—A light hydrocarbon that is the main component of natural gas and marsh gas. It is the product of the anaerobic decomposition of organic matter and enteric fermentation in animals and is one of the greenhouse gases.