

March 16, 2015

SCAQMD CONTRACT NO. C10482

MSRC CONTRACT NO. MS07022A

FINAL REPORT

SUBMITTED BY

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

HYDROGEN RESEARCH & FUELING FACILITY



SCAQMD Officer:

Mr. Joseph Impullitti

South Coast Air Quality Management District

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South Coast Air Quality Management District/MSRC

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Reporting Time Period

This final report is submitted March 16, 2015.

Acknowledgements

CSULA acknowledges Mr. Joseph Impullitti of SCAQMD, Mr. Matthew Mackenzie of MSRC, and the Board and Executive leadership of these organizations for their steadfast patience and commitment to the project. This report is submitted in fulfillment of SCAQMD contract # C10482 and MSRC contract # MS07022A.

Disclaimer

The statements and conclusions of this report are those of the Contractor (CSULA) and not necessarily those of the South Coast Air Quality Management District (SCAQMD) or the Mobile Source Air Pollution Reduction Review Committee (MSRC). The mention of commercial products, their sources or their uses

in connection with material reported is not to be construed as either an actual or implied endorsement of such products.

Project Description & Work Performed

The CSULA Hydrogen Station was constructed by design-builder Weaver Electric, Inc., and a turn-key facility was to be delivered to Contractor. In July, 2011, with the Station approximately 95% completed, a construction dispute arose between Contractor and its design-builder. Pressure pulsations in the hydrogen gas were discovered during vehicle fueling events, and auto manufacturers refused to utilize the station. The dispute concerned both the required technical solution and responsibility for the defect, and effectively halted commissioning of the station for over two years. Contractor was compelled to take remedial measures, and hired both a full time Station Manager and Station Technician to assist with moving the project forward. Thereafter, Contractor was compelled to proceed unilaterally to achieve an engineering solution. Sub-contractors of the original design-builder were brought back to work, and a plan was developed to fix the station. In April of 2014, four (4) high pressure storage tanks were procured from Europe, and installed with associated piping, safety devices, vents, controls, programming, etc. The tanks arrangement provided a “buffer volume” in the high pressure gas stream, and the hydrogen pressure pulsations were successfully eliminated. This modification, along with the repair of other plant defects, finally allowed for vehicles to be fueled at both 350 and 700 bar protocols in April, 2014. A station dedication event was held on May 7, 2014.

Following dedication, approximately 250 successful fueling events, equipment repairs and testing were conducted. Moreover, several recent accomplishments demonstrate that Contractor has delivered an operational station:

- October 23, 2014 the station received DMS Temporary Approval to sell by the kilogram; a 5% tolerance sticker for both 350 and 700 bar dispensing was issued.
- November 12, 2014 the station made the first sale of hydrogen by the kilogram under CA DMS approval.
- January 8, 2015 the station became the first in California history to receive Permanence Type Approval of its hydrogen fuel dispenser for sale of hydrogen by the kilogram; a 5% tolerance

sticker for 350 bar and 10% tolerance for 700 bar dispensing were issued. Per CA DMS, this is also believed to be the first the Nation. (see "Exhibit A").

- On or about January 15, 2015, the station entered into a fully executed fueling contract with Hyundai Motors America (HMA), and on January 22, 2015 made its first fuel sale by the kilogram for a Lessee of the Hyundai Tucson FCEV.

The instant report is submitted in light of this performance.

In summary, all major project milestones are completed, including "Equipment Design & Selection", "Site Development and Permitting", and "Construction and Installation." In specific compliance with Contract Attachment 3, the following work has been accomplished:

A. Contractor installed the Station at the agreed upon CSULA location, on Circle Drive adjacent to the parking lot designated as "Lot 9".

B. Contractor included the required new equipment:

- Hydrogenics electrolyzer capable of producing 60kg hydrogen per day, including water supply and filtration equipment and chillers.
- Three (3) compressors- one (1) PDC and two (2) Hydropac.
- ASME storage vessels providing storage for 60kg hydrogen.
- One dual hose dispenser capable of fueling vehicles at both 5,000 and 10,000 psig, respectively.
- Multi-card reader capable of accepting payment via MasterCard and Visa (reader for both the 5,000 and 10,000 dispensers; embedded).
- All accessories to include breakaways, hose vent valves, nozzles, hoses, etc.

(see "Exhibit B" photographs of above equipment)

C. Contractor worked with permitting agencies of the jurisdiction to ensure that approvals of all building permits, inspections and other requirements were completed.

D. Contractor installed the Station with a HAZOP safety analysis provided by its licensed design-engineer, and incorporated the fire protection, fire detection and other safety elements recommended therein. The HAZOP safety analysis is posted on-site and available on request.

E. Work planned for next reporting period includes upgrading of the station dispenser programming to achieve strict compliance with NFPA leak test requirements. Although the station conducts leak testing and has multiple levels of safety protection, these improvements must be made in

order to place the station in full automatic operation and available for 24/7 operation. The station is currently operating under an attended fueling protocol with limited hours of operation, with full approval of the State Fire Marshal. At the request of two OEM's, the station is also being upgraded with construction and installation of a dew point, moisture analyzer panel. Work is also underway towards the future acquisition of Fuel Cell Shuttle Buses for service to the campus community.

F. Overall project cost details are provided with this final commissioning report (see "Exhibit C").

G. Data acquisition capabilities have been achieved with the installation of advanced power metering, flow measurement and computing equipment. Data acquisition and analysis will be provided as soon as possible.

H. Promotion of the station has been underway for the past two years. The attached Public Outreach Plan details many of these efforts (see "Exhibit D").

Problems Encountered

See above project description.

Many problems arose with the commissioning of the station. Because the station is still involved in a dispute with the original General Contractor, Contractor refrains from detailed commentary in this regard. However, it is fair to say that for a significant period, it was unclear how to remedy the hydrogen pulsation problem. This problem was remedied with the installation of the high pressure buffer tanks system. Limited vendor pools, parts availability and turn-around times continue to pose challenges. Hopefully these issues will diminish with the proliferation of more infrastructure and advancement of hydrogen infrastructure technology.

Emissions Benefits

Not applicable, as no emissions credits are associated with instant project.

Photographs & Outreach

SCAQMD and MSRC are prominently noted on a list of station donors and contributors beside the station fueling dispenser. Contractor will display additional decals as approved and required.



The station has hosted approximately 2500 visitors since the Grand Opening in May, 2014. International guests have travelled from China, Korea, Japan, Germany, Russia, Scotland and other reaches.

In addition, the station is forming collaborative relationships with other area schools and universities to leverage the station for educational purposes. The station has a visitor gallery, which enables the public to view the major components of a hydrogen station, how they work, and how they are integrated. Frequent tours provide opportunities to teach the public about progress with hydrogen as an alternative fuel.

Summary and Conclusions

The construction and commissioning of the CSULA Hydrogen Station has been extremely challenging. However, it has made history with both the first DMS approved sale of hydrogen by the kilogram, and the first Permanence Type Approval of a hydrogen dispenser in California (and the U.S., according to CA DMS). The station has rapidly become a centerpiece of the California hydrogen infrastructure movement, and is providing surprising educational and outreach opportunities.

Contractor therefore requests distribution of funding as awarded, under both the SCAQMD and MSRC contracts herein.

Please advise if any comments, questions or changes are requested for this report.

Respectfully submitted,

A handwritten signature in blue ink that reads "Michael G. Dray". The signature is fluid and cursive, with the first name "Michael" and last name "Dray" clearly legible.

Michael G. Dray, Esq.

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EXHIBIT A

First California Division of Measurements and Standards
Permanence Type Approval of a Hydrogen Fueling Dispenser



EXHIBIT B



Left: Electrolyzer, three compressors, storage banks and H2 chiller

Center: 700 Bar H2 dispenser and card reader

Right: 350 Bar H2 dispenser and card reader

Hydrogen Fueling Station Payment Sorted List

Hydrogen Fueling Station

"EXHIBIT C"

Workorders/Requisitions											
Date	Submit Date	PR#	Contractor	Scope	Encumbered	Payments	O/S Amount				
10/13/10	10/15/10	3929	APSI Construction Management	Schedule Review	7,890.00	(5,660.00)	2,230.00				
08/21/13			ARC cost transfer/ETPLCON166	Printing	98.74	(98.74)	0.00				
09/20/11	09/20/11	7447	AT&T Datacomm	Data Switches	9,628.76	(9,628.76)	0.00				
03/16/12	03/18/12	9264	AT&T Datacomm	Data Switches	736.23	(736.23)	0.00				
09/01/10		3528	Brandow & Johnston Assoc.	Seismic Review	5,493.00	(5,493.00)	0.00				
03/28/14	03/31/14	18379	Broadlux, Inc.	Card Reader	12,082.94	(10,331.03)	1,751.91				
11/16/10		4171	Cal State Rent A Fence	Fencing	686.08	(686.08)	0.00				
03/28/14	03/31/14	18378	Chaincontrols.com	Controls	7,350.00	(7,350.00)	0.00				
04/28/10			Contract Mgmt Services		92,114.00	(92,114.00)	0.00				
08/08/14	08/11/14	20266	COSCO Fire Protection, Inc.	Fire Protection	15,000.00	(15,000.00)	0.00				
06/14/10			CSU Trustees/Builder Risk Ins		3,384.37	(3,384.37)	0.00				
04/21/10	04/22/10	DirectPay	CSU Trustees/CSU Office of the Chancellor		28,552.00	(28,552.00)	0.00				
12/17/13	12/30/13	17314	Engineering, Procurement and Construction	Design	35,526.07	(35,526.07)	0.00				
01/24/14	01/24/14	17570	Engineering, Procurement and Construction	Design	129,668.40	(89,136.95)	40,531.45				
09/01/10		3527	ESGIL Corporation	Plan Check	5,013.25	(5,013.25)	0.00				
02/28/11			Facilities Services		1,080.03	(1,080.03)	0.00				
10/28/14	10/29/14		Fire Marshal FY13-14 4th quarter	Plan Check/Inspection	1,052.00	(1,052.00)	0.00				
10/26/09			General Physics Corp.	Equipment Purchase	1,478,512.36	(1,478,512.36)	0.00				
03/25/10	04/05/10	2291	Hampton Tedder Elec.	Electrical	1,900.00	(1,900.00)	0.00				
07/01/10	07/01/10	Exp Trans	Herbert F. Burnett	Consulting	87,097.00	(87,097.00)	0.00				
07/06/10	Transf from Phase I		Herbert F. Burnett	Consulting	21,500.00	(21,500.00)	0.00				
02/05/14	02/07/14	17690	Hydro-Pac, Inc.	Compressors	7,444.19	(7,444.19)	0.00				
02/05/14	02/07/14	17690	Hydro-Pac, Inc.	Compressors	12,761.70	(12,761.70)	0.00				
06/06/12		10413	Hydrogenics Corp.	Electrolyzer	7,200.00	(7,200.00)	0.00				
07/25/13	07/25/13	15686	Hydrogenics Corp.	Electrolyzer	1,000.00	(1,000.00)	0.00				
04/14/14	04/14/14	18586	J.E.DeWitt Inc.	Parts	2,107.79	0.00	2,107.79				
07/30/13	07/30/13	15764	PDC Machines Inc.	350 Bar Compressor	10,287.68	(10,287.68)	0.00				
08/08/13		15861	PDC Machines Inc.	350 Bar Compressor	35,085.39	(35,085.39)	0.00				
08/08/13		15861	PDC Machines Inc.	350 Bar Compressor	5,806.45	(5,806.45)	0.00				
12/31/12-09/30/14			Postage total incurred		95.96	(95.96)	0.00				
10/31/12	11/01/12	12175	PPG orig of \$7,743.51	Furniture	7,761.32	(7,761.32)	0.00				
07/25/13	07/25/13	15678	Quantum Fuel Systems Technologies, Inc.	Dispenser	11,383.01	(11,383.01)	0.00				
03/18/14	03/18/14	18243	Quantum Fuel Systems Technologies, Inc.	Dispenser	150,094.26	(96,694.26)	53,400.00				
07/20/11		6766	Smart Chemistry	Quality Test	15,166.00	(15,166.00)	0.00				
03/19/12	03/23/12	9277	Smart Chemistry	Quality Test	4,080.00	(4,080.00)	0.00				
03/14/14	03/14/14	18209	Smart Chemistry Corporation	Quality Test	9,800.00	(9,800.00)	0.00				
08/05/10	08/05/10	3325	Smith Emery Lab	Inspection/Testing	34,998.21	(27,442.44)	7,555.77				
03/12/12			Smith Emery Lab/4908-0020D	Inspection/Testing	132.50	(132.50)	0.00				
10/11/13	10/11/13	16591	Solar Electric Energy	Electrical	3,200.00	(3,200.00)	0.00				
10/31/12			Supplies and services		40.98	(40.98)	0.00				
12/11/14	12/11/14	21708	TDI Refrigeration and Air Conditioning Inc.	Maintenance	3,780.00	(1,095.56)	2,684.44				
02/04/10-08/17/12			Twining Laboratories	Inspection/Testing	47,682.63	(47,682.63)	0.00				
10/31/13			US Bank		821.51	(821.51)	0.00				
03/19/14	03/20/14	18273	Vector Security Inc.	Camera System	10,925.00	(10,925.00)	0.00				
05/08/14			Vital Inspection Services/PO#2100008140	Inspection/Testing	1,440.00	(1,440.00)	0.00				
10/26/09			Weaver Inc.	Design Builder	2,158,128.96	(1,957,859.64)	200,269.32				
					4,485,588.77	(4,175,058.09)	310,530.68				

EXHIBIT D

PUBLIC OUTREACH PLAN

The Hydrogen Station has been incorporated into CSULA's public outreach and education mission.

Ongoing and future activities are summarized below:

- Hundreds of K-12 and college students have toured the facility in past year, via a special visitor gallery incorporated into the Station design.
- Visitor safety procedures have been established, and safety glasses are issued to all visitors. Visitors are escorted by trained personnel.
- CSULA has employed a Station Manager for Operations and Marketing, who is charged with facilitating public outreach events, as well as cultivating relationships with governmental and private stakeholders. CSULA has also hired a Station Technician, who also accommodates Station tours. CSULA engineering students also provide tours to the public.
- Hydrogen First Responder Training has been hosted as recently as summer 2013, facilitating training for Los Angeles Fire Department first responders.
- Station has been represented at the DOE Annual Merit Review in Washington, D.C.
- Station was represented in February 2014 at the Western States Petroleum Marketing Association Convention in Las Vegas, NV, which attended by approximately 3000 fuel marketing participants.
- Station has been joined the California Fuel Cell Partnership (CAFCP) as an auxiliary member, and collaborates with the CAFCP whenever possible. Station hosted the quarterly meeting of the CAFCP March 12-13, 2014.
- A ribbon cutting ceremony for the Station was conducted May Wednesday, May 7, 2014.
- Plan remains for display of the MSRC Logo on the Station; form to be mutually agreed upon by the parties.
- Plans are being discussed to dispatch students on public service projects, to promote clean fuels technology in the local communities.
- The Station has also been featured on social media and recent news releases:

<https://www.facebook.com/CalStateLA>

<http://www.sgvtribune.com/environment-and-nature/20140507/cal-state-los-angeles-joins-the-hydrogen-highway>

<http://www.calstatela.edu/univ/ppa/publicat/cal-state-la-celebrates-opening-its-hydrogen-research-and-fueling-facility-only-0>

<http://www.calstatela.edu/univ/ppa/publicat/today/storyArchives/spring2011/hydrogen.php>

<http://www.calstatela.edu/univ/ppa/publicat/cal-state-la-hydrogen-station-becomes-first-california-be-certified-sell-fuel>

<http://www.theeastsiderla.com/2015/01/running-low-on-hydrogen-you-can-now-filler-up-at-cal-state-l-a/>

<http://www.fleetsandfuels.com/fuels/hydrogen/2015/01/first-cal-hydrogen-for-public-sale/>

<http://www.greencarcongress.com/2015/01/20150121-csula.html>

http://www.greencarreports.com/news/1096416_hydrogen-fuel-now-available-for-sale-in-california

http://www.fuelcellpartnership.org/news_events/blogs/calstate_la_hydrogen_station_certified_sell_fuel

<http://www.globalnrgnews.com/cal-state-la-hydrogen-station-becomes-first-in-state-certified-to-sell-to-the-public-by-the-kilogram/>

<https://autos.yahoo.com/news/hydrogen-fuel-now-available-sale-california-133004045.html>

<http://ecotopical.com/green-car-congress/58326/cal-state-la-hydrogen-station-becomes-first-in-state-certified-to-sell-to-the-public-by-the-kilogram/>

http://www.thecarconnection.com/news/1096421_smarts-u-s-plans-scion-drops-ig-honda-civic-type-r-whats-new-the-car-connection

<http://la.streetsblog.org/2015/01/21/todays-headlines-1645/>

<http://www.autoevolution.com/news/first-hydrogen-selling-facility-opens-up-in-california-91440.html>

http://www.ngtnews.com/e107_plugins/content/content.php?content.10390#.VMGFiGR4rzE