

Prepared for the Mobile Source Air Pollution
Reduction Review Committee (MSRC) under the
AB2766 Discretionary Fund Work Program
FINAL PROJECT REPORT

BORDER VALLEY TRADING, LTD
**Alternative Fuel Infrastructure
Project**

Prepared by: Jacque Bates, CFO for Border Valley Trading

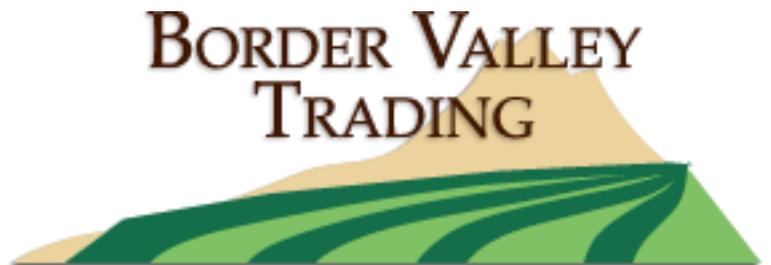
Primary Author(s):

Jacque Bates
Ulrich Sauerbrey
Greg Braun

Border Valley Trading, LTD
604 East Mead Road
Brawley, CA 92227
760-344-6700
www.bordervalley.com

Contract Number: MS11010B

**Prepared for: Mobile Source Air Pollution Reduction
Review Committee**



JULY 2015

TABLE OF CONTENTS

Acknowledgements & Disclaimer	1
CHAPTER 1 Project Description & Work Performed	2
Purpose 1.1	3
Critical Link 1.1.1	3
Emissions Reduction 1.1.2.....	3
Connecting with ICTC 1.1.3	3
Improved Air Quality 1.1.4.....	3
Approach 1.2.....	4
Team 1.2.1.....	4
Architectural Design 1.2.2	4
Budget Preparation 1.2.3	4
Grant Proposal 1.2.4.....	4
Permitting 1.2.5.....	4
Equipment Ordering 1.2.6.....	5
Construction 1.2.7.....	5-10
CHAPTER 2 Problems Encountered.....	10
CHAPTER 3 Emissions Benefits (to be completed by MSRC)	11
CHAPTER 4 Photographs & Outreach.....	11-18
CHAPTER 5 Summary & Conclusions.....	19

Acknowledgements

Border Valley Trading, LTD would like to acknowledge the following agencies and entities/individuals for their assistance in this project:

1. GreenFix America and Managing Member Mark Kimberlin for their efforts as the contractor and design team for the fueling station
2. Ulrich Saubrey who managed the project for Border Valley Trading, LTD
3. California Energy Commission for their grant of \$500,000 for the project
4. South Coast Air Quality Management District for their grant of \$900,000 for the project
5. Mobile Source Air Pollution Reduction Review Committee for their grant of \$150,000 for the project

This report was submitted in fulfillment of contract number MS11010B and Alternative Fuel Infrastructure Project by Border Valley Trading, LTD under the partial sponsorship of the Mobile Source Air Pollution Reduction Review Committee (MSRC). Work was completed as of March 14, 2015.

Disclaimer

The statement and conclusions in this report are those of the contractor and not necessarily those of the Mobile Source Air Pollution Reduction Review Committee (MSRC) or the South Coast Air Quality Management District (SCAQMD). 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.

Chapter 1 Project Description & Work Performed

Border Valley Trading, LTD (BVT) and HayDay Farms, Inc. (HDF) are two of the largest hay exporters on the West Coast. Both companies have and continue to be committed to aggressively converting their trucking fleets to low-carbon alternative fuels, specifically Liquefied Natural Gas (LNG) and Liquefied to Compressed Natural Gas (LCNG). In order to accomplish this goal, the companies needed a fueling station to link their respective locations in Brawley and Blythe California to the ports of Los Angeles and Long Beach California. They began with a smaller “phase I” 10,000 gallon fueling station along the I-10 corridor. Once operational in 2012, it was apparent that a much larger public access fueling station was needed to not only service their demand, but the demands of other heavy duty trucks traveling the corridor between Phoenix, Arizona and the ports of Los Angeles and Long Beach.

BVT, with grant assistance from California Energy Commission (CEC), South Coast Air Quality Management District (SCAQMD) and Mobile Source Air Pollution Reduction Review Committee (MSRC), has completed construction of phase II of its publicly accessible (LNG) and (LCNG) fueling station in the Coachella Valley. One of the major purposes of this fueling station was to reduce carbon emissions leading to better air quality and a reduction in the transportation industry’s dependence on imports of carbon intensive conventional fuels. Not only does air quality improve, this station provides a critical “half-way point” fueling link along the heavily traveled I-10 corridor between the California/Arizona Border and Ontario California for LNG and LCNG trucks.

As such, the fueling station is a vital piece to providing the infrastructure necessary for large heavy duty diesel fleets to transition to clean-burning natural gas. It also provides a critical and very accessible location in Palm Springs, California for fueling options along the ICTC.

In addition to the goal of reducing carbon emissions, the following goals were also established:

This station also brings important economic improvements to the region in the way of immediate job benefits and sales tax revenues by providing economic fueling options for local fleets. This station supports criteria pollutant emission reductions in an area that is heavily impacted by emissions, geography and weather patterns. It supports businesses located in hard-hit communities, helping them save money, displace large quantities of petroleum, and use entirely low-carbon fueling operations.

The process was to architecturally design and build a new dual 11,000 gallon storage tank system to allow for 2.5 days of fuel storage necessary based upon the anticipated initial demand of BVT, HDF and other companies for their combined 80 fleet of heavy duty LNG/LCNG trucks. The result of this project is an easily accessible state-of-the-art LNG/LCNG full capacity fueling station that not only services BVT and HDF, but many other companies with large trucking fleets using the I-10 freeway from outlying locations to the ports of Los Angeles and Long Beach whereby substantially reducing the carbon emissions along this heavily used trucking route.

1.1 The following is a list of goals of the project:

1.1.1 Critical Link:

The purpose of this project is to provide a critical LNG/LCGN fueling station link along the I-10 corridor between Phoenix, Arizona and the ports of Los Angeles and Long Beach California to allow companies using large heavy duty trucks, to convert high carbon emission vehicles to low-carbon alternative fuel vehicles. This project was developed specifically in response to the federal, state and local agency demands for improved air quality and a reduction in the transportation industry's dependence on imports of carbon intensive conventional fuels.

The clean-burning natural gas fuel dispensed at this station is used in heavy-duty trucks that would otherwise be using diesel fuel. Transitioning from diesel to natural gas is a low emission strategy that has been approved by the CEC as a technologically simple approach for near-term cost-effective benefits. This project directly supports the fundamental component in achieving the CEC's AB118 goals.

1.1.2 Emissions Reduction

The development of this station is a much needed large step forward for AQMD and CEC to ensure significant emission reductions from fleets traveling within the Coachella Valley by providing the infrastructure necessary for diesel fleets to transition to clean-burning natural gas. With the construction of this station, a critical gap in suitable LNG/LCNG infrastructure along the Interstate 10 Freeway in Palms Springs, California have been bridged. This location provides easy access for the fueling of many large heavy-duty fleets that have already transitioned to LNG/LCNG.

1.1.3 Connecting with ICTC

The station provides an important link in a growing multi-state system of heavy-duty natural gas fueling options along the Interstate Clean Transportation Corridor (ICTC). Since its inception, the ICTC has become widely recognized for increasing the use of clean, low carbon, sustainable fuels in heavy-duty natural gas vehicle operations closing the fueling infrastructure gaps between states. The ICTC maximizes the benefit from alternative fuel stations by siting them along well-travelled corridors and making sure there is a high-volume fleet to use the stations as its base for fueling operations.

1.1.4 Improved Air Quality

The I-10 corridor is one of the most prominent and congested main transport routes on the West Coast with traffic projected to increase at least 250 percent over the next 15 years. The heavy use of this corridor and the proposed increase in use necessitates an alternative to high carbon emission to improve the air quality in Southern California. This LNG/LCNG station will contribute to the significant reduction in high carbon emissions and lead to a significant improvement in air quality in the region.

1.2 Sequence of Work Performed

The following is the sequence of the activities performed:

1.2.1 LNG Dispensing Unit

- Purchase wall mount LNG dispensing cabinet and UL listed dispenser control head
- Revise mechanical general arrangement drawing to include only one tank (Tank A)
- Purchase wall mount classified dispenser hardware
- Fabricate tank supports
- Purchase station control hardware
- Finalize station process control program
- Complete installation of the flame and combustible gas detection devices to LNG tank frames

1.2.2 LNG Control Cabinet

- Approve VJ mechanical piping general arrangement drawings for fabrication
- Review revised TME drawings
- Order cryogenic valves and instrumentation
- Complete wall mount LNG dispenser
- Complete LNG station electrical control cabinet and process control program.
- Complete final assembly of station electrical control cabinet.
- Bench test wall mount LNG dispenser with station controller program.
- Pick up building department permit.

1.2.3 Concrete Foundation

- Pickup building department permit
- Start concrete foundation work per revised structural plans.
- Revise mechanical drawings and controls to accommodate the addition of Tank B
- Completed new building department submittal for addition of Tank B per approved structural plans.
- Perform underground utility repairs.
- Complete concrete foundation work per revised structural plans.

1.2.4 Removal of Existing LNG Equipment

- Prepare existing LNG station equipment for removal.
- Decommission existing LNG station. Remove existing LNG phase one station skid.

1.2.5 Mechanical Construction

- Set new horizontal LNG tanks (A&B), LNG pump skid, vaporizer coil, electrical control cabinet, CNG compressor, CNG storage vessels and LCNG buffer tank.
- Install mechanical piping and flanges.
- Start classified electrical installation.
- Start electrical wiring and control terminations.
- Test station controls and alarm shut downs.
- Order bulk fuel delivery – cool down tank A and off load 8,800 gallons of LNG.
- Test LNG pump skid operation, meter cool down function and dispensing sequence.

1.2.6 Electrical Completion

- Completed classified electrical installation and electrical wiring and control terminations.
- Test station controls and alarm shut downs again.
- Completed cryogenic insulation.
- Fuel testing.
- Received building department sign off.
- Calibrate POS device.
- Debug PLC program.
- Complete vapor recovery connections.

1.2.7 Prepare Equipment Listing

11,000 Gallon LNG Storage Tanks (2)

Once the pre-manufactured LNG storage tanks were received, they were pre-plumbed and wired for the gas and flame detection system devices, automated station control valves and process monitoring devices. All of this work was done and tested off site at the contractor's local shop.

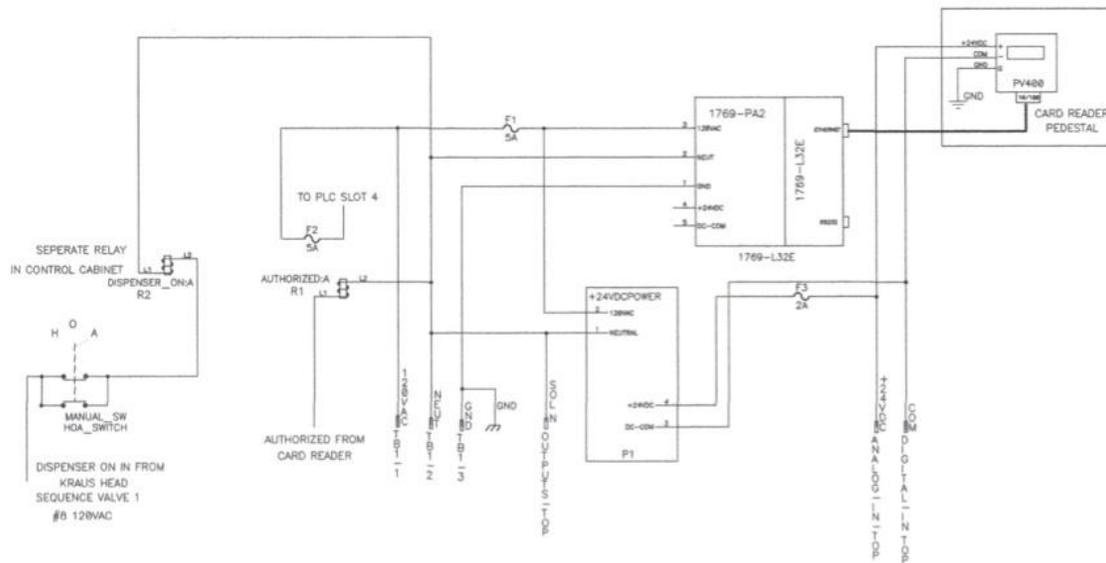
LNG Heat Exchanger

The stainless steel lined aluminum LCNG heat exchanger vaporizer was manufactured by a Southern California manufacturer and stored at the contractor's local yard until needed. This unit was designed and sized to produce twice the rated capacity needed for future CNG expansion. The system was also incorporated a gas warmer to capture and recover all vehicle vent gas including the LNG tank boil off gas. With proper LCNG demand this site is intended to be free of all venting to the atmosphere.

LNG Dispensing Pump Skid

The LNG dispensing pump skid was pre-fabricated off site in a unitized skid and set into place between both LNG storage tanks. The skid is connected to the LNG wall mount dispenser panel, interconnected to both LNG tanks and LCNG vapor recovery system. The LNG pump dispensing process is monitored and controlled by the GreenFix process controller. It shuts down the dispensing process based on a low flow fill cut off, excessive flow (broken hose) or any one of three pump alarms.

LNG Fuel Dispenser and Card Reader Diagram:



Connecting Vacuum-Jacketed (VJ) Piping

The pump skid and two horizontal LNG storage tanks are interconnected by VJ mechanical piping. The specific circuits requiring VJ piping are: Tank fill / Pump suction line, Pump sump vent line, Dispenser and meter cooling recirculation circuit. The VJ assembly is stainless steel construction with sealed flexible bellows for seismic and expansion provisions.

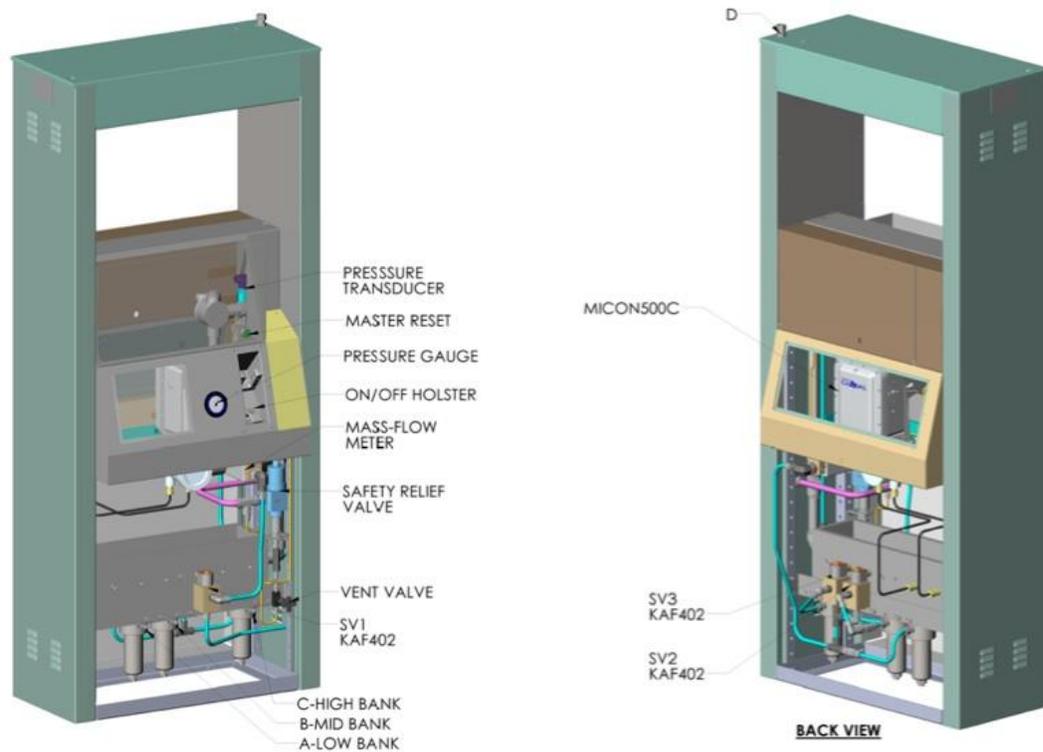
Automated Valves and Controls

The LCNG automated control vales are electro-mechanical pneumatic controlled cryogenic valves. The GreenFix programmable logic controller (PLC) systematically controls the valve sequence during LNG filling, CNG vapor recovery, tank saturation, tank filling and emergency shut downs.

LCNG Dispensing Pump Skid

The pre-fabricated LCNG pump skid is comprised of a vacuum jacketed stainless steel sump containing a centrifugal multiple stage cryogenic pump all connected to the station process via VJ mechanical piping, schedule 10 stainless steel welded lines and flexible bellows where required for seismic and expansion.

LCNG Dispenser Illustration:



281 Gasoline Gallon Equivalent GGE CNG (34,880 CU. FT @ 4,700 psi) Storage

The CNG storage cylinders are that manufactured by CP Industries. The assembly includes (3) 24 inch high pressure steel cylinders, "I" Beam frame assembly, Pressure relief valves and manual shut off valve connections.

Assembly weight = 23,660 lbs

Test Pressure = 8,070 psi

Design working pressure = 5,380 psi

Assembly Nominal Water Volume = 101.1 CU. FT.

CNG Weights & Measures Certified Dispenser

The dispenser is a standard single hose CNG dispenser as manufactured by Kraus Global.

3,600 psi compensated fill pressure

5,000 psi design pressure.

Single hose fill nozzle / vent return line and break away devices

CNG Compressor Package

As pre-manufactured and packaged by Bauer Compressor Company. This unit is a high capacity fully enclosed water cooled CNG Compressor package.

Discharge Capacity = 150 cfm

Design Working Pressure = 5,000 psi

Compensated Electronic Priority Control

LCNG System Control Panel

The LCNG System Control Panel is housed in an explosion proof classified enclosure. The system includes a Greenfix process control program, Allen Bradley programmable logic control platform (PLC), power supply, electrical interface between fuel display head and card reader and lock out key switch. The process control interface is through a touch screen located at the card reader pedestal, which allows the operator to have complete line of site visual access to the process from outside the dispensing and storage area.

Methane and Fire Detection Equipment

The station is equipped with a National Fire Protection Association (NFPA) rated LNG storage and handling compliant flame and combustible gas detection system. The system devices are mounted on the horizontal LNG storage tanks and are elevated to be visible from the fuel dispenser and storage impound area.

Card Reader Systems (2)

The card reader (card lock point of sale interface) is located outside the fuel dispensing and storage area. There are two card swipe readers. One is a slave unit for the CNG dispenser and the second is the master card swipe reader located at the LNG dispenser. Both are connected to a phone line for 24/7 data access for fuel data logging and control. This Fuel Force system is hosted by GreenFix.

Electrical Control Panel

The LCNG System Control Panels are independent MCC (motor control center) located outside the classified fuel storage and dispensing area. The MCC hardware includes electronic motor starter and speed controllers, disconnect switches, fire alarm panel, control relays, power supply and alarm beacons. All panels are equipped with locking devices to provide for controlled security access.

Card Lock Gate Access

The site is only accessible through a card lock gate access system. This system was installed with phase 1 construction and is unaltered as approved and inspected by the local fire department authorities during that phase of construction.

Impound Area Containment

The impound area containment is of concrete masonry construction as depicted on the site construction drawings. This is designed and constructed to control and contain an unscheduled release of LNG. This is a failsafe emergency design element meeting hazardous fuel and local fire code requirements.

Lighting

The site is equipped with elevated area lighting. This system was installed with phase 1 construction and is unaltered as approved and inspected by the local building department authorities during that phase of construction.

Signage

The site, LCNG component fixtures and impound areas are delineated with NFPA compliant signage as approved and inspected by the local fire department authorities. The site also is placarded with various user instruction and warning signs.

2.1.8 Station Commissioning

The station was signed off for fuel handing by the Palm Springs Fire Department on March 15, 2015. Initial fuel testing met operational requirements with minor adjustments required to the meter cool down / dispensing program routine. Additional modifications were implemented to the vapor recovery routine to maintain a more desirable tank vapor pressure required to successfully fuel warm fuel vehicles. This station is required to fuel both warm and cold fueled vehicles. The site is open for fleet fueling with manned supervised fueling to safely train the fleet drivers with both fuel types. Unmanned 24/7 CNG fueling is currently servicing new commercial fleet operators.

CHAPTER 2 Problems Encountered

A new design was implemented in this project to meet timeline objectives, cost objectives and City of Palm Springs objection to a 42-foot vertical tank. GreenFix America, LLC (GFA) pursued this new horizontal tank technology design with success. Implementing this technology into an LNG station format is a new concept to the generally accepted practices.

GFA developed, in collaboration with manufacturer's and process control engineers, a system that works with limited negative operational consequences. The horizontal, elevated "cradle" installation provides greater operational latitude and mobility versus the vertical tank installations widely used in the industry.

This type of construction provides for:

- Reduced upfront installation costs
- Reduces visual impacts on sensitive view corridors
- Allows for trailer mount "intermodal" installations for remote service areas including agricultural boiler and vehicle operations where a gas source is not readily available
- Provides for lessor cost tank and pump relocations as market demand and influences dictate

In conjunction with the primary LNG use, CNG and vapor recovery capability has been added to the site. An important component to the site design was the addition of a vapor recovery system that not only captures and re-uses storage tank "boil-off", it also provides for truck operators to vent their tanks through the recovery system promoting 100% re-use of unused gas. The addition of CNG also provides a fuel source for localized and short-haul operators reducing the emissions footprint and further promoting the use of alternative, cleaner burning fuels.

This technology is successful from the perspective of providing transportable and cost effective access to alternative fuels. Even small companies now have the opportunity to switch to alternative fuels which provides for a cleaner environment and a long term cost effective solution for renewable energy to be used in a wide variety of operations.

CHAPTER 3 Emissions Benefits

This section reserved for MSRC.

CHAPTER 4 Photographs & Outreach

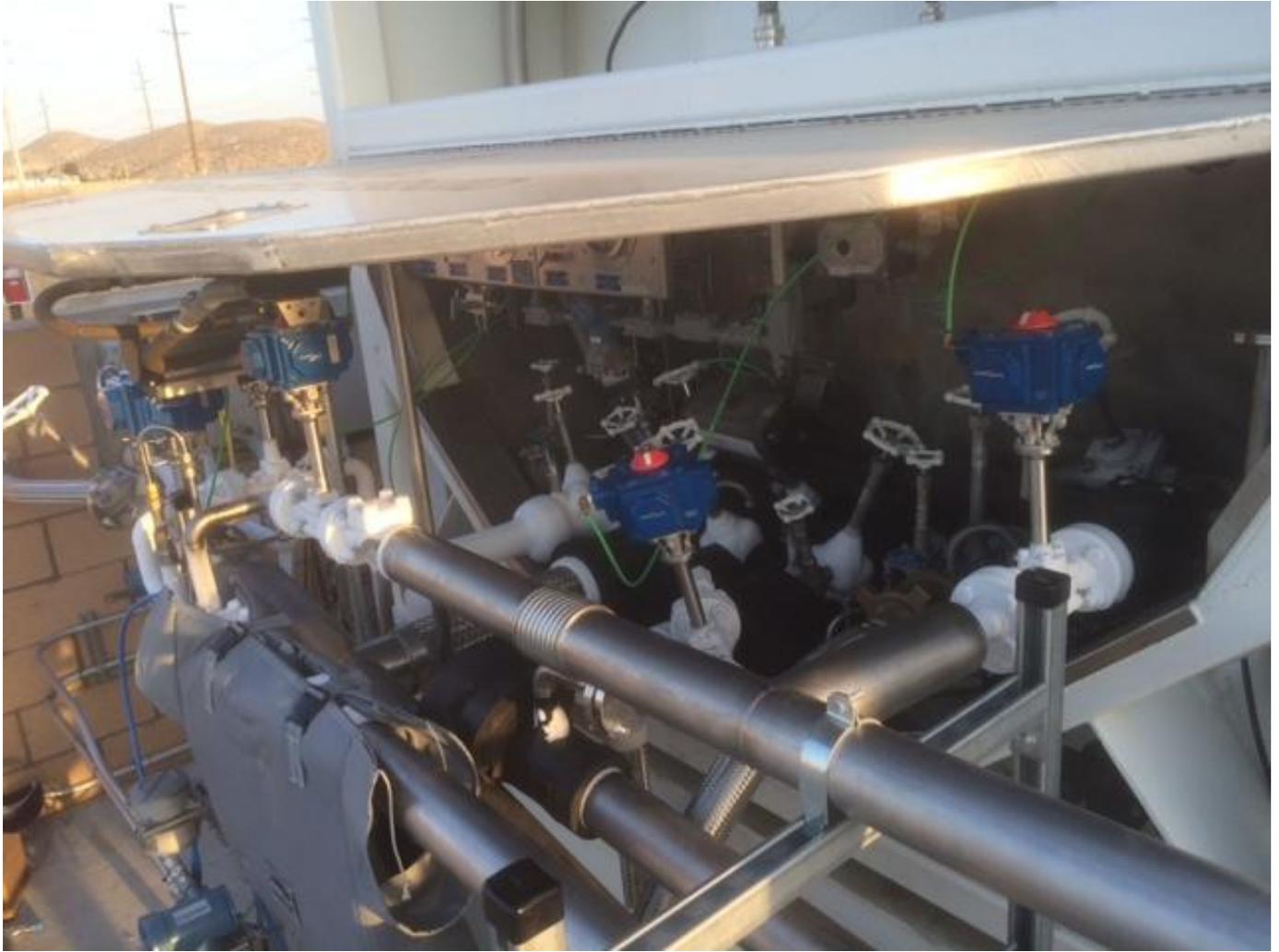
The following photographs are of the final fueling station project:



LNG Storage Tanks and LCNG Compressor and Storage Skid



LNG Pump Skid System



Plumbing for LNG System



LNG Wall Mount Dispenser System



LCNG Dispenser Panel



Truck Fueling LNG



Truck Fueling LCNG



LNG Storage Tank with MSRC Decal

CHAPTER 5 Summary and Conclusions

The work done on the project included design and construction of two LNG storage tanks and an LNG dispensing unit and control cabinet along with an LCNG compressor storage skid and dispensing unit. The tanks were installed on concrete foundations and then connected to the control cabinet and dispensing unit for each type of fueling unit (LNG and LCNG).

The initial station proposal for the site was to utilize a vertical tank installation which is common place in the industry. However, these types of installations are both costly and are burdened with long equipment lead times for key components. In addition, the City of Palm Springs (lead agency) was initially resistant to approve a visually unattractive installation on a major thoroughfare to the City. This resistance added significant time to develop mitigation measures (added landscape and site treatments) to address the City's concerns, which necessitated an analysis of alternate installations.

Experience suggested that a horizontal tank installation would not work. The fluid mechanics of the fuel would not provide enough head pressure at the pump impellers to provide for efficient pumping and dispensing. This led to a detailed and exhaustive analysis of the various options by GFA resulting in the horizontal tank design implemented at the Palm Springs station.

GFA had to develop a dual management dispensing program to operate the station. This was the result of equipment manufacturer's and suppliers wanting to retain proprietary rights to their equipment and programming, all of which lengthened delivery times and inflated costs.

GFA developed a dual management dispensing program removing the proprietary nature of the programming creating the opportunity to replicate LNG storage and pumping facilities such as the one located at Palm Springs at a much more economically feasible budget. This made it feasible to build one, fixed base, tank system for under \$1 million and portable and mobile installations for under \$600k, both of which resulted in greater investment in LNG fueling infrastructure.

Since BVT's goal was to find a least cost, scalable equipment package solution that would work on a small site footprint with mobile capability, without sacrificing operational readiness. BVT found that solution in the Palm Springs station.

There is great benefit to Southern California by providing funding to assist in the construction of LNG stations and mobile re-fuelers at remote locations which link the ICTC corridors and importers and exporters to the Long Beach and Los Angeles ports and other major metropolitan areas. This investment will support LNG conversion for not only heavy duty trucks, but machinery used at base plant operations as well. The cost effectiveness of the small scale technology developed in our process combined with funding assistance would minimize the financial risk for going LNG and would greatly enhance air quality and meet emission reduction standards.