Heavy-Duty Vehicle Repair Program Pilot Project

Final Report

December 17, 2020

Prepared by the San Joaquin Valley Air Pollution Control District

Acknowledgments

The San Joaquin Valley Air Pollution Control District (District) would like to express gratitude and appreciation to the California Air Resources Board (CARB) for creating the Heavy-Duty Vehicle Repair Program Pilot Project (HDVRP, or Pilot Project), in which the District actively participated. The District is optimistic that the data gathered from this pilot project will assist in the determination of the necessity and effectiveness of a future heavy-duty truck repair program. The HDVRP provided financial assistance to San Joaquin Valley (Valley) small fleet truck owners to aid in the repairs of heavy-duty truck emission control systems with the goal of allowing these fleets to operate well-maintained trucks that meet California emission standards. The information gathered from the HDVRP Pilot Project will ultimately assist CARB and the District in determining if a similar program should be deployed on a larger scale and if so, aid in developing and implementing a future heavy-duty truck repair program.

The Valley has unique needs and challenges compared to other regions and metropolitan areas throughout the State. With CARB's support for projects like this one, the Valley will continue to make great strides in reducing criteria pollutants by ensuring vehicles are operating properly to further the efforts in the State to reduce emissions from heavy-duty vehicles.

The District would like to recognize the following heavy-duty truck repair shops for their participation in the Pilot Project and contributions to the creation of this report. Their commitment and contribution was essential to a successful pilot project and will provide valuable insight and perspective in studying the need for a heavy-duty repair assistance program.

- Valley Truck Repair
- Myers Diesel
- RDM Diesel
- Affinity Truck Center – Fresno and Bakersfield
- Interstate Truck Center - Stockton
- Righetti Enterprises

Preface

The light-duty inspection and maintenance program, known as the Smog Check Program, provides repair assistance for low-income vehicle owners that fail a smog check inspection. This program, which is run by the Bureau of Automotive Repair, assists low-income motorists by paying for repairs to bring vehicles back into emissions compliance. In 2017, one million dollars was appropriated in the State budget to pilot a heavy-duty repair program in order to study the need for repair assistance for truck owners in a future heavy-duty inspection and maintenance program. On September 20, 2019, Governor Newsom signed Senate Bill 210[1] (SB 210), which directed CARB to develop a Heavy-Duty Inspection and Maintenance program in consultation with both the Department of Motor Vehicles and the Bureau of Automotive Repair.

Heavy-Duty vehicles, those with gross vehicle weight ratings (GVWR) of > 14,000 pounds, are a major contributor to the air quality challenges faced by the State, and the San Joaquin Valley (Valley) is particularly impacted. Despite extensive efforts by CARB and the air districts, heavy-duty trucks continue to contribute a majority of the criteria pollutants for on-road vehicles.

Over the last decade, the State has adopted new regulations to reduce air pollution emissions from the heavy-duty truck sector. Such efforts include the Truck and Bus Regulation, which was adopted on December 11, 2008, with a phased-in requirement that nearly all trucks and buses in the State meet the 2010 emission standards of 0.20 g/bhp-hr of NOx and 0.01 g/bhp-hr of PM by January 1, 2023. To comply with the Truck and Bus Regulation, owners of heavy-duty vehicles powered by older, higher polluting engines are required to upgrade their vehicles with improved emission control technologies. Additional efforts made by CARB include new engine standards; programs to promote and advance zero-emission truck technologies such as the state's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program (HVIP); and manufacturer warranty and durability requirements for emission control components.

Promoting and accelerating the adoption and deployment of new, cleaner heavy-duty vehicles has considerably reduced emissions from this sector. However, when emissions control systems are not functioning correctly, emissions can increase. Currently, CARB's Heavy-Duty Vehicle Inspection Program (HDVIP) and the Periodic Smoke Inspection Program (PSIP) are the only available programs to check and ensure vehicle emissions control systems are properly functioning. Still, these programs primarily target PM emissions and do not ensure that the systems to control NOx emissions are functioning properly. Recent investigations by CARB have indicated that there are substantial levels of in-use emissions beyond what would be expected from heavy-duty vehicles based on current standards. This, along with the passage of SB 210, has led CARB to start the development of a more comprehensive inspection and maintenance program that will help to ensure heavy-duty vehicle emissions control systems are properly maintained and functioning correctly. As such, CARB is considering the need and functionality of a repair assistance program to compliment inspection efforts and aid vehicle owners that may not otherwise be able to afford the financial burden of costly repairs.

[1] Leyva; Chapter 298, Statutes of 2019, http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200SB210

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List of Acronyms

ACM	After-treatment Control Module
BIT	Biennial Inspection of Terminals
CARB	California Air Resources Board
DEF	Diesel Exhaust Fluid
District	San Joaquin Valley Air Pollution Control District
DMV	Department of Motor Vehicles
DOC	Diesel Oxidation Catalysts
DOT	Department of Transportation
DPF	Diesel Particulate Filter
DTC	Diagnostic Trouble Code
ECM	Electronic Control Module
ECT	Engine Coolant Temperature
EGR	Exhaust Gas Recirculation
GVWR	Gross Vehicle Weight Rating
HD	Heavy-Duty
HHDD	Heavy Heavy-Duty Diesel
HD I/M	Heavy-Duty Inspection and Maintenance
HDVIP	Heavy-Duty Vehicle Inspection Program
HDVRP	Heavy-Duty Vehicle Repair Program Pilot Project
HP	Horse Power
MIL	Malfunction Indicator Light
NOx	Nitrogen Oxide
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
PM	Particulate Matter
PSIP	Periodic Smoke Inspection Program

PTT	Premium Tech Tool
SCR	Selective Catalytic Reduction
Valley	San Joaquin Valley

Chapter 1: Project Overview

Executive Summary

In June of 2018, the District entered into a Grant Agreement with CARB to implement the Heavy-Duty Vehicle Repair Program Pilot Project (HDVRP, or Pilot Project). The Grant Agreement designated $850,000 for repair costs, up to $100,000 for project implementation and $50,000 for administrative costs. During the course of this project, the District issued vouchers for 156 repairs. There were 131 trucks repaired of which, 15 trucks went through the program two times and five trucks returned three times. Trucks that went through the program more than once received vouchers for different eligible repairs that occurred during different visits to the repair shop. An overwhelming 95% of the trucks were class 8 (33,001+ GVWR), with a majority having an engine model year between 2013 and 2017. Upon completion of the pilot project, the District was successful in fully expending all of the project funds.

Background

CARB has developed the most stringent heavy-duty (HD) vehicle emissions control program in the world. CARB has adopted and implemented rules that require increasingly tighter new engine standards, heavy-duty engine certification procedures, on-board diagnostics systems, and emission control device verifications. CARB rules also require accelerated turnover of the in-use fleet to cleaner, lower-emitting emission control and engine technologies. Ongoing implementation of CARB's current heavy-duty control programs is anticipated to result in a 70 percent reduction in NOx emissions from the on-road heavy-duty sector between 2013 and 2025. In 2018, the HDVIP and PSIP opacity limits were lowered to 5 percent from 40 percent (55 percent for older vehicles) because the requirement to use diesel particulate filters essentially meant that any visible smoke from the truck needed repair. However, only looking for high PM emissions does not ensure that the emissions control systems to control NOx emissions are functioning properly. Because of this, many HD vehicles operating in California in compliance for PM are emitting excess NOx emissions. Recent investigations by CARB have indicated that there are substantial levels of in-use emissions beyond what would be expected from heavy-duty vehicles based on current standards. It is imperative that these systems are functioning properly if the true emission reductions are to be realized. To ensure that in-use heavy-duty vehicles continue to operate at their cleanest possible level, CARB is developing a heavy-duty inspection and maintenance program pursuant to SB 210. The details of how this new program will work are currently being workshopped but are likely to include inspection procedures that take advantage of the improvements in on-board diagnostic (OBD) systems that are now mandated in heavy-duty trucks that are 2013 and newer. The OBD systems in newer engines monitor the performance of nearly every emission control component.

A 2018 Grant Agreement between CARB and the District provided $1 million for the HDVRP pilot project to provide financial assistance to small fleet truck owners and operators for emissions system related repairs. The goal of the Pilot Project was to determine whether a heavy-duty repair assistance program should be part of a future heavy-duty vehicle inspection and maintenance program. As part of the tasks set forth within the Grant Agreement, the District developed program guidelines, applications and participant surveys. The District also solicited interested heavy duty vehicle repair shops to participate in the program.

Partnerships

The following repair shops participated in the Pilot Project. Each shop had to meet the following base requirements to be eligible to participate:

1. Based within the San Joaquin Valley APCD boundaries.
2. Be certified by engine manufacturer(s) to perform repairs.
3. Have the ability to provide itemized estimates and invoices with labor, parts costs, and applicable OBD codes.
4. Provide shop itemized invoice that documents the approach used to diagnose necessary repairs and document the time and cost of each performed repair.
5. Enter into an Agreement with the District to participate in the program.

Valley Truck Repair
Located in the AB617[2] selected community of South Central Fresno, just off highway 99, Valley Truck Repair is a locally owned and operated repair facility specializing in Mack and Volvo trucks and offers 24/7 service, 365 days per year. They employ technicians with certifications in multiple areas including, but not limited to, Master Technician, Mack Master Technician, Volvo Engine Electronics, and M1, MP7 and MP8 Mack Engines. Currently, Valley truck repair employs six technicians in which three technicians hold a "Master Mechanic" certification, two have over 10 years of mechanical experience each, and one has over 20 years of mechanical experience. The certified technicians are responsible for diagnostics and all repairs including those that are considered to be advanced, such as electrical. Valley Truck Repair also employs two journeyman-level technicians that are responsible for minor repairs and maintenance such as oil changes. The repair shop offers a vocational training program for their technicians for improvement in mechanical education and skills. Valley Truck Repair was the first repair shop to participate in the program and submitted applications throughout the process for their customers.

Meyers Diesel Repair
Located between Interstate 5 and Highway 99 in Kern County, Myers Diesel Repair has been in business for over 15 years. Locally owned and family run, Myers Diesel Repair provides complete repair and service 24/7 for on-road heavy-duty trucks of all makes and models. Along with certified mechanics, Myers Diesel Repair also employs technicians to perform certified DOT and BIT inspections. Currently, there are 10 technicians employed at Meyers Diesel Repair. Eight technicians have more than 10 years of experience and two that have more than 20 years. Three of the technicians hold a "Master Mechanic" title and the other seven hold Meritor OEM certifications. Additionally, the shop provides vocational schooling for their technicians to achieve their Meritor certifications from the manufacturer. The repair shop is not exclusive to a particular manufacturer as they have technicians and parts available for all heavy-duty truck brands.

RDM Diesel
Located in the AB617 selected community of South Central Fresno, just off highway 99, RDM Diesel specializes in Volvo and Mack Trucks but is not exclusive to those manufacturers, providing a full range of repair and service. Currently, there are nine technicians employed for their services. Three of the technicians hold a "Master Mechanic" certification and oversee the repairs being done in the shop. Four

[2] Assembly Bill 617 (C. Garcia, Chapter 136, Statutes of 2017).
http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617

technicians have over 10 years of experience, and one has over 20 years of experience who performs diagnostics and advanced repairs, such as electrical issues. While RDM Diesel does not currently provide vocational school or programs to their technicians, they are currently in the process of contracting with the Tech Tool and software manufacturers to implement a training program for their technicians.

The following shops were contracted to participate but did not submit any applications for repairs:

Affinity Truck Center – Bakersfield and Fresno locations
Affinity has 39 technicians in total from its two locations in Fresno and Bakersfield. There are 14 technicians between the two shops with more than 10 years of experience each, and five technicians that have more than 20 years of experience. Most of the technicians hold a "Master Mechanic" title and hold certifications in Volvo, Mack, Prevost, Autocar, and Cummins. The repair shops offer vocational training to their technicians by sending them to the manufacturer's facility for enhanced learning to achieve their certifications. Newly hired technicians start their employment in an apprentice program under the guidance of the "Master Mechanics," and are recruited from various programs and colleges, such as Universal Technical Institute. Affinity Truck Center is a Volvo and Mack dealership and provides advanced diagnostics for Volvo, Mack, Prevost, and Autocar manufactured trucks. However, the dealership does have the capacity to perform basic repairs for all manufacture brands.

Interstate Truck Center (Stockton location)
Interstate Truck Center has 32 technicians to serve its customers. There are 14 technicians currently employed with either the "Master Mechanic," or the Original Equipment Manufacturer (OEM) certified equivalent titles. The shop requires all diagnostics and repairs for all components to be completed by the experienced technicians. However, the repair shop does provide in-house training with Peterbilt representatives that visit the facility to train the technicians on OEM specific systems and parts. There are 14 technicians present at the shop that have more than 10 years of experience each, two of which have more than 20 years. Interstate Truck center is an exclusive repair shop as it functions as a dealership for Peterbilt, but accepts repairs for all heavy-duty manufacturers.

Righetti Enterprises LLC
Righetti Enterprises, LLC currently employs 12 technicians of which six hold a "Master Mechanic" certification, and provides vocational training to their technicians. The repair shop has eight technicians that have more than 10 years of experience. This shop provides each technician a dedicated laptop computer with Cummins factory software installed for diagnostics and repairs. This shop is exclusive to heavy-duty trucks that have Cummins branded engines and OEM truck appurtenances that support Cummins engine function, and predominantly services Cummins warranty work.

Project Funding

The funding amount of this Grant Agreement was $1,000,000. Funding was allocated according the categories in the following table.

Award Category	Allocated Funds
Repair Costs	$850,000
Implementation Costs	$100,000
Administrative Costs	$50,000
Total	***$1,000,000***

Upon receipt of the fully executed Grant Agreement, the District created a separate account for the repair cost allocation. This account was added to the District Grants Management Database in which all the project information for the applicants was kept and vouchers were issued. As projects were approved, funds from this account were utilized to issue vouchers to the truck owners. The District utilized its Labor Information System database to track hours spent by staff working on this project. This database tracks the activity performed associated to the hours so that the time spent could be easily applied to the following areas related to project implementation and administration:

- Project implementation
- Outreach and education
- Research and data analysis
- Program evaluation
- Required reporting
- Information technology

The District staff positions that participated in the program were as follows:

Departments				
Finance	**Incentives**	**Compliance**	**Information Technology Service**	**Operation & Program Support**
Accountant I	Air Quality Assistant	Air Quality Field Assistant	Information Systems Manager	Office Assistant II
Accountant II	Air Quality Specialist I	Air Quality Inspector I	Programmer/Analyst I	Office Services Manager II
Accounting Assistant II	Air Quality Specialist II	Supervising Air Quality Inspector	Programmer/Analyst II	Senior Office Assistant
Accounting Technician I	Senior Air Quality Specialist		Senior Programmer Analyst	
Senior Accountant	Staff Technician I		Supervising Programmer/Analyst	
Supervising Accountant	Staff Technician II			
	Supervising Air Quality Specialist			

Objective & Scope of Work

The objective of this pilot project was two-fold. First, to provide financial assistance to small fleet truck owners and operators to provide durable repairs for broken emission components or systems on heavy-duty trucks. Second, to determine whether a HDVRP should be a part of a future heavy-duty vehicle inspection and maintenance program. The program was intended to gather information on the following:

- What types of emission-related repairs are most common?
- In general, how much do emission-related repairs cost?
- Was the program necessary to ensure comprehensive and effective repairs, or would the owner decline the repairs without assistance?
- How do shops diagnose failures and repair them, and what training do shops require or provide technicians to ensure they are qualified and knowledgeable on providing durable and complete repairs?
- Is a HDRVP program useful or necessary, and how might it fit into a future heavy-duty inspection and maintenance program?

As the project administrator, the District was responsible for determining vehicle, participant and repair eligibility; selecting repair shops and implementing a process in which the repairs were diagnosed, conducted, and reimbursed; surveying and documenting the participants satisfaction with and acceptance of the vehicle repairs; and evaluating the feasibility of implementing a large scale program. Additionally, the District was responsible for meeting with CARB's Project Liaison on a regular basis to provide status updates, discuss any difficulties encountered, project milestones or deliverables, and notification of pending disbursement requests.

Outreach Efforts

Outreach efforts were focused on identifying repair shops throughout the Valley who would be interested in participating in the pilot project. The District started by gathering a list of truck repair shops in the Stockton, Fresno and Bakersfield areas. District staff took a grass roots approach by calling each shop to tell them about the program and assess their potential interest. Conversations included, but were not limited to, the intent of the pilot project, truck eligibility, truck owner eligibility, repair shop participation requirements, eligible repairs and potential funding levels. While some shops were highly interested, their primary focus was warranty work, thus making them not suitable shops for this project. The District also conducted training workshops at the repair facilities upon request to educate the repair shop staff on the project, required documentation, and program process. The District did not engage in targeted outreach to truck owners but rather allowed the repair shops to advertise the pilot project to their customers.

Chapter 2: Implementation

The Grant Agreement identified the tasks listed in Table 1 to be completed by the District.

Table 1: Required Milestone Tasks as defined in the Grant Agreement

	Milestone Task Name
Task 1	Determine Heavy-Duty In-Use Vehicle Eligibility
Task 2	Determine Participant Eligibility
Task 3	Select Participating Repair Shops
Task 4	Determine Eligible Repairs
Task 5	Develop and Implement Program Procedures
Task 6	Develop Participant Surveys
Task 7	Evaluate Incentive Feasibility
Task 8	Final Report

Tasks 1 - 3

The District developed Tasks 1 and 2 by identifying criteria for vehicle eligibility and participant eligibility as defined within the Grant Agreement. The Grant Agreement specified the following data points for eligibility:

1. Vehicle Eligibility **should** include:
    a. Truck or bus
    b. 2007 or newer model year diesel engine
    c. Has one of the following:
        i. Equipped with a diesel particulate filter that has an illuminated malfunction indicator light
        ii. Has an exhaust which has been tested by the SAE J1667 Snap Idle test to exceed five (5) percent opacity
        iii. Has visible smoke coming out of the exhaust pipe during operation when a regeneration event is not occurring
2. Participant Eligibility, may include, but is not limited to:
    a. Residency in the San Joaquin Valley APCD boundaries
    b. Small fleet (20 or less trucks)
    c. Low income criteria
    d. Operation in disadvantaged communities
    e. Must agree to full participation, including surveys

As with many pilot projects, the criteria for participation is kept relatively loose so that the greatest range of participants can be identified and unforeseen issues can be easily handled along the way. For vehicle eligibility, the District started the program guidelines with the three criteria listed above on line 1(c). This provided a basis for repair shops to start identifying eligible vehicles. Likewise, for participant eligibility, the District required the truck owner to meet the follow criteria:

1. Own a heavy-duty diesel vehicle greater than 14,000 lbs. with a 2007 or newer engine model year.

2. Be currently registered in California and domiciled within the San Joaquin Valley APCD boundaries. Domiciled location is determined by the registered address on the DMV cab card. A copy of the current California DMV registration cab card was also required.
3. The truck fleet must be fewer than 20 vehicles, as defined by the California Truck and Bus regulation.

These criteria allowed the District to maintain basic consistency with other heavy-duty truck programs the District was currently operating, as well as meet the requirements set forth with in the Grant Agreement. When it came to selecting participating repair shops the District chose to start with smaller, local shops. The District felt that small, local fleets would be more likely to visit local "mom-and-pop" type repair shops due to lower hourly labor rates as compared to the larger dealership run shops. Additionally, smaller repair shops could get trucks in for services quicker as opposed to the larger, more heavily visited dealerships. However, with a slow start to application submittals by the initially selected repair shops, the District decided to accept a few larger shops into the program in order to expand the types and number of trucks participating.

Tasks 4 – 6

One of the most challenging aspects of the pilot project was identifying the eligible repairs for Task 4. Initially, the District worked with CARB staff to develop the emission systems repairs that could be eligible and the typical items within those systems. Table 2 was developed by CARB and District staff to include within the program documents and was used as a tool to guide the determination of eligibility of repairs during application processing.

Table 2: List of Eligible Emissions Categories

Injection System (DI, DDI,)	Exhaust Gas Recirculation (EGR)	Turbo Charger (TC) (CAC)	Computer System (ECM) (OBD)	Diesel Particulate Filter (DPF) (PTOX)	Catalyst (SCR)	Catalyst (OC) (TWC)	Sensors, switches, etc	Other Emission Control Systems (ECS)
Includes injectors, wiring, fuel pump, regulators, etc.	Includes EGR valve, cooler, controls	Includes Turbo Charger and Charge Air Cooler	Includes computers, modules, wiring, connectors warning lights	Includes filter, regeneration system (including 7th injector), monitoring system, warning lights	Included catalysts, DEF dosing system, monitoring systems, warning lights	Includes catalysts, monitoring systems, warning lights	Includes oxygen sensors (HO2S), air fuel sensors (HAFS), coolant temperature, air intake temperature, barometric pressure, intake manifold pressure, etc.	Includes intake and exhaust manifolds, valve adjustment, air filter, crankcase controls,

Table 2 was incorporated into a worksheet that District staff used when processing applications in order to determine if the quoted repairs were eligible. It was also used as part of the Pre-Repair Survey to get an understanding of the types of repairs the vehicle may have previously had completed. However, shortly into the processing of vehicle applications, it became clear that this table alone was not

sufficient in determining if repairs were eligible. Often times there were multiple factors that played into the determination. For example, project G-90788 presented with an illuminated check engine light and illuminated DEF light along with active codes for the SCR system. Eligible system repairs were quoted at $3,291.86. However, upon more detailed examination of the DTC printout it appeared there could have possibly been user error with this system. Further information needed to be obtained before an eligibility determination could be made. Because of the complexity of these systems and the wide range of repair types needed, the District asked CARB to play a larger role in helping to identify eligibility. While the District maintained the final determination based on the terms of the Grant Agreement, each project was presented to a member of CARB staff who had expertise in the repair field to aid District staff in better understanding the types of repairs and what follow up documentation or information may be needed to properly make an eligibility determination. This collaboration greatly increased the final success of the program and allowed District staff the opportunity to learn far more about emission system repairs than what would otherwise have been possible.

For Task 5, the following documents were created:

1. Program Guidelines
2. Program Application
3. Eligible Cost Form
4. Pre Repair Survey
5. Repair Shop Contract to participate
6. Repair Shop Guidelines (Exhibit B to the Repair shop Contract)
7. Repair Voucher
8. Claim for Payment Procedures
9. Claim for Payment Request form
10. Post Repair Survey
11. Internal processing checklists

The District utilized an application template currently being used in the District's heavy-duty truck grant program for the truck owner application. This allowed for some consistency in the look and flow of the application with other programs as well as being efficient with time.

For Task 6, in March 2019, the District began developing the pilot project's Pre-Repair and Post-Repair surveys in collaboration with CARB and participating University of Chicago researchers who attended the initial project meetings to assist with the program surveys. The District and CARB discussed the layout and the format of the surveys while also determining what information needed to be obtained from the program participants to meet the objectives of the project. After multiple meetings, conversations and edits to the surveys, CARB provided final edits to both surveys in July 2019.

During the development of the surveys it was agreed by both the District and CARB that the surveys should not cause apprehension for would-be applicants to participate in the program. It was determined that the surveys should not be lengthy in nature, too intrusive into the applicant's business, nor expose the applicant to any possible legal trouble for non-compliance with emissions standards. The Pre-Repair survey was designed to acquire data about the applicant's truck operations, types of emission control repairs needed for the truck, the frequency of similar emission control repairs, and the necessity of incentive funds to assist with the costs of emission control repairs to get their truck re-deployed. The Post-Repair Survey was provided to program participants to gather information regarding the frequency the truck had been to the repair shop, how necessary the program was in getting the truck back on the road, and how satisfied they were with the repairs.

Tasks 7 - 8

Task 7 and 8 go hand-in-hand as the Evaluation of Incentive Feasibility is included in the Final Report. In order to accurately assess and analyze the information collected throughout the course of this pilot project, the District compiled survey questions from all applications funded. The resulting data was analyzed and presented in the Final Report. The District also contacted the repair shops and spoke with them regarding the program process to survey how they perceive the program and any suggestions they might have for improving the process. In an incentive program that ultimately relies heavily on a third party, such as the repair shops to complete the process, it is crucial to understand how a program impacts their operation and how well it fits into the flow of their business. This helps to ensure good participation from well-qualified third parties. This Final Report was written by the District staff that worked directly on implementing the program and was provided to CARB during the writing process for review and comment.

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Chapter 3: Project Data

Summary of Repairs

Throughout the length of the HDVRP, the District received 166 applications. Due to the complexity of eligible repairs, once the District reviewed the applications they were presented to CARB for further review and recommendations on eligibility. In some cases, CARB staff identified items that required additional investigation in order to more accurately make a determination. The District would then contact the repair shop to get further information on the item in question. Based on the additional information the District would make a final eligibility determination on the project. Outlined below are a selection of projects that the District believes to be the most complex. These examples provide some insight into the types of challenges that could be faced in a future program. Additionally, these projects represent those that required additional clarification and information from the repair shops. While the shops were able to provide a verbal response, the resulting information did not end up on the quote or final invoices in many cases. Having shops describe all service work to be performed and parts replaced on the estimate, as well as on the final invoice, is critical to holding shops accountable for diagnostics and repairs performed and critical in determining eligibility in a program such as this pilot.

General Issues Relating to Diagnostics and Repairs

Manufacturer's diagnostics vs OBD

Intermittent MIL - OBD addresses intermittent MIL illumination through diagnostic fault code (DTC) confirmation requirements. An OBD MIL will not illuminate unless the DTC has been confirmed by the OBD system. Lack of an MIL-on fault code suggests the inactive DTC's were not confirmed emissions faults

Priority of repairs - OBD captures "freeze frame" data which is a list of parameter identifications describing the conditions under which the vehicle was operating at the time the DTC is captured. This information provides context to aid technicians in diagnosing failures, verifying repair effectiveness, as well as prioritizing repairs. Freeze frame data is only captured for the first DTC or subsequent higher priority DTC's, i.e. misfire or fuel system faults. DTC's with freeze frame data are to be repaired first.

Repair verification - OBD provides not only freeze frame data, but DTCs also have enabling criteria. Post repairs, technicians use both freeze frame and enabling criteria information to recreate the conditions under which the DTC was detected to see if the OBD system acknowledges the DTC has been corrected.

Diagnostic and repair descriptions on final invoice lacks specificity

Diagnostic tests and results that are not recorded on the final invoice create ambiguity and conjecture. A complete and thorough accounting of the diagnostics and repairs are needed for implementing staff to be able to review, understand, and determine eligibility. When specificity is lacking on the invoice, staff has to take additional time to reach out to the repair shop and acquire the necessary information to make a proper eligibility determination resulting in increased processing time and additional time spent for the repair shop as well.

Failure to follow manufacturer and/or accepted industry standards in diagnosing & repairing excessive emissions

Engine manufacturers publish diagnostic and repair data for the products they sell. In that the manufacturer was responsible for the design and production of the engine, the manufacturer is the default expert. In some instances, after-market tools and equipment become available to make the diagnosing and repairing of engines faster, easier, and cheaper. Some after-market tools and equipment, along with the procedures necessary to use them, work as represented and others do not. Those that work and don't conflict with manufacturers diagnostic and repair data are typically written about in nationally published industry journals and become recognized as alternative accepted trade standards. During CARB's review of the projects, research was conducted as to the nature of the proposed repair strategies which brought up questions whether or not these repair strategies proposed by shops complied with manufacturer/industry standards. As such, many projects raised questions as to the repair strategy leading to further discussions with the repair shop for clarification.

The projects highlighted below involved one or more programmatic issue which represent areas of the application where questions or concerns were present during the review process. Projects that had one or more of these programmatic issues required further conversations with the repair shop or additional documentation in order to make an eligibility determination.

1. G-87994 and G-91223

Projects	Application Received	Chassis	Engine	Location
G-87994 G-91223	11/21/19 1/27/20	2016 Volvo, Class 8	2015 Detroit Diesel DD13, 500 HP, HHDD	Clovis, Ca

The District funded two separate applications for repairs on this truck. The first time the truck applied the repair estimate identified the following:

G-87994
Entering Complaint: Check engine light comes on when throttled. Engine is hard to start.

Diagnostics: Showed three inactive codes for turbo/boost control mechanical and active codes for ECT signal stuck and NOx inlet sensor.

G-91223
Entering Complaint: Won't go through ReGen after turbo/injector replacement.

Diagnostics: Two active codes for NOx and an active code for the AHI module.

Programmatic Issues: Manufacturer's diagnostics verses Onboard Diagnostics (OBD), priority of repairs, and specificity of diagnostic and repair descriptions on the final invoice.

Outcome: Based on diagnostic codes, the shop investigated the hard start first.

- Checked for air bubbles going into the engine's cylinder head. No air bubbles found.
- Checked for air bubbles coming out of the engine's cylinder head, found air bubbles present, indicating a need to remove the injectors for further inspection as exhaust gases could be leaking into the system causing the NOx sensors to create active codes.
- Inspection of the injectors confirmed exhaust gases were leaking into the system.

- It was concluded that the injectors needed to be replaced as they were contributing to the active code for the engine coolant temperature along with the turbo due to the inactive codes that were indicating its failure in operation.

The District approved the repairs and issued a voucher. The repair shop submitted a request for reimbursement on 11/25/2019, which was paid after review and approval. Upon receipt of the second application (Project G-91223), it was determined that the invoice number was the same along with the previous items already claimed on application G-87994. Upon further review of the documentation and a conversation with the shop, it became apparent that the repair shop had received the truck back in for a regeneration issue and rather than opening a new invoice number they added the new job (itemized list of repairs) to the original invoice. Upon review by CARB, there was concern about whether the original injector repair was needed. The District spoke to the repair shop to better understand their justification. It was determined that the truck had two separate failures for the same code and that fixing only one of the failures would not have allowed the truck to run a complete regen. Therefore, it was necessary to fix both for a properly running system. The repair of the AHI module and the 7th injector was approved by the District and paid upon receipt of a properly supported and reviewed reimbursement request form.

This particular type of failure was not fully apparent upon first inspection. It was not until the injector kit was replaced that the issues with the AHI module were identified as being a contributing factor to the overall emission system failure. By quoting the second set of repairs on the same work order number, it was difficult for the District to quickly identify the situation, as it appeared they were submitting an application for funding on previously funded repairs. The District recommends that in a future program, repair shops should be instructed to open a new work order number for each application to more easily track and separate repeat repairs.

Due to the lack of specificity on the quotes and final invoice, it is difficult to determine whether repairs performed as part of the 11/21/2019 transaction were emissions related. The following issues were identified:

- Priority of repairs, lack of specificity and an intermittent MIL suggests that the shop relied on manufacturer's diagnostics which don't focus exclusively on emissions faults nor provide repair verification.
- Documentation lacks a description of the diagnostics performed specific to the inactive DTC's.
- Inactive DTC's are those not currently active, suggesting it would be difficult or impossible to conduct accurate diagnostics.

As such, District staff had to spend additional time discussing the quote and invoice with the shop to gain enough information to make an eligibility determination. This additional time equates to slower application processing, approval, and final payment. It is recommended that, for a future program, the repair shops are instructed to provide a greater level of detail and description on their quotes and invoices as well and only allowing OBD diagnostics for eligible repairs.

2. G-90116

Project	Application Received	Chassis	Engine	Location
G-90116	1/2/20	2015 Volvo, Class 8	2015 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: New DEF pump module installed in truck but the pump is still not working.

Diagnostic: Active codes for Reductant Pressure Sensor, Circuit open.

Programmatic Issues: Final invoice lacks specificity and inability to determine if manufacturer specifications when diagnosing/repairing vehicle were properly followed.

Outcome: This truck had previously been seen at the repair shop for a check engine light and multiple OBD codes were found to be at fault. In the initial visit the shop:

- Diagnosed the codes,
- Found the issue to be part of the DEF system, and
- Replaced the DEF pump.

However, after replacing the DEF pump, the truck still had the same codes as before and the shop continued to diagnose the issue. Upon inspection, the mechanic found that the DEF pump did not need to be replaced as originally believed in the previous repairs because the codes were due to an open circuit on the front part of the chassis wiring harness. The repair shop felt that this project would be eligible based on the program guidelines as the front portion of the chassis harness controls sensors around the truck that can lead to faulty readings. The District presented this project to CARB for review and recommendation. CARB raised concerns that the wiring harness was not an emissions related failure, but rather a correction of their previous repair and additional information should be obtained to substantiate eligibility. The final invoice states a faulty chassis wiring harness is the root cause of the customer's complaint. The following issues were identified:

- The invoice lacks specificity on:
    - The cause of the failure
    - The parts description which listed two harnesses with no explanation of the need for the 2nd harness
- Lack of specificity suggests the first repair was not verified as addressing the customer's complaint and raises concerns that the shop may not have followed accepted trades standards in diagnosing and repairing of the vehicle.
- Lack of specificity on the invoice and the possibility of a previous repair make it difficult to effectively analyze the diagnostic and repair proposal requiring the District to obtain further clarification.

Conversations with the shop resulted in an explanation that the faulty codes for the sensors are caused by the front chassis harness which sends the truck into a derate (reduction in engine output). This then disabled the truck from completing proper regenerations. Upon understanding how the front chassis harness plays an active role in the emission systems, the repair was approved as it was determined to be directly linked to the check engine light being illuminated. The DEF pump replacement was not submitted to the District for funding as the original DEF pump was reinstalled on to the truck after the removal of the new pump, therefore only the front chassis harness diagnostic and replacement was funded.

3. G-91951

Project	Application Received	Chassis	Engine	Location
G-91951	2/11/2020	2012 Volvo, Class 8	2012 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: Loss of power / vibration while running.

Diagnostic: No MIL illuminated or active codes, however, further diagnosing determined that the injectors were out of their seats, thus requiring replacement.

Programmatic Issues: Diagnostic and repair descriptions on final invoice lacks specificity and manufacturer's diagnostics verses OBD.

Outcome: Upon initial review of this project, CARB recommended that it not be deemed eligible, as there was no emissions related MIL or diagnostic codes present for the truck, and additional information would be needed if the shop felt like this was an eligible repair. The District contacted the repair shop and the shop explained that:

- The technician observed engine temperature increase and decrease repeatedly indicating the truck was attempting to run a regeneration but could not complete it.
- The incomplete regen was due to the repeated drop in temperature.
- Failure to regen is an indication of a problem in the after-treatment system, there were no electrical faults detected or active codes occurring.
- The shop determined that faulty injectors were preventing the truck from completing a proper regeneration.

The final invoice lacked the above information or any other diagnostic or repair descriptions. Engine diagnostic printouts were provided but there were no active or inactive DTC's for either fuel injectors or the diesel particulate filter. The final invoice did reflect the following:

- Air fuel monitors and diesel particulate filter inspection and maintenance readiness monitors were showing "not ready."
- Extensive inactive and pending DTC's for engine and vehicle network issues such as:
    - Data erratic, intermittent or incorrect,
    - Abnormal update rates, and
    - Invalid or missing data from ECU.

The issue with the air fuel monitor and the DPF inspection and maintenance readiness monitor being "not ready" is suspect. Air fuel monitors are continuous and typically reflect being complete or ready. Due to this, it is difficult to determine if either is due to all of the network faults, diagnostic scan-tool software issue, and/or lack of understanding of OBD, as the OBD system was not leveraged for this truck's diagnostics. The District, in consultation with CARB, ultimately approved the application as it was an emission related failure and the complexity of it could serve as a valuable training tool for a future program.

4. G-91299

Project	Application Received	Chassis	Engine	Location
G-91299	1/28/20	2014 Volvo, Class 8	2014 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: "Check and advise Check Engine Light." MIL illuminated, truck purging air every minute.

Diagnostic: Performed PTT, active codes for Exhaust Gas Recirculation Temperature Sensor and NOx sensor Performance Signal Stuck. Physical inspection found EGR valve stuck open and leaking coolant causing progressive damage, as well as, the fuel line from the AHI module to the 7th injector was stuck to the union.

Programmatic Issues: Diagnostic & repair descriptions on final invoice lacks specificity, manufacturer's diagnostics verses OBD, failure to follow manufacturer and/or accepted industry standards in diagnosing & repairing excessive emissions.

Outcome: When this project was discussed with CARB staff, it was agreed that the EGR repairs were eligible due to the active codes and MIL but the eligibility if the 7th injector and AHI module was questioned. The vehicle had active DTC's for the exhaust gas recirculation and NOx sensor performance. The final invoice stated approval was sought for the EGR valve & "progressive damage." The final invoice lacked specificity for the following items:

- Description of the "progressive damage."
- Reasoning for items needing to be removed in order to replace the EGR valve.
- Reasoning for removal of the AHI module.
- Diagnostic and repair narrative lacks mention/description of the active DTC for the NOx sensor.
- Reasoning/support for replacing inlet and outlet NOx sensors.

The diagnostic printout stated "NOx sensor performance – stuck signal high bank 1 sensor 1" but provided no indication in the diagnostic printout or specificity in the final invoice narrative that supports replacing both sensors. There is no mention of freeze frame data or why the EGR DTC was addressed over the NOx sensor. CARB recommended that additional information be obtained to explain these repairs. The invoice indicated that the "7th injector was stuck to the union" indicating the fuel line from the AHI module to the 7th injector was clogged correlating to a failure of the 7th injector. Upon the District speaking to the shop, it was explained that:

- The engine is not loaded heavily enough for the passive regen at the time the ECM and ACM requested the truck run a regen.
- As a response, the AHI module sends fuel through the fuel line to the 7th injector which then sprays it into the exhaust system.
- Fuel saturates the DOC which allows the regen to run as requested by the onboard computer system.

Since the AHI module had shut off in response to the failure of the 7th injector, both parts of the after-treatment system needed to be replaced in order for the system to fully function properly. Due to the additional information provided by the repair shop, the District determined the repairs to be eligible for program funding. The additional time needed for staff to converse with the shop to clarify the

reasoning and basis for the repairs could have been avoided if there had been a more detailed explanation provided on the invoice.

5. G-91321

Project	Application Received	Chassis	Engine	Location
G-91321	1/29/20	2016 Volvo, Class 8	2015 Detroit Diesel DD15, 505 HP, HHDD	Fresno, Ca

Entering Complaint: MIL illuminated and STOP engine light on, truck asking for regen every 2,000 miles.

Diagnostic: Active code for ECU RDF Data error and SCR efficiency low.

Programmatic Issues: Manufacturer's diagnostics versus OBD, priority of repairs, repair effectiveness verification, and diagnostic & repair descriptions on final invoice lacks specificity.

Outcome: The invoice lacks specificity as it is unclear which light or if both lights are illuminated. The invoice indicated, "Found active codes" for NOx outlet dew point and SCR efficiency due to low DEF quality. However, the diagnostic printouts that were provided were illegible. Additionally, there was no mention of freeze frame or priority of repairs or verification of repair effectiveness indicated on the invoice.

When CARB reviewed the project, it was recommend that the District investigate further as there was a potential for tampering involved since the codes listed an issue with DEF quality. A conversation with the shop revealed that the technician began diagnosing the issue and found:

- An active code for the SCR efficiency low due to DEF quality, and
- An exhaust leak.

Since the DPF was consistently filling with soot the truck was frequently trying to clean it through regens. The technician replaced the exhaust pipe and cleared out the codes, and verified the repair was correct when the codes did not return during the manual regen performed in the shop. Upon discussing the project with the repair shop, the District determined that the repairs were eligible for program funding as regen issues are emissions related and the truck presented with an illuminated MIL, which was an eligibility criteria. While additional specificity on the invoice could have eliminated the need for District staff to call the repair shop, the District believed this project to be of value in better understanding the vast range of emission related issues and could serve to help establish eligible and ineligible repairs in a future program.

6. G-91326

Project	Application Received	Chassis	Engine	Location
G-91326	1/29/20	2015 Volvo, Class 8	2015 Volvo D13, 500 HP, HHDD	Lodi, Ca

Entering Complaint: Engine not starting.

Diagnostic: Shop removed the Turbo actuator and found it locked in place and found progressive damage to EGR cooler and DPF. Over 200 counts of inactive codes for Compressor Discharge Temperature Too High, EGR Temperature Too High, and Turbo Charger Boost Control.

Programmatic Issues: Manufacturer's diagnostics verses OBD, no direct emission failure.

Outcome: The truck went into the repair shop because the truck would not start up. During the preliminary inspection, the repair shop determined:

- The turbo charger was stuck open and leaking.
- The faulty turbo charger was causing damage to the EGR cooler and DPF.

When the turbo is inoperative, the air entering the diesel engine is not compressed before the fuel is injected resulting in an overflow of air, which prevents the fuel from being fully extended into the engine's cylinder thus preventing the truck from starting. Due to progressive damage, the shop replaced the turbo and cleaned the DPF and EGR cooler. During the review of the project with CARB, a concern was presented that the repairs were a result of lack of preventative maintenance rather than a faulty system as the diagnostic printout provided showed no active DTC's or MIL illumination. Additional information was requested. The District engaged the shop in a conversation regarding the complexity of the trucks failures and damage. The shop stated:

- During the inspection, the technician determined that the turbo had not performed correctly staying open and leaking fluid into the EGR.
- Turbo failure caused the EGR to progressively leak into the DPF further damaging the systems.
- The sensors on the vehicle were not able to detect the failures because the truck was not able to start thus no illuminated MIL was present during the initial diagnostics.
- By replacing only the turbo, the plugged DPF and EGR cooler would not have allowed the system to run the necessary regen leading to a derate and loss of operation.

Based on the connection of the failed turbo to the other emission related system failures, the District deemed this project eligible for funding. It should be noted, in a future HD I/M program, a truck that is unable to start should be considered untestable and this condition should be remedied prior to participating. It is recommended that a future program identify this condition as not eligible for funding until such time the truck can start.

7. G-93107

Project	Application Received	Chassis	Engine	Location
G-93107	03/11/20	2016 Volvo, Class 8	2016 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: Regen issue, asking for regen every 2 hours.

Diagnostic: Connected truck to computer to pull codes, found codes for excessive time to enter closed loop DPF regeneration control, DPF efficiency, and SCR NOx catalyst efficiency below threshold. Shop removed EGR coupler to find EGR cooler is 70% dirty. Tested EGR valve and failed due to too much flow.

Programmatic Issues: Diagnostic & repair descriptions on final invoice lacks specificity.

Outcome: The truck came to the repair shop for excessive regen requests and the shop found active codes related to the DPF. Upon inspection, the mechanic discovered that the EGR valve needed replacing as it was leaking coolant into the EGR and plugging up the DPF. When the estimate was initially submitted to the District, it included the replacement of the DPF, DOC, EGR temperature sensor, intake temperature boost sensor, and EGR valve along with EGR cooler cleaning. During the review of the project with CARB, it was agreed that the DPF, DOC, and EGR were easily determined as eligible but CARB had concerns regarding the sensors as there was no indication as to why the sensors needed

replacement from the repair shop's estimated work description. CARB recommended that additional information was necessary to properly make an eligibility determination. The District reached out to the shop and received verification of the connection of the sensors to the emission control systems validating the necessity of being eligible for replacement. This project serves as an example of not having enough detail in the initial estimate to properly determine all eligible repairs.

8. G-94132

Project	Application Received	Chassis	Engine	Location
G-94132	03/16/20	2016 Volvo, Class 8	2016 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: MIL illuminated.

Diagnostic: Active codes for SCR NOx catalyst efficiency below threshold. During physical inspection found DPF filter completely plugged.

Programmatic Issues: Manufacturer's diagnostics verses OBD, repair verification, and failure to follow manufacturer and/or accepted industry standards in diagnosing & repairing excessive emissions.

Outcome: This truck was brought to the same repair shop for a check engine light on two separate occasions.

- During the first visit,
  - The truck presented with an illuminated MIL and active code for the EGR system.
  - Diagnostics showed an EGR valve failure which was plugging up the EGR cooler.
  - The repair shop submitted an application and the District approved and funded the project (G-93231) to replace the EGR valve and to clean the EGR cooler.
- During the second visit,
  - The truck presented with an illuminated MIL and active codes for the SCR, NOx and the same EGR related code that was active for project G-93231.
  - The repair shop submitted a new application for additional repairs.

When the District reviewed the project with CARB, CARB staff communicated concerns that the first visit could have been misdiagnosed by the shop or had potential substandard workmanship performed leading to the return of the truck. CARB recommend additional information be obtained to better understand the nature of the repairs. While it is understood that technicians can make mistakes during diagnostics or by performing the incorrect repairs, the District and CARB felt it important to learn as much as possible about this project before making a determination. After speaking in depth with the shop, it was explained that:

- Certain codes require a multiple number of diagnostic steps.
- Multiple diagnostic steps can be lengthy and costly.
- Owners that no longer have warranty coverage can be hesitant to invest in the recommended diagnostics due to the time and cost.

In order to ease their customers concerns, the repair shop incrementally performs diagnostics, then performs the repairs one-step at a time, completing the repairs and then returning the truck back to operation. In some cases, the single repair is all that is needed but in others cases, the truck returns for the next step in the process. This approach can be problematic in that manufacturer's diagnostic flow

charts are meant to be followed to completion to assess the condition of the entire system. Incrementally diagnosing the vehicle fails to assess the system which might have several problems and therefore might not be worth repairing considering the costs and the value of the truck. The District, in consultation with CARB, deemed this project eligible based on the additional information provided by the repair shop. This project serves as an example of the types of challenges that are faced by smaller fleets with limited financial resources who are unable to have the truck out of operation for extended periods of time. The total amount funded would have remained the same if the two projects had been combined under one invoice.

9. G-92790

Project	Application Received	Chassis	Engine	Location
G-92790	03/05/20	2017 Volvo, Class 8	2017 Volvo D13, 455 HP, HHDD	Fresno, Ca

Entering Complaint: MIL illuminated.

Diagnostic: Shop connected to PTT found codes for misfire, fuel injector offset, and NOx sensor performance. Physical inspection found cylinders were good, DPF face was plugged, DPF filter needed to be replaced, and injectors were bad.

Programmatic Issues: Diagnostic & repair descriptions on final invoice lack specificity, failure to follow manufacturer and/or accepted industry standards in diagnosing and repairing excessive emissions, manufacturer's diagnostics verses OBD, and priority of repairs.

Outcome: After reviewing the estimate and DTC print out, the information on the estimate regarding the DPF diagnostic was incomplete. The invoice stated active DTC's for misfire and NOx and recommended DPF replacement. The invoice showed both the inlet and outlet NOx sensors and the DPF delta pressure sensor were replaced, but lacks specificity in that there is no mention in the diagnostic/repair narrative of testing them or the results of the tests. During the review of this project with CARB, the resulting recommendation was that additional information should be acquired in order to justify eligibility for the DPF replacement due to face plugging. The District spoke to the shop which stated that the manufacturer cites in their repair information that a face plugged filter must be replaced and not cleaned. The District concluded this project eligible along with the DPF replacement due to the additional information provided by the repair shop. It is important to note that manufacturers play a role in determining how repairs are completed and the determinations may vary from one manufacturer to another.

10. G-93220

Project	Application Received	Chassis	Engine	Location
G-93220	03/16/20	2011 Mack, Class 8	2011 Mack MP7, 405 HP, HHDD	Del Rey, Ca

Entering Complaint: DPF system is by-passed and the customer is requesting to get it up to code.

Diagnostic: Connected to PTT and found codes for NOx sensors and SCR inducement severity. The repair shop attempted to run a regen on the truck, but the temperatures would not reach the required temperature which suggested the DPF be replaced. All other functions of the DPF were working.

Programmatic Issues: Known tampering of DPF system.

Outcome: Initial conversations between the District and CARB were focused around the issue of a known tampering of the emission system. However, both agencies acknowledge that it would be important to the larger scope of this program to obtain more information regarding the circumstances surrounding the tampering. The District contacted the applicant directly to discuss the by-passed DPF in which the applicant provided a full history of events. He explained the following:

- Single truck owner/operator, located in DAC.
- 2011 Crane Truck that is utilized in a yard loading trellis.
- The truck was purchased recently from Texas where the previous owner got the emission system up to normal function prior to having the truck driven to California. Upon purchase, he drove the truck to California.
- Shortly after the truck arrived from Texas, the emission control system failed causing a derate in which the truck's speed was limited to 5 mph. During this time the truck was not operational within its vocation.
- The owner tried on multiple occasions and at his own expense to get the system repaired and functioning properly. However, due to limited financial resources, the repairs were not sufficient and the truck continued to have the failure and derate.
- The owner spoke with Valley Truck Repair about the emission control issues, and was provided assurance that the program would reimburse him for repairs.

The District acknowledges that by-passing the DPF is an illegal act, however since the program guidelines and the Grant Agreement did not specifically identify tampered systems as an ineligible for repairs and the truck met the program eligibility criteria, CARB and the District came to the conclusion to fund this project. The District understands the applicant's intent was not malicious but out of desperation to continue operating the truck. The District also believes this project provides valuable information in regards to the pilot project and can provide information for a future program. This project is also discussed in Chapter 4: Lessons Learned, Success, and Recommendations.

11. G-91295

Project	Application Received	Chassis	Engine	Location
G-91295	01/28/20	2014 Volvo, Class 8	2014 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: MIL illuminated.

Diagnostic: Shop connected to PTT and found an active code for DPF efficiency below threshold and multiple inactive codes for DPF pressure sensor. Advised removing the DPF for inspection and found DPF failed. Checked EGR valve, it was stuck open and leaking.

Programmatic Issues: Diagnostic and repair descriptions on final invoice lacks specificity, manufacturer's diagnostics verses OBD, and repair verification.

Outcome: During review of the project with CARB, the eligibility of the unit injectors being replaced and the EGR repairs were brought into question. The invoice stated there are active DTC's for, "DPF pressure sensor," but the diagnostic printout provided by the shop shows only one (1) active DTC for DPF efficiency below threshold. The final invoice lacked specificity in that there is no mention of what was found wrong with the DPF that supports its replacement, no mention of why the injectors were disassembled and ultimately replaced, no mention of testing or condemning the DPF pressure sensor, and no mention of repair effectiveness verification. The District reached out to the repair shop to get

clarification on these two items. The repair shop stated that, upon physical inspection, the technician found the EGR valve to be stuck open and leaking into the DPF. Since the part was not available to be repaired, the only option to correct the issue was to replace it. In regards to the injectors, when the technician attempted a regen for the truck, he noticed the temperature continually fluctuated. The temperature would escalate quickly and then suddenly drop which directly relates to the injectors having a faulty or broken seat. Due to the injectors having a faulty or broken seat, the truck was not able to regen properly. Based on the additional clarification from the shop, the District, in consultation with CARB, determined the injector and the EGR valve repairs were eligible for program funding.

12. G-93217

Project	Application Received	Chassis	Engine	Location
G-93217	03/16/20	2016 Volvo, Class 8	2016 Volvo D13, 500 HP, HHDD	Fresno, Ca

Entering Complaint: Unit has done four regens within 5,000 miles.

Diagnostic: Shop checked trouble codes and found 23 inactive codes for DPF delta pressure sensor, removed and replaced sensor. Cleared codes and put the truck into regen. During regen, found the charge air cooler was leaking.

Programmatic Issues: Manufacturer's diagnostics verses OBD, and diagnostic and repair descriptions on final invoice lacks specificity.

Outcome: This project did not present itself with an illuminated MIL or active codes, however, the repair shop felt that it met the program eligibility for a "failed emission system" since the emission system was not functioning properly. During review of the project, CARB identified eligibility concerns due to the lack of MIL and no active DTC's were present on the diagnostic printout provided by the shop. Additionally, there was no way to confirm appropriate diagnostic and repair strategy due to lack of specificity on the final invoice. The recommendation was to deem ineligible unless the shop could provide additional information. The District contacted the shop to obtain additional information regarding the truck's regen issue. The repair shop stated that it was determined that the truck was having excessive regens by looking at the current soot levels of the DPF using a Tech Tool. This tool states that the soot levels were at 91% causing the excessive regens, but not being able to complete them. The shop provided a copy of the Tech Tool diagnostic to include in the project file. Upon receiving clarification from the repair shop, along with viewing the multiple counts of inactive codes for DPF pressure sensor, the District determined that these repairs fit the guidelines for program funding.

Observations

The District, along with CARB, utilized Table 3 to reference what emission system(s) was in need of repairs and if the repair(s) was eligible for program funds. The Eligible Cost Form displayed the eligible repair system categories as well as a breakdown of total eligible materials cost, labor cost, total eligible amount, and grant amount. Collecting this data from every eligible application submitted enabled the District to determine which emissions systems were most common in repairs/replacements, how many applications required multisystem repairs, and which repair shops were repairing certain emissions systems more often. The categories for emission control systems in the following table include Injection System, Exhaust Gas Recirculation, Turbo Charger, Charge Air Cooler, Computer System, Diesel Particulate Filter, Catalyst (SCR), Catalyst (OC, TWC), Sensors and Switches, and Other Emission Control Systems.

Table 3: Eligible Cost Table

Injection System (DI, DDI,)	Exhaust Gas Recirculation (EGR)	Turbo Charger (TC) (CAC)	Computer System (ECM) (OBD)	Diesel Particulate Filter (DPF) (PTOX)	Catalyst (SCR)	Catalyst (OC) (TWC)	Sensors, switches, etc	Other Emission Control Systems (ECS)
Includes injectors, wiring, fuel pump, regulators, etc.	Includes EGR valve, cooler, controls	Includes Turbo Charger and Charge Air Cooler	Includes computers, modules, wiring, connectors warning lights	Includes filter, regeneration system (including 7th injector), monitoring system, warning lights	Included catalysts, DEF dosing system, monitoring systems, warning lights	Includes catalysts, monitoring systems, warning lights	Includes oxygen sensors (HO2S), air fuel sensors (HAFS), coolant temperature, air intake temperature, barometric pressure, intake manifold pressure, etc.	Includes intake and exhaust manifolds, valve adjustment, air filter, crankcase controls,

The District reviewed all 156 Eligible Cost Forms along with each final invoice from all the contracted repair shops. The District then reviewed which systems were circled on each form stating which repairs/systems were deemed as broken emissions components and were eligible for program funding.

Of the 156 eligible applications submitted, exactly 50% of the total had the DPF system circled. 46% of all the applications contained an invoice with a type of sensor or switch in need of repair, while 28% contained Injection System repairs. A total of 21% of the Catalyst (SCR) system and the Turbo Charger systems were repaired through the pilot project. Projects with repairs associated with the EGR system represented 18% of the total applications. The District concluded that some of the less common emissions systems repaired were the Computer System category and the Other Emission Control System category with their respective percentages of 13% and 10%. Lastly, the District found that there were no repairs associated with the Catalyst (OC, TWC) category. This category contained Catalyst components such as monitoring and warning lights which were not displayed on any service invoice sent in for the program. The District observed that many failed emissions system components have a high probability to effect other emission systems, as we saw 67% of applicants have eligible repairs completed in more than one category from the above table.

Recent investigations by CARB have indicated that there are substantial levels of in-use emissions beyond what would be expected from heavy-duty vehicles based on current standards. It is imperative that these systems are functioning properly if the true emission reductions are to be realized. To ensure that in-use heavy-duty vehicles continue to operate at their cleanest possible level, CARB is developing a more comprehensive heavy-duty inspection and maintenance program, pursuant to SB 210. This new HD I/M program will help ensure emissions control systems are adequately maintained throughout the vehicles' operating lives. The details of how this new program will work are currently being workshopped but are likely to include inspection procedures that take advantage of the improvements in OBD systems that are now mandated in heavy-duty trucks that are 2013 and newer. Having an understanding of the most common emission systems seen for repairs will help direct CARB in their

efforts to develop an effective HD I/M program as well as a possible future Repair Program. This information can also assist manufactures as they look to improve the engineering of these systems for future trucks.

Participant Survey Questions and Results

Pre-Repair Survey Questions Results

All truck owners participating in the program were asked to complete the Pre-repair survey questions at the time they filled out the initial application. The results from the surveys include 156 applicants that received funding for emissions related repairs through the pilot project. A copy of the Pre-repair survey is attached in Appendix A.

The pre-repair survey demonstrates the typical use of the vehicles, through annual truck mileages. Data shows that 68% of the owners travel more than 60,000 miles per year with their trucks. See Table 4 below for the range of miles traveled.

Table 4: Annual Miles Traveled per Vehicle

Pre-Survey Question 1	# of Trucks
< 10,000	3
> 60,000	116
10,001 - 25,000	5
25,001 - 40,000	5
40,001 - 60,000	16
No Answer	11
Grand Total	**156**

In addition to assessing the emissions related repairs that were completed through this project, the survey captured the type of emissions related repairs that were previously done on these vehicles. While the repairs varied, 44% of the repairs were performed on two or more categories, followed by the category “Sensors, Switches, etc.” Table 5 displays the common repairs that were completed prior to participating in the pilot project.

Table 5: Past Vehicle Repairs

Pre-Survey Question 2	# of Trucks
2 or More Systems	69
Catalyst (SCR)	2
Diesel Particulate Filter (DPF) (PTOX)	10
Exhaust Gas Recirculation (EGR)	15
Injection System (DI, DDI)	7
Sensors, Switches, etc.	35
Turbo Charger (TC) (CAC)	9
Computer System (ECM) (OBD)	1
No Answer	8
Grand Total	**156**

The survey found that 50% of the applicants would be willing to pay $5,000 or more towards the cost of repairs without financial assistance, while 47% applicants indicated they would only be willing to pay up

to $4,000 if the financial assistance of this pilot project was not available (3% of the surveys failed to answer this question). Table 6 below shows the breakdown in the costs that applicants would pay out of pocket without subsidized costs.

Table 6: Applicant's Costs for After Treatment Repairs without Program

Pre-Survey Question 3	# of Trucks
$1,000 - $2,000	26
$2,000 - $4,000	29
$5,000+	78
< $1,000	18
No Answer	5
Grand Total	**156**

The pre-survey also asked applicants to indicate how they learned about the pilot project to determine how successful outreach efforts were. As anticipated, about 83% (129 applications) learned about the program from the repair shops. Due to the limited amount of funds for the program and the status of a pilot project, the District allowed the selected repair shops to advertise the program and chose not to do any targeted outreach to the truck owners. For the 26 applicants that learned about the program through friends or family, 21 of them applied from February 2020 onward, which indicates that information about the program was starting to travel more quickly throughout the trucking community. One application indicated a response of "other."

To better determine common issues with the engines in the vehicles, staff grouped the data collected by those that had marked a single item and those that had marked multiple items. As seen in Table 7, an overwhelming majority of applicants indicated that four to five of the listed items applied to their trucks.

Table 7: Common Engine Issues in Vehicles

Pre-Survey Question 5	# of Trucks
2-3 items selected	15
4-5 items selected	122
Clogged filter	2
De-rating engine	2
Having DPF status warning light on	2
Trouble regenerating	7
No answer	6
Grand Total	**156**

Table 8 shows that 83% of the applicants felt there was an immediate need for the repairs to be completed as the truck was not able to run properly without repairs. Small fleets often do not have back-up trucks that can be put into service while a truck is in the shop or is waiting for repairs. Additionally, many of the emission system failures cause the truck to be inoperable. Within the trucking industry, income is typically earned by the load. The more loads you can complete within a day, the more money you earn. Therefore, every minute the truck is not in service equates to a loss of revenue. Repair shops usually have common parts in stock so that they can perform repairs the same day, often times within hours of the diagnosis.

Table 8: Sense of Urgency for Repairs

Pre-Survey Question 6	# of Trucks
Slight Rush	6
Urgent	18
Very Urgent	129
No Answer	3
Grand Total	156

A customer's satisfaction with their selected repair shop is an important factor in the success of a program such as this. Of the projects received, 20 applicants indicated they did not normally use the repair shop chosen for the pilot project, while 130 answered that they did. There were six applicants that did not answer this question. This indicates a high return rate of customers for the contracted repair shops, indicating a high level of customer satisfaction of the services provided. To better understand these results, Table 9 applies the responses to the repair shop used. A total of 90% of the applications funded were received from Valley Truck Repair, the results in the table below further support that a majority of the truck owners are repeat customers to the shops selected.

Table 9: Use of Services at the Repair Shop

Pre-Survey Question 7	# of Trucks
Meyers	**8**
No	5
Yes	3
RDM Diesel	**7**
Yes	6
No Answer	1
Valley Truck Repair	**141**
No	15
Yes	121
No Answer	5
Grand Total	**156**

Additionally, the survey asked applicants to respond whether they would have been able to complete the repairs if they had not received assistance from the HDVRP Pilot Project. 89 applicants indicated 'No,' 36 applicants indicated 'Yes,' and 31 applicants did not answer. Based on the "No" responses, 57% of the applicants did not think they could afford the repairs without the assistance of the program, although 20% of the applicants did not respond. After speaking with repair shops and reviewing notes on repair quotes, there is indication that a number of the applicants opt for only a portion of the repairs, those repairs that are most critical, to keep the cost down. However, with the assistance of the program, more truck operators would be willing and able to complete all necessary repairs to the emission control systems.

The final question in the pre-survey asked the applicants to rank how often they encountered issues on their vehicles with the charge air cooler, diesel particulate filter, EGR valve, and turbo charger. Table 10 below identifies the categories of emission related issues and the number of trucks that identified having the selected issues. As shown, about 63% of the issues involved diesel particulate filters and EGR valves.

Table 10: Common Vehicle Issues

Pre-Survey Question 9	# of Trucks
2-3 Categories	3
Charge Air Cooler (Leakage)	4
Diesel Particulate Filter (DPF)	50
EGR Valve	48
Turbo Charger	6
No answer	45
Grand Total	**156**

Post-Repair Survey Questions Results

All participating truck owners were asked by the repair shops to complete the Post-repair survey after the repairs were completed and prior to leaving with their trucks. The data collected from the second round of surveys include the same 156 applicants that were approved for this program. A copy of the Post-repair survey is attached in Appendix A.

The second survey focused on the truck repairs and inquired when the last time the truck was in the repair shop. As shown in Table 11 below, about 65% of the applicants had the last repairs done to their truck less than one month prior to participating in the pilot project. Although the survey does not ask what specific repairs were done previously, it is important to note that the pre-survey showed that 68% of the owners travel more than 60,000 miles per year with their trucks, which indicates that many of these trucks are fully utilized on the road and may require more maintenance as a result.

Table 11: Latest Repair Shop Visit

Post-Survey Question 1	# of Trucks
Less than 1 month	101
1-3 months ago	28
4-6 months ago	13
6-8 months ago	10
No Answer	4
Grand Total	**156**

Since Diesel Particulate Filters make up a higher percentage of common issues in trucks, as shown in the pre-survey section above, the survey collected data on when the last time each truck had their diesel particulate filter cleaned before participating in the pilot project. Data in Table 12 below shows that half of the trucks had the DPF cleaned less than 6 months before visiting the shop for repairs through the program.

Table 12: Latest DPF Cleaning

Post-Survey Question 2	# of Trucks
Less than 6 months	78
6-12 months ago	30
12-18 months ago	12
Over 18 months	9
Never	20
No Answer	7
Grand Total	**156**

Many truck owners have to work around their business schedule and the repair shop's schedule. As a result, applicants were asked about how long it took to take their truck to the repair shop when they were made aware of emission issues. Results in Table 13 shows that the majority (81%) of the participating truck owners took their vehicles into a repair shop within three months of being notified of issues.

Table 13: Timeframe to Repair Shop with Emission Issues

Post-Survey Question 3	# of Trucks
Less than 3 months	127
3-6 months ago	15
6-8 months ago	5
Greater than 8 months	6
No Answer	3
Grand Total	**156**

The post-survey also inquired whether the emissions related repairs through the pilot project were necessary to operate the truck. Aside from two applicants that did not answer this question, all remaining applicants indicated "Yes." Additionally, the applicants were asked whether they have been prolonging any after treatment repairs to their truck due to associated costs. Although seven applicants missed this question, 96 applicants answered "No" and 53 applicants answered "Yes." With an overwhelming majority indicating that repairs were necessary to operate the truck and approximately 62% responding that they did not prolong the time to complete the repairs, it was concluded that, of the 156 participants, approximately 1/3 had significant financial concerns leading to a delay in completing the necessary repairs. With many of the trucks reporting that the necessary repairs were needed in order to be operational, it would be expected that vehicle owners would not readily prolong these repairs, unless they were unable to afford them.

Another item that is important to take into account, is the additional costs in repairs that the truck owners have to pay. While the pilot project helped funded 90% of the eligible costs, the remaining 10% of the total cost varies by the type and number of emissions related repairs. It is also important to note that additional costs from other needed repairs that may not be emissions related were also included in the invoices, although not paid for through the program. Table 14, below, shows that the majority of the applicants (89%) paid over $1,000 out of pocket, which includes all emissions and non-emissions related repairs.

Table 14: Out of Pocket Costs for Current Repairs

Post-Survey Question 6	# of Trucks
$1-$300	2
$301-$500	1
$501-$800	5
$801-$1000	7
>$1000	139
No Answer	2
Grand Total	**156**

The post-survey asked if the repairs through this pilot project were recurring issues for the trucks. 99 of the applicants indicated that they did not have any prior issues with the repairs through the pilot project and 54 answered that these were recurring issues. Three applicants did not answer this question.

The next question in the post-survey addressed the length of time it took to complete the emissions related repairs through the pilot project. As shown in Table 15, 110 of the applicants (over 70%) had their repairs completed within seven days or less. However, the remainder of the trucks took over one week for repairs to be completed. Some of the repairs may have taken longer than expected, due to special circumstances. Based on previous data, applicants also indicated that their trucks have required multiple repairs or have multiple issues. See Table 15 for the length of time to repair each truck during the pilot project.

Table 15: Timeframe for Truck Repair

Post-Survey Question 8	# of Trucks
1 day	7
2 days	12
3 days	28
4 days	19
5 days	17
6 days	11
7 days	16
8 days	4
9 days	3
10 days	4
11 days	3
12 days	1
15 days	1
16 days	1
20 days	1
21 days	3
25 days	1
30 days	6
60 days	4
90 days	1
No Answer	13
Grand Total	**156**

The timeframe that it takes to repair the trucks could have an impact on the business operation for the truck owners. As such, the post-survey asked if work was missed due to repairs. The survey found that 89 applicants (57%) indicated that they did not have to forgo any days of work for the repairs, while 61 applicants (39%) answered the length of time to repair the vehicles related to work days. Six applicants did not answer this question. Table 16 shows the number of days of work that the applicants had to forgo due to the repairs.

Table 16: Timeframe of Business Delays (days of work lost)

Post-Survey Question 9a	# of Trucks
1 – 3	18
4 – 6	22
7 – 14	8
15 – 29	3
30 – 45	7
46 - 60	3
None	89
No Answer	6
Grand Total	**156**

The truck owners were asked to rank their satisfaction level for the emissions related repairs through the pilot project. Based on the feedback, the pilot project received generally high ratings, especially with the repairs, and the customer service. Applicants indicated a high likelihood of participating in a similar repair program in the future. The slightly lower percentage of satisfaction with the repair timeliness can be attributed to initial processes for applications submittal, review and approval requiring slight modifications after initial opening of the program to further streamline the process. The District worked with providing additional training to the repair shops and making modifications to the application and internal processes to further streamline the program resulting in faster turnaround times for the truck owner. The following table shows that majority of the ratings were for the highest satisfaction level of 10, being 'very satisfied' with the program and 'very likely' to participate again:

Table 17: Percentage of Highest Satisfaction Rating

Post-Survey Questions	Percentage of 'Very Satisfied' and 'Very Likely' Ratings
10. How satisfied are you with the repairs to your vehicle?	93%
11. How satisfied are you with the process to repair your vehicle?	83%
12. How satisfied are you with the level of customer service provided by the repair shop?	93%
13. How satisfied are you with the timeliness of your repair?	75%
14. How likely are you to use a program like this for future repairs?	94%

The following table identifies the number of applicants that responded to each question, based on their satisfaction level:

Table 18: Applicant Satisfaction Ratings

Satisfaction Level	Number of Trucks with Response				
	Question 10 Vehicle Repairs	Question 11 Repair Process	Question 12 Customer Service	Question 13 Timeliness of Repairs	Question 14 Program Useful for Future Repairs
1	0	0	2	0	2
2	2	2	0	2	0
3	0	0	0	0	0
4	0	0	0	2	0
5	0	1	0	2	0
6	0	4	0	0	0
7	0	3	0	4	0
8	4	5	0	7	1
9	4	11	7	21	5
10	145	129	145	117	147
No Answer	1	1	2	1	1
Grand Total	**156**	**156**	**156**	**156**	**156**

Data Analysis

Analysis was performed on a variety of factors involving the type of trucks, model year of trucks, location of applicants, active codes and MIL, eligible costs, and total invoice costs. The information provided will help to identify trends in the pilot project to better identify how to best reach out to truck owners in the future, as well as, achieve a better understanding of the typical costs related to repairs.

Chassis & Engine

Chassis and Engine Make: A majority of the trucks (67%) were Volvo chassis with Volvo engines. While this could indicate a high rate of malfunctioning emission systems with this manufacturer, it is important to state that the majority of applications funded were from a shop that specializes in repairing Volvos. Analysis on the remaining manufacturers represented shows that 59% of the trucks were Freightliner with 48% of those Freightliners having a Detroit Diesel engine as seen in Table 19.

Chassis Weight Class: The program funded one truck in the Class 4 (14,001 – 16,000 ponds GVWR) weight category, one truck funded in the Class 7 weight class (26,001 – 33,000 lbs GVWR) and 154 trucks in the Class 8 (33,001+ lbs GVWR).

Table 19: Chassis & Engine Manufacturer by Percent of Total and Number of Trucks

Chassis and Engine Manufacturer	Percent of Total
Ford	**2%**
Ford	2%
Freightliner	**59%**
Cummins	2%
Detroit Diesel	49%
Freightliner	6%

Chassis and Engine Manufacturer	Number of Trucks
Ford	**1**
Ford	1
Freightliner	**29**
Cummins	1
Detroit Diesel	24
Freightliner	3

Chassis and Engine Manufacturer	Percent of Total
Mercedes-Benz	2%
International	**4%**
Cummins	2%
Navistar	2%
Kenworth	**14%**
Cummins	4%
Paccar	10%
Mack	**2%**
Mack	2%
Peterbilt	**18%**
Cummins	12%
Paccar	4%
Peterbilt	2%
Grand Total	**100%**

Chassis and Engine Manufacturer	Number of Trucks
Mercedes-Benz	1
International	**2**
Cummins	1
Navistar	1
Kenworth	**7**
Cummins	2
Paccar	5
Mack	**1**
Mack	1
Peterbilt	**9**
Cummins	6
Paccar	2
Peterbilt	1
Grand Total	**49**

Engine Model Year: The HDVRP allowed engine model years 2007 and newer to participate. However, the addition of the SCR systems was not available until the 2010 – 2011 model year engines for most manufacturers. The 2015 model year engine saw the greatest number of repairs, 52 trucks, as seen in Table 20, with an overall participation average of a 2013 model year. It should be noted that the District did not conduct inspections on the trucks to confirm engine model years. Therefore it is possible that some applicants may have incorrectly reported engine model years as the engine is typically one year off from the chassis.

Table 20: Number of Trucks Repaired by Engine Model Year

Engine Model Year	# of Trucks
2008	2
2009	1
2011	10
2012	11
2013	12
2014	18
2015	52
2016	33
2017	16
2019	1
Grand Total	**156**

Applicant Demographics

Location by City & County: The District has jurisdiction over the eight counties of the San Joaquin Valley; San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and the valley portion of Kern. Even with a small number of shops contracted to participate, the District received applications from six of the eight counties. A majority of the applications funded were located in the city of Fresno which is expected since Valley Truck Repair completed the highest number of repairs and is located in Fresno.

Table 21: Fleet Location by County and City

County & City	# of Trucks
Fresno County	**130**
Clovis	8
Del Rey	1
Fowler	9
Fresno	104
Hanford	1
Kerman	2
Parlier	1
Reedley	2
Sanger	2
San Joaquin County	**3**
Lodi	1
Stockton	1
Tracy	1

County & City	# of Trucks
Kern County	**7**
Bakersfield	4
Buttonwillow	1
McFarland	1
Shafter	1
Kings County	**1**
Hanford	1
Madera County	**7**
Chowchilla	2
Madera	5
Merced County	**8**
Livingston	1
Los Banos	4
Merced	3

Fleet Size: The program funded 156 applications for a total of 96 different companies. A majority, 69%, of the companies funded had a fleet size of 1-3 trucks. Table 22 lists the number of companies funded per fleet size.

Table 22: The Number of Companies Based on Fleet Size

Fleet Size (# of trucks owned)	# of Companies
1	37
2	16
3	13
4	5
5	7
6	1
7	2
8	1

Fleet Size (# of trucks owned)	# of Companies
9	1
11	1
12	1
14	2
15	2
16	4
17	1
18	1
19	1
Grand Total	**96**

Repair Information

Quoted Eligible Items: Applications indicating the need for two or more of the emission system categories requiring repair represented 53% of the total applications funded. Table 23 identified the number of trucks that reported a need for repairs in the eligible system categories. When compared to the Eligible Costs, determined during processing, it clearly shows that the DPF system was most frequently funded for repairs. Table 24 shows the number of trucks approved per emission system category per repair shop. Again, the DPF was consistently the most frequent repair across all repair shops.

Table 23: Faulty Emission Systems Identified on Quote

Emission Systems	# of Trucks
2 or More Systems	82
Catalyst (SCR)	10
Diesel Particulate Filter (DPF) (PTOX)	20
Exhaust Gas Recirculation (EGR)	8
Injection System (DI, DDI)	11
Sensors, switches, ect	16
Turbo Charger (TC) (CAC)	8
No Answer	1
Grand Total	**156**

Table 24: Emission Systems Approved for Repairs

	Injection System (DI, DDI)	Exhaust Gas Recirculation (EGR)	Turbo Charger (TC) (CAC)	Computer System (ECM) (OBD)	Diesel Particulate Filter (DPF)	Catalyst (SCR)	Catalyst (OC) (TWC)	Sensors, Switches, etc	Other Emission Control Systems (ECS)
Valley Truck Repair:									
Number of trucks	42	25	30	13	70	29	0	62	14
RDM Diesel:									
Number of Trucks	2	2	3	0	6	1	0	5	0
Myers Diesel:									
Number of Trucks	0	1	0	0	2	3	0	5	1
% of Total	28%	18%	21%	8%	50%	21%	0%	46%	10%

MIL Illuminated & Active Codes: Having an illuminated MIL and/or active DTC codes were eligibility criteria established in the Grant Agreement and specified in the program guidelines. However, as with many pilot projects, there are a number of unforeseen situations that present themselves during the application process. As such, the District handled applications that did not have one or both of these criteria met on a case-by-case basis, in consultation with CARB, to determine if they met the overall objectives of the project. As a result, the District funded 101 applications where there was both an illuminated MIL and at least one active code; 32 applications with only an illuminated MIL and no active codes; six applications that had at least one active code but no illuminated MIL; and 17 applications that had neither an illuminated MIL nor any active codes.

Chapter 4: Lessons Learned, Successes, and Recommendations

This pilot project has produced many lessons learned through both its challenges and successes that will be valuable to informing the development a future repair program. By working through the challenges, both the District and CARB have come to a greater understanding of the issues faced with emission related repairs and providing incentives for those repairs. The discussion below describes some of the more notable challenges and successes and how those can be utilized in developing and implementing a future repair program.

Challenges

1. Challenge: Issuance of a voucher prior to repair completion

The District originally selected a voucher-based format for contracting eligible projects. Under this format, applications, along with supporting documentation, are received by the District and reviewed for eligibility. If deemed eligible, the project is allocated funds and a voucher is issued. With a pilot project, there are often many questions and most projects required communication between the repair shop and the District to understand the nature of the repairs in order to determine eligibility. However, the District quickly realized that the repair shops were able to complete repairs much faster than the District could review and approve them. In some cases, diagnosis and repair was completed within a matter of hours while the truck owner waited. Additionally, truck owners did not want to wait days to receive an approval while their truck sat idle, potentially resulting in a loss of revenue for the truck owner. The District engaged the repair shops to understand the normal process for the industry, the issue was presented to CARB during a workgroup meeting, and the Grant Agreement was reviewed to determine available options necessary to align the grant program with the normal process of the repair industry. Following discussions with CARB and the repair shops, the District amended the sub-contract with the repair shops, along with the program guidelines, to allow for repairs to be completed prior to receipt of an approved voucher. The amended language included disclaimers that funds were not guaranteed until a voucher was issued. The District also instructed the repair shops to inform truck owners that payment was not guaranteed until a voucher was issued and an eligible claim for payment was submitted and approved. This allowed the repair shops to continue to provide expedited service to their customers.

Lesson Learned:

The District gained a better understanding of how repair shops function along with the expectations of the truck owners. The District found that the participating shops wanted to get their customers in and out in the least amount of time. The shops expressed that fast, accurate service is what their customers are looking for and ultimately what will ensure that the customer returns for future repairs. The shops expressed hesitation to participate in the program in the beginning as their customers were becoming impatient and upset with the extra wait time added to the repairs for program approvals. After the District amended the process, the repair shops expressed gratitude about the more efficient process. A successful future program should ensure quick turnaround time for repair review and approvals.

2. Challenge: Poor Quality of provided DTC printouts

The HDVRP requires a DTC printout to review the active and inactive codes present for the applicant's truck. The DTC is necessary in that it helped the District determine the eligibility of the repair in

question through codes that are related to emissions. While the repair shops would properly submit the required DTC's, they often were difficult to read. This was normally due to the repair shops printing out their sheets of paper and then scanning them and submitting them through email. It is suspected this was due to the document being compressed as an email attachment. While this may not appear to be a big issue, the additional time it took for District staff to request a new copy, and the time required for the shop to send over a corrected document further delayed the application process. Often, shops took more than a day to send over the required DTC printout due to being busy with repairs and not having dedicated staff to handle HDVRP applications.

Lesson Learned:

Program guidelines, repair shop contracts and repair shop training needs to be very clear on the necessity of the documents being requested. Attempts to streamline and expedite the application process can be greatly hindered with poor quality documents being submitted. With the DTC printout being a critical part of the eligibility determination, it is imperative that the documents submitted are legible. Based on conversations with the repair shops, it is believed that a contributing factor may have been the shops inability to print a high quality document that would then be able to be scanned or faxed. Low ink levels and outdated printing equipment may have contributed to the issue. The District believes that providing multiple ways for submittal, such as a document upload portal that would allow participants to take a photo of the document with their cell phone and upload it directly to the implementing agency, may help to resolve this. This feature is already available in other programs operated by the District and has been a valuable tool in being able to receive documents easily and accurately.

3. Challenge: Proper identification of Eligible Repairs

Determining program eligibility is the main goal during the processing of applications. While participant eligibility is straightforward and easily determined, emission system repairs were not. These systems are complex and involve many parts. They function as part of the entire truck system and can be affected by associated parts or systems. In some cases, the MIL is not illuminated yet active codes are present while in others situations the problem is related to an intermittent process such as a regen and may not present itself immediately upon arrival at the shop. While the Eligible Cost Form and associated chart were helpful in providing a starting point for the repair shops, truck owners, and the District staff, the reality of repairs is far more complicated. The chart identified that components such as the EGR, SCR, and fuel injection systems are eligible, but the MIL must be illuminated in the vehicle. However, these systems may not result in an illuminated MIL but may still cause faulty emission systems. The shops expressed that some trucks may often have the light on while it is out on the road with an active code and may turn off as the code becomes inactive during the time it is at the shop. They argued that the codes, whether active or inactive, at the time of the truck's diagnostics are present due to the existence of an issue and therefore eligible for the repairs covered by the HDVRP Pilot Project. Additionally, emission systems listed on the chart can cause progressive damage to each other without producing an active code. There were a few cases during the pilot project where the DPF had to be replaced due to over-fueling from the injectors, which caused the fuel to travel straight into the DPF causing damage. Although there was a code present for the injector, in some instances, no codes were active for the progressively damaged DPF.

Eligible repairs found throughout the length of the program without active codes included:

- Diesel Particulate Filter (DPF)
- Diesel Oxidation Catalysts (DOC)
- EGR Cooler
- Fuel Injector(s)
- Hydrocarbon Dosing Module (AHI Module)
- Turbo Charger
- Sensors (NOx, DPF, EGR, etc)

Lesson Learned:

The repair shops deemed their applicants' eligibility based off the list of eligible repairs provided to them. Although a majority of the approved repairs had an illuminated MIL, the shops advised that this is not always the case. Some repairs cause emission related issues without activating the MIL due to the lack of electrical components within that system. For a future program to be successful, eligibility of repairs will need to be very clear and easily understood by the truck owner, the repair shop, and the implementing agency. This can be accomplished by requiring an illuminated MIL and active codes for all projects. If a repair shop or implementing agency feels strongly that a project be eligible despite a MIL and active codes, that project needs to go through a predetermined process such as the case-by-case process (CBC) seen in the Carl Moyer Program. The Carl Moyer Program Guidelines clearly identify the process of obtaining a CBC from CARB staff so that every implementing agency follows the same procedure and determinations remain consistent. In these situations, additional information is gathered to support the case and presented to CARB for final decision and approval. Projects are evaluated on a consistent basis and determinations are tracked and published for future reference. This process allows for a future program to be written with very clear, specific eligibility criteria while still providing some structured flexibility for cases that meet the programs goals and objectives but fall outside the normal eligibility. It will also allow CARB to analyze the types of CBC requests over a period of time for future enhancement or clarifications to programs. The Carl Moyer Program case-by-case process can be found in its entirety in Chapter 3, section U of the 2017 Carl Moyer Program Guidelines.

It should be noted that, in a statewide program repair program, a high number of CBC requests may be seen, which could be time consuming for both the implementing agency as well as CARB staff but would help to minimize the number of ineligible repairs funded and help maintain a high level of integrity for a future repair program.

4. Challenge: Insufficient Information Presented On Repair Shop Documentation

One of the most challenging issues this pilot project faced was the lack of specificity on the repair quotes and final invoices. In multiple cases, District staff had to reach out to the repair shop in order to engage in a discussion to gain a better understanding of how they were classifying the repairs as emission related or to connect the dots in the diagnostics performed and the repairs recommended. Often times there was an unclear description on the final invoice of the findings during the repair process that ultimately lead to the recommended repairs. For example, in a project funded through this pilot, the final invoice stated "Check and advise Check Engine Light." The vehicle had active DTC's for the exhaust gas recirculation and NOx sensor performance. Upon the shop technician's inspection, progressive damage to the EGR system was found and determined, by the shop, to be a result of the EGR valve being stuck open and leaking coolant. Additionally, they stated that the fuel line from the AHI module to the 7th injector was stuck to the union which indicated that the fuel line from the AHI module to the 7th

injector was clogged causing the failure of the 7th injector. The final invoice stated that the shop received approval from the District for the EGR valve & "progressive damage" but lacked specificity as to description of "progressive damage." The shop did describe items needing to be removed in order to replace the EGR valve as well as the removal of the AHI module but did not indicate why the AHI module was removed. Additionally, the final invoice lacked language to address the NOx sensor active DTC that was presented in the diagnostic and repair narrative although new inlet and outlet NOx sensors were listed with parts replaced. The diagnostic printout stated, "NOx sensor performance – stuck signal high bank 1 sensor 1," however there was no indication in the diagnostic printout or specificity in the final invoice narrative that supported replacing both sensors. There is no mention of freeze frame data or why the EGR DTC was addressed over the NOx sensor.

Lesson Learned:

The project discussed above required a large amount of staff time to fully understand what was diagnosed on this truck and how that diagnosis fit into the eligibility criteria for the pilot project. Determining what expenses are eligible for the program and what expenses are related to repairs for other, non-emission related systems is difficult. Without detailed information on the quote or invoice, it became challenging for staff to make these determinations. Being cognizant of the fast turnaround time needed for these types of repairs it is critical that the repair shops provide a detailed dialogue on issues diagnosed via OBD, what was visually diagnosed, what repairs are recommended and which parts are necessary for those repairs. The shop's standard way of invoicing and the lack of detail in the description of diagnostics, recommended repair and completed repairs on the quotes and invoices was found to be a challenge during this pilot project. Careful consideration should be given in a future program on the requirements of how this type of information is presented on quotes and final invoices to avoid unnecessary delays in application eligibility determinations.

5. Challenge: Incoming Applications

The District operates one of the largest and most well-respected voluntary incentive programs in the state. Since the District's inception in 1992, considerable funding has been expended in support of clean-air projects across multiple categories including, but not limited to, heavy-duty programs such as on-road trucks, off-road mobile equipment, locomotives and stationary agricultural pumps; as well as community level programs such as woodstove change out, electric car rebates, electric lawn care rebates and light-duty vehicle repair and replace programs. There are two pathways the District employs for application submittal in incentive programs, a solicitation where there is a set amount of time in which applications are received, and over-the-counter in which applications are received on a continual basis. In the solicitation process, applications are not selected for funding until the solicitation is closed and all applications have been reviewed and ranked. The highest ranking applications are then selected for funding. While this process ensures the best projects are funded, it requires a greater amount of time before the applicant knows if they will receive funding. The over the counter method allows for a more expedited selection process. As applications come in, they are processed and selected based on eligibility then funded on a first-come first-serve basis.

Due to the nature of repairs, the HDVRP was processed as an over-the-counter program which is consistent with the District's existing truck replacement program. Additionally, the District chose to implement the HDVRP as a voucher-based program in which the repair shop was contractually obligated to collect the application and supporting documents and submit them on behalf of the truck owner. The District found that repair shops often bundled several applications and submitted them at the same time. This was due to the time it takes for repair shops to move trucks through the process allowing for

repair bays to be free for the next truck. As the funds started to near an end, it was difficult for the District to identify the order each application was received in order to determine which application would receive the last of the funds. Adding to this challenge, some applications had missing information from the applicant and/or the shops. When this occurred, District staff would have to reach out to the shop or truck owner to obtain the necessary information or documents. This process can take several days leaving an application as incomplete and holding up a spot in line for funding. While funds are abundant, this issue is easily dealt with, but as funds neared their completion and expenditure deadlines came up, this posed a challenge for proper implementation of the program.

Lesson Learned:

Guidelines for a future program should state that applications are selected for funding on first-come first-serve of "complete" applications. The guidelines will need to clearly identify what constitutes a complete application so that the repair shops and the truck owners understand missing information will cause a delay in approval or potentially a rejection of the application. Additionally, a future program needs to clearly represent that funds are not guaranteed until a voucher/contract has been issued. With some repairs happening faster than the District could process the application, there was a concern that a truck owner may be anticipating the funds and not receive them due to their application being ineligible or received after funds had been exhausted. The District experienced the HDVRP to be oversubscribed and thus anticipates a future program will also see a very high demand. It will be important to have a process of receiving and approving applications that is easily understood by the truck owners and the repair shops and provides funds in a fair and equitable process.

6. Challenge: Shop involvement

One of the biggest challenges faced was getting qualified repair shops involved in the HDVRP. Although multiple shops eventually contracted with the District across multiple regions of the Valley, only a few turned in applications. This is worth noting, as data collected for the program may not reflect the types of repairs that are seen throughout the state as a whole or across a varied range of vocations and socioeconomic groups. The District initially selected smaller, locally owned repair shops, as they are oftentimes preferred by smaller fleets due to their lower hourly shop rates. Additionally, the District chose to only fund trucks that were domiciled within the San Joaquin Valley APCD boundaries and therefore felt that the smaller local shops would best be able to target the eligible participants. However, as with many new programs, the District found that while repair shops were very interested in the concept, they were skeptical that the District was actually going to pay out on the vouchers issued or that their customers would be able to easily be approved for funding. They expressed concerns over a "to be good to be true" situation and did not want to cause dissatisfaction with their customers if they should not receive funding. They also expressed concerns on when and how they would be reimbursed for approved funds that the truck owner did not pay up front for.

Lesson Learned:

Although utilizing smaller shops for the HDVRP pilot project implementation was successful, it limited the range of repairs for the overall collection of data. The District found that once the first shop completed a few applications and received reimbursement, the other shops started submitting applications. This is a similar situation in many new programs the District has implemented over the years where there is a level of disbelief on the validity of the program or a concern about the process. With the pilot project now complete, there is the ability for the shops that participated to serve as references and the District believes that a future program may not see the same level of initial

resistance to participation. A future program should also look to include larger dealership-based shops as they provide repairs for small fleets as well.

The District learned that truck owners engaged in long haul operations often need more complex repairs completed at dealerships in order to receive warranty coverage. If a truck has multiple systems worked on, such as the SCR, DPF and the turbo at a Volvo dealership based shop, the repairs are warrantied at any Volvo dealership repair shop in the country. If those same repairs were completed at a smaller, local shop, the warranty on those repairs would only be valid at that specific shop. For a long haul driver, the concern is that they can be anywhere when something goes wrong and they want the assurance that repair work performed will be supported and backed at multiple locations. The District concluded that both types of shops are valuable in a larger future program and should be considered in equal numbers to support a repair program across multiple types of fleets and vocations.

7. Use of OBD verses Manufacturer Diagnostics

OBD systems are self-diagnostic systems incorporated into the computers of vehicles that monitor almost every component in the vehicle that is related to or can affect the emission control system performance. This system ensures that the vehicle operates as clean as possible over its entire life. If the OBD system detects a problem with an emissions-related component, a warning light on the vehicle instrument panel is illuminated and important information about the malfunction is stored in order for a repair technician to accurately find and correct the problem. Starting with the 2010 model year, some heavy-duty vehicles started to be equipped with OBD systems. However, by 2013, OBD systems became the required standard in all heavy-duty vehicles. Since the OBD system is not manufacturer specific it brings consistency across all brands of vehicles and allows manufacture neutral repair shops to be able to quickly and effectively diagnose emission related issues in heavy-duty vehicles. Additionally, CARB has developed the OBD system regulations for vehicles sold in California and certifies these OBD systems to further ensure they are meeting system requirements. For example, project G-90116 presented with an active DTC for Reductant Pressure Sensor, Circuit open, code P204A13. The repair performed was on a chassis wiring harness. While a chassis wiring harness is not specifically an emission system part, the shop explained that the faulty codes for the sensors are caused by the front chassis harness which sends the truck into a derate and disables the truck from completing proper regenerations. When researching this project, it was determined that the DTC code was a Volvo specific DTC. It is possible that, based on manufacturer specific information, the shop proceeded in the proper fashion however, from a program perspective it is difficult to verify without the use of a standardized DTC as found with the OBD systems in 2013 and newer trucks.

Lesson Learned:

The District strongly recommends that any future heavy-duty vehicle repair program only accept diagnostics based on OBD codes for engines that are a 2013 model year or newer to ensure consistent diagnostics. In many of the projects seen during this pilot project, questions or concerns were raised during review as to whether or not the repairs were emission system related. This led to additional conversations with the shop to gain further information or justifications and time spent researching the codes to determine if they were manufacturer specific or OBD, all of which added to the amount of time needed to process an application. To streamline the review process, the consistency provided by OBD codes will help prevent unnecessary and often lengthy delays in the processing. Additionally, since the OBD codes are universal across all makes of trucks and engines, a reference guide could be created to assist implementing staff in deciphering the proper use of OBD codes verses manufacturer codes.

8. Challenge: Eligibility of Repairs on Tampered System

Whether or not to repair tampered emission control systems was an area that had not been identified or discussed in the HDVRP Grant Agreement or during the approval process of the program guidelines. As such, the District had not built in any language for applicants or repair shops to identify tampered systems in order to disqualify them from eligibility. During the course of the program, the District received one project that had its malfunctioning DPF removed prior to coming to the repair shop for repair. Based on the program guidelines and eligibility table provided by the District, the repair shop deemed the truck to be eligible as it met the requirements of an illuminated MIL and had an emission failure of the after treatment system. Upon review of the project with CARB, the concern regarding funding a tampered system was presented. After numerous discussions with CARB staff, the District proceeded to investigate the circumstances that led up to the tampering. The discussions with the truck owner revealed the following information:

- Single owner operator located in DAC.
- 2011, Class 8 Crane Truck currently operating in a yard loading trellis.
- Repair Issue - DPF bypassed, requested voucher amount: $8,282.02.
- Truck was purchased recently from Texas, prior to having the truck driven to California the previous owner got the system up to requirement (it seems to have had previous failures) and drove it to California.
- Shortly after the truck arrived in California, the emission control system failed causing a stop to operation.
- Owner tried on multiple occasions, at their own costs, to repair the emission control system, however the truck continued to have the same issues and problems.
- Unable to work or even sell the truck with a faulty system, the applicant was financially unable to perform additional repairs so he bypassed the system in order to keep working to earn money. Once he heard about the repair program he immediately brought the truck in for repairs.

This particular project met the pilot project requirements due to the illuminated MIL and faulty emissions system (a missing DPF) and the applicant fit the target group of truck owners as he is a small fleet and was not able to afford to repair prior to the program. Unfortunately, this exact target scenario of a small fleet with financial difficulties is what led the system to being tampered with. After investing as much money as he could afford into repairs, the truck owner became desperate to continue working with his one and only truck which led to him to bypass the system and continue running his truck. During conversations between the truck owner and repair shop about the emission control issues, the shop assured the applicant that the truck would be eligible and the program would reimburse him for repairs. With that assurance, he approved the completion of the repairs despite the District not yet providing confirmation of eligibility. Based on the information provided by the applicant and the lack of direction in the Grant Agreement and the approved program guidelines, the District, in consultation with CARB, deemed the project eligible for funding and utilized it as an example for discussion on a future program, as it represents a situation that the District feels will be seen again.

Lesson Learned:

A future project will have to make it clear to the shops and the implementing agencies what scenarios are NOT eligible for funding even if all other eligibility criteria are met. The District believes there will be similar cases in a future program where the applicant brings in a tampered truck for repair. It will be important for the shops to understand the program's direction for these situations to avoid confusion and miscommunication. In cases where a truck owner has financial limitations and has tampered with a faulty emission system in order to continue operating, it is highly probable that they would continue to operate as is and with higher emissions. By allowing for these types of situations to be considered for financial assistance through a case-by-case process, a future program can address the issue of small fleet's financial constraints while reducing emissions. The District believes that careful consideration should be given to these situations in a future state program in order to provide needed assistance to small fleets and owner operators who may otherwise not be able to afford costly repairs after recently having to upgrade their trucks to meet State regulation requirements.

Successes

1. Success: Expenditure of Funds

The District, as the implementing agency, experienced many successes throughout the length of the program. The team was able to exhaust all funds without many of the registered shops participation in submitting applications for processing. As mentioned as part of our challenges, some registered shops sent minimal to no applications after electing to participate in the HDVRP. However, the team was still able to expend all funds through a small number of shops and one shop in particular that was able to contribute more than 50% of the applications. This success also represents the potential success a future program can have with a wider range of shops involved as the current pilot was only focused on a small number of participants.

2. Success: Relationships with Repair Shops

Another success of the HDVRP pilot project is that the communication between the participating shops and the District strengthened over time, which allowed for strong relationship between the repair shops and the District. Going into the pilot project, both the District and the shops expected challenges but good communication resulted in quick solutions. Through multiple conversations, the repair shops gained a better understanding of the pilot project allowing them to better present and explain the HDVRP to their customers. Additionally, the District increased its understanding of eligible trucks, allowing for productive conversations regarding the more challenging applications. The relationships built during the HDVRP will play a key role in a future program as it increases the level of understanding by both the shops and the District in regards to the intricacies of the program.

3. Success: Ease of Implementation

Each shop was contacted by District staff who explained the pilot project and inquired how much of their shop's business was involved in repairing emissions systems and asking if they would be interested in participating in this pilot project. Once shops were informed about the eligibility requirements for the pilot project they were eager to start participating. They saw and understood the benefit for their customers, the need for the collection of data, and the overall benefit to emission reductions in the Valley. The first repair shop to contract with the District was Valley Truck Repair in Fresno, California.

Many phone calls took place between District staff and Valley Truck Repair to discuss the program application and invoice requirements. District staff also met with repair shop owners and managers to ease the documentation process and brainstorm how supporting documents could potentially be submitted. Throughout the pilot project, fluid communication was maintained which assisted in the overall success of the program, satisfaction of the applicants, and an increased knowledge of the repair process for District staff. This success provides a foresight on how shops should be approached for future programs as the measures taken by District can be used as a blueprint for a future program and implementing agencies.

4. Success: Successful Receipt of Surveys

The District was able to receive all of the pre- and post-repair surveys from the applicants that were funded by the pilot project. The surveys were the most crucial measuring tool used for data collection and a critical component of the program. The District made completion of the surveys by the applicants a requirement of funding and reimbursement to help ensure the best rate of return. While surveys were received for all applicants, in some cases, applicants failed to answer all the questions on either the pre- and/or post-surveys. The occurrence of unanswered questions was relatively low and did not significantly affect the usefulness of the information gathered. Due to the high return rate and the usefulness of the information, a future program should also incorporate a survey/program assessment tool.

5. Success: Gaining Technical Knowledge

The District started the program with little to no knowledge about heavy-duty diesel engine repairs. Through the course of program development and application processing, the District was able to gain a basic knowledge of the diagnostic process, DTC printouts, and the types of repairs and parts that are commonly seen in broken emission control systems. Through ongoing conversations with the repair shops and CARB staff, repetition of certain repairs on multiple applications, and the addition of a new District staff member with prior truck repair experience, the District was able to understand the repairs better and increase the knowledge of the staff overall in regards to emission control system repairs. This enabled the District to quickly identify missing or unclear information on quotes and/or invoices and obtain clarification. The repair shops expressed their appreciation in those situations which further contributed to building their relationship with the District.

6. Success: Understanding of Need

The HDVRP allowed the District to gain a better understanding of the needs of small fleet and owner/operators located in Valley communities. News of the program quickly spread throughout the Valley following its release. District staff spoke to many interested truck owners calling in to inquire about the program, many of which described how it could potentially save their businesses. Through these phone calls and the collection of survey data, the District observed a need for financial assistance with repairing faulty emissions components. It became apparent through these conversations and data collection that the need was highest in trucks ranging from years 2012 to 2016. After analyzing the data from funded projects, we saw that over 20 small fleet owners had multiple trucks in their fleets repaired through the program. The District found success in these phone calls and surveys from truck owners who were in need of repairing multiple trucks as they enlighten manufactures, policy makers, and communities that there is a need for assistance in heavy-duty emissions system repairs.

Chapter 5: Evaluation of Feasibility

CARB is considering the need and functionality of a repair assistance program to compliment inspection efforts and aid vehicle owners that may not otherwise be able to afford the financial burden of costly repairs. The District will also continue to look for feasible opportunities to help further reduce criteria pollutants in the San Joaquin Valley that includes providing support to CARB and contributing our efforts to ensure that vehicles operate as cleanly as possible. HDVRP was developed to provide financial assistance to the small fleet truck owners and operators on emission related repairs, and to determine whether the program can contribute to a future heavy-duty vehicle inspection and maintenance program. Based on the information and data gathered from the pilot project, implementation of a full-scale heavy-duty truck repair program for fleet owners poses certain challenges. However, with careful consideration to the program guidelines, a repair program can be successfully implemented.

Feasibility, Effectiveness and Utility of Large-Scale Program

As part of the Grant Agreement Task 7, the District looked at the feasibility of a large-scale repair program across three areas: Can it be easily implemented? Will it be successful in reducing emissions? How useful will it be?

Can a repair program be easily implemented?

Currently, there is no large-scale repair assistance program for heavy-duty vehicles. However, light-duty vehicle repair programs have been in place for over 20 years through the State and local air districts. These programs have been highly effective and well accepted by vehicle owners due to their ease of use. To determine the feasibility of a large-scale heavy-duty truck repair program for fleet owners, staff analyzed the District's successful Drive Clean in the San Joaquin Program, which includes a component for passenger vehicle emission related repairs that is aimed at reducing emissions through monetary incentives for Valley residents. The Tune In Tune Up Vehicle Repair Program is designed to quickly screen and identify high-emitting vehicles in need of emissions related repairs and provide necessary incentive funding of up to $850 toward testing, diagnostic, and eligible emissions related repair work.

The District, in partnership with Valley Clean Air Now (Valley CAN), works with BAR certified STAR Test & Repair smog shops, community based organizations, and local community leaders in all eight Valley counties to hold weekend events. At the events, the emissions of each vehicle are tested to determine the likelihood of that vehicle failing a smog test. Owners of vehicles that fail this initial screening are provided with vouchers that are redeemed at participating smog shops.

Participating smog shops agree to accept program vouchers for eligible repairs and complete necessary emissions related repairs for program participants. Once repaired, confirmatory smog tests are conducted on the vehicles, which can be used by the vehicle owners to complete their registration process, as needed. The District provides payments to participating smog shops for documented eligible emissions related repairs. To ensure the integrity of the program, Valley CAN communicates and checks in with the participating repair shops, as well as verifies that estimates and repairs are legitimate. The District team also reaches out to the applicants occasionally to verify information and get feedback on the program. To date, over 31,000 high polluting vehicles have been repaired through the Tune In Tune Up Vehicle Repair Program, which speaks to the ease and success of implementing this type of repair program.

Given the different type of setting for business owners and operators of heavy-duty vehicles, staff recommends a more streamlined and modified approach to a voucher program. Based on staff's experience in working with the repair shops through the pilot project, it would be more feasible for the truck owners to have a pre-inspection done at the participating repair shops at their convenience. Truck owners identified with a need for emissions-related repairs would be issued a voucher for up to a capped dollar amount towards testing, diagnostic, and eligible emissions related repair work. Participating repair shops would be reimbursed based on documented eligible repairs. With this approach, using experiences from existing repair programs for light-duty vehicles and information gathered from the pilot project, a similar program for heavy-duty vehicles could be easily implemented.

How successful can a repair program be in reducing emissions from faulty emission control systems?

CARB had developed and implemented EMFAC2017 as a tool in order to assess emissions from on-road vehicles within California. Based on the EMFAC2017 estimates, heavy-duty vehicles are still projected to represent 24% of NOx and 10% of PM tailpipe emissions statewide from all mobile sources in 2025. Although there have been significant reductions in this sector through various programs, a repair assistance program that helps reduce emissions from faulty emission control systems will contribute to further emission reductions in California. Once the repair shops were fully aware of the program requirements and began to promote the pilot project to truck owners, there was a significant increase in applications that led to the program being oversubscribed. District staff believes the program would continue to garner interest from truck owners with additional outreach and funding. Given the interest level, staff believes that a large-scale program would bring in more truck owners and increase emissions-related repairs, as well as identify needed maintenance that may otherwise be delayed. However, to fully understand how successful repairs to faulty emission systems would be in reducing pollutants, emission level testing pre- and post-repairs would need to be completed. If a large-scale repair program was part of a larger HD I/M program, trucks could be screened and tested for excessive emissions during an inspection then tested again after repairs are complete, similar to the smog tests performed on light-duty vehicles. This information could be used to substantiate the success in reducing emissions from faulty control systems.

How useful can a repair program be?

In addition to the continuous turnover of newer trucks that are meeting more stringent emission standards, it is important to ensure that emissions from heavy-duty vehicles that are operated in the State do not significantly increase over time. While this pilot project accepted vehicles that had a 2007 or newer model year engine, the On-Road Truck & Bus Regulation will require the 2007 – 2009 model year engines be replaced by 2023, and the number of trucks remaining in-use under special exemptions will be minimal. The average engine model year seen in this pilot project was 2013. For 2013 and later model years, the OBD systems have extensive capabilities in monitoring the performance of nearly every engine and emission control components. A repair program would be valuable by incentivizing business operators to bring in their trucks sooner to identify and fix emissions related repairs. With newer technologies to monitor the performance of the emission control components, the information should be accessible and identifiable. Additionally, data from such a program will help local air districts and CARB further identify areas of focus for emission reductions.

A repair program would also be useful in covering emissions related preventative maintenance. Every truck manufacturer requires that certain emission related parts such as the DPF be checked and maintained or cleaned at certain mileages throughout the life of the truck. If not maintained properly, the results can affect an entire emission system or multiple emission systems leading to a system failure.

As presented in the data collected for the pilot project, there were many cases where the DPF was in need of replacement due to the damage sustained. Often times, a truck owner may forget or bypass a routine maintenance due to financial concerns. A preventative maintenance program can cover a smaller portion of the fees for the truck's maintenance of items such as the DPF cleaning at the required mileage. This will not only encourage the applicants to have their maintenance performed, but it will also address potential emission issues before they become excessive. By offering a much lower incentive than what would be provided for a repair to a failed system, it would help to incentivize the proper upkeep, which allows the systems to function at its highest capacity. It will also help some trucks to avoid having a costly, major engine or emission system failures. Often times a small amount paid to encourage proper maintenance will lead to fewer dollars spent on costly, major repairs.

Concepts to Sustain and Streamline Funding

Providing financial assistance as an incentive for truck owners to get faulty emission control systems repaired will help further reduce emissions in heavy-duty vehicles, especially for those that may not have adequate funding to proceed with immediate repairs. The overall success of a full-scale program depends on the amount of money allocated to the program. This pilot project found that the cost of repairs varied by the labor and emission parts within each category of the control systems. The average cost of eligible repairs through the pilot project was $6,076.10 , with a range from $259.03 to $19,711.78. Over 92% of the trucks had repairs completed in three control system categories or less. See Table 25 below.

Table 25: Number of Controls Repairs and Average Costs of Projects

Number of Controls Repaired	Average Costs	Total Number of Projects	Percentage of Projects
1	$3,120.40	52	33.3%
2	$6,586.32	65	41.7%
3	$9,180.46	28	17.9%
4	$6,386.80	6	3.8%
5	$12,905.25	4	2.6%
6	$10,505.41	1	0.6%
Grand Total	**$6,076.10**	156	100.0%

The sustainability and amount of funding over time for applicants are likely to determine the success of a repair program for heavy-duty vehicles. As discussed, the District's light duty vehicle repair program has been operating for 10 years and account for an average of over 3,000 vehicles per year. The funding should take into account the variable costs of labor and emission parts, as well as multiple control categories that each truck may encounter. The pilot project allocated $1 million for emissions related repairs at 90% of the eligible costs and as a result, helped reduce emissions from 156 vehicles and generated interested from additional truck owners. Although, a repair program that pays for 90% of the eligible costs may not be sustainable for the long term, other funding levels should be considered. Such options include an "up to" amount in eligible costs which may help the applicant prioritize more significant emissions related repairs or a combination of a flat rate incentive for diagnostic and/or labor along with a more conservative percentage for itemized repair costs. The District has learned over many years of implementing a variety of incentive programs that applicants are most likely to participate and feel a high level of satisfaction with the program if they have a good idea of how much money they are

eligible for and that there are sufficient funds to keep the program running. Heavily oversubscribed programs that run out of funds quickly give an impression that the program is "too good to be true" and often leave potential applicants discouraged and frustrated as the types of repairs a future program would target cannot wait for funding to be renewed.

In addition to sustainable funding, allocating and spending the funds efficiently while ensuring the integrity of the repair program is also important. As part of a streamlined approach to a voucher program, the District has many years of experience in implementing programs where funds can be paid out either to the applicant as a reimbursement or directly to the participating contractors, such as repair shops that would be fronting the eligible voucher amount for truck owners that are on a budget constraint. To help minimize the impact and ensure that the participating contractors continue to operate effectively, the District has also made it a priority to expedite payments for providing this service to the applicants. The approach to the concepts above, which have been successfully and efficiently implemented for years, will help contribute to an effective repair program for heavy-duty vehicles.

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Chapter 6: Recommendation and Conclusion

Recommended Program Implementation Guidelines

The HDVRP was developed to provide financial assistance to small fleet truck owners and operators on emission related repairs, and to determine whether the HDVRP can contribute to a future heavy-duty vehicle inspection and maintenance program. Based on the District's extensive knowledge and experience in administering successful incentive programs, including HDVRP, the District is providing the following recommendations to assist in the development of implementing guidelines for a future statewide repair program.

Intent of Program: The intent of the HDVRP should continue to assist small fleets by providing financial assistance to aid in the repairs of faulty heavy-duty truck emission control systems allowing these fleets to continue to operate the cleanest running trucks. The District recommends that a future program should continue to provide incentives to fleets with less than 20 trucks with engine model years 2010 or newer to ensure funding is being utilized for trucks that are in compliance with the State Truck and Bus Regulation.

Case-by-Case Approvals - The HDVRP established eligibility on an illuminated MIL or having a SAE J1667 Snap Idle test that exceeds 5 percent opacity. Although a majority of the approved repairs had an illuminated MIL, 23 projects did not. Through the process of better understanding these projects, the District learned that an illuminated MIL may not always be the indicator of eligibility. In the case of application G-91326, discussed in chapter 3, the damage to the EGR and DPF was not evident with an illuminated MIL due to a malfunctioning turbo charger that ultimately caused the truck to not start. Additionally, application G-93217, discussed in chapter 3, also did not present with an illuminated MIL but ultimately was determined to have a failure with the DPF after being diagnosed using a Tech Tool. An illuminated MIL is still the most efficient way to determine a need for and the eligibility of repairs, however, it may not be the sole determining factor. While the District recommends this eligibility criteria be kept, it is also recommended that an alternative pathway be created for eligibility approval such as a case-by-case approval process. In these situations, additional information is gathered to support the case and is presented to CARB or the implementing agency for final decision and approval. By having this feature in a program, it allows the implementing agency to capture projects that are valid and meet the intent of the program but that may not meet the eligibility as written due to known and complex variances.

Eligibility of Repairs – Determining eligibility of repairs was one of the more challenging aspects to implementing the HDVRP. While District staff have a high level of knowledge of heavy-duty trucks and the trucking industry, the intimate knowledge of mechanical specifications related to the repair of complex engine systems was lacking. It is anticipated that most implementing agencies will face a similar challenge even with a strong incentive program implementation background. Because of this, the District is recommending that a future program will need to clearly define eligibility for repairs. The Eligible Cost Table was successful but could be expanded to include more clarification and definitions. Additionally, the guidelines should have a detailed category for ineligible items so that it is easily understood for the truck owner, the repair shop, and the implementing agency which applications should be deemed ineligible. Such items to consider for detailed definition in a future program include, but are not limited to, tampered systems, repeat applications for the same truck, and associated systems that are not directly emission control systems but contribute to the overall function of the emission controls.

Shop involvement – During the length of the Heavy-Duty Vehicle Repair Program pilot project, importance of building relationships with the contracted shops was apparent. The District has operated many incentive programs that required partnerships with equipment dealerships, manufacturers and repair facilities. Each program was successful due to the relationships fostered during the course of implementing the programs. Because of this experience, the District team did not hesitate to start building relationships with the repair shops from the beginning by offering in-person training to repair shop staff on the pilot project. During the course of the project, the District did not hesitate to reach out to the shops regarding questions about quoted repairs, which in turn helped the shops to understand the level of information the District needed to make an eligibility determination. Likewise, District staff was always available to speak to repair shop staff regarding questions they had while assisting truck owners in filling out the application or preparing documents to submit for review. This active communication made it easy for both sides to be able to resolve any issue quickly as many of the repairs were time sensitive as truck owners did not want to have their repairs delayed due to questions about the program. As a result, many applicants promoted the program by recommending it to their peers who also faced emission-related issues with their trucks. Establishing a good relationship with interested shops will assist in achieving an efficient, well-received program in the future.

Quote, Invoices and DTC Printouts – Every repair shop presents quotes in a different format based on their computer software. Receiving applications with hard to understand quotes, missing information, or lack of itemized repairs impedes the review and approval process. While the District understands that shops cannot change the format of their quotes, if made aware of quote requirements, they often can add clarifying language or additional support documents to allow for more efficient processing. The District recommends that the items needed for eligibility determination be clearly listed on the quote and specified in the program guidelines as such. These items include but are not limited to, applicants name, address, truck information (at minimum VIN), full list of diagnostics performed, itemized repairs, itemized labor hours for emission system related jobs, tax, and estimated total

As with quotes, DTC printouts play a big role in eligibility determination. When DTC printouts are submitted blurry or are of poor quality, it impedes the review process causing unnecessary delays. Program guidelines, repair shop contracts and repair shop training should be very clear on the necessity of the documents being requested. The District recommends that future guidelines specify that repair shops should submit a clear, legible print out, which accurately provides the trouble codes, VIN, and date associated with each vehicle.

During the HDVRP, the District saw several applications that had final invoice amounts different than the amount approved on the original estimate. Often times this was a result of the repair shop basing the initial quote on just the codes seen during the diagnostic testing. However, once they started removing parts, progressive damage was found and additional repairs were needed. As a result, some parts listed on the approved estimate were not needed and new items were added thus causing the differences between the quote and final invoice amounts. Future guidelines should provide direction on this by either having a disclaimer that once approved for funding, additional repairs cannot be added for reimbursement or all diagnostic time needed for a certain issue should be approved by their customer prior to application submittal ensuring the most accurate estimate.

Outreach - To ensure that truck owners are familiar with the program and its requirements, it will be important to provide adequate outreach to the target population. Having program materials and available funding information available on a public website will assist in allowing the truck owners to know what items may or may not be eligible for the program. Information regarding participating shops will also need to be easily accessible to allow truck owners to select the repair shop they are most

comfortable with, and allow price comparisons to ensure they are receiving the best service for the best price.

Repair Timeliness – Each day that a truck is in the shop and not on the road is a day that the truck is not generating revenue. The contracted repair shops expressed that fast, accurate service is what their customers are looking for and ultimately what will ensure that the customer returns for future repairs. Early on, repair shops expressed hesitation to participate in the program due to the lengthy process of the program eligibility. It became clear to the District that some repairs were capable of being completed within the same day of being diagnosed. While the District implemented a relatively fast turnaround time for application approval, in many cases it was still much slower than the time it takes for repair shops to diagnose and complete the repairs. The issue of timing in regards to application approval will need to be considered in future program implementation guidelines in order for the program to be successful. Having an online portal for application submittal could be a valuable tool to expedite the implementing agencies processing time. A well-built portal can also provide an application status update so that the repair shops and/or truck owner can see where their application, and eventually their claim, is in the process. Additionally, if eligibility and issuance of the voucher is completed at the time of a HD I/M program inspection similar to what is done in the light duty vehicle programs, then the implementing agency will only be responsible for the reimbursement of the voucher. The District believes that this would be the most efficient way to implement a full scale repair program.

Application Process - There are two pathways the District employs for application submittal in incentive programs. First is a solicitation in which a set amount of time is allocated for application submittal after which submissions are closed and the projects are ranked then selected. Second is an over-the-counter in which applications are received on a continual basis and funded on a first come, first served basis. In the solicitation process, applications are not selected for funding until the solicitation is closed and all applications have been reviewed and ranked. The highest ranking applications are then selected for funding. While this ensures the best projects are funded, it requires a greater amount of time before the applicant knows if they will receive funding. The over the counter method allows for a more expedited selection process. As applications come in, they are processed and selected based on eligibility then funded on a first-come first-serve basis.

Due to the nature of repairs, the HDVRP was implemented as an over-the-counter program which is consistent with the District's existing truck replacement program. Additionally, the District chose to implement the HDVRP as a voucher based program in which the repair shop was contractually obligated to collect the application and supporting documents and submit them on behalf of the truck owner. The District found that repair shops often bundled several applications and submitted them at the same time. This was due to the time it takes for repair shops to move trucks through the process allowing for repair bays to free for the next truck. As the funds started to run out, it was difficult for the District to identify the order each application was received in determining which application would receive the last of the funds. Adding to this challenge, some applications had missing information from the applicant and/or the shops. When this occurred, District staff had to reach out to the shop or truck owner to obtain the necessary information or documents. This process can take several days leaving an application as incomplete and holding up a spot in line for funding. While funds are abundant, this issue is easily dealt with but as funds neared their completion and expenditure deadlines came up, this posed a challenge to proper implementation of the program.

Guidelines for a future program should state that applications are selected for funding on a first-come first-serve of "complete" applications. The guidelines will need to clearly identify what constitutes a complete application so that the repair shops and the truck owners understand missing information will

cause a delay in approval or potentially a rejection of the application. Additionally, a future program needs to clearly represent that funds are not guaranteed until a voucher/contract has been issued. With some repairs happening faster than the District could process the application, there was a concern that a truck owner may be anticipating the funds and not receive them due to their application being ineligible or received after funds have been exhausted. The District experienced the HDVRP to be oversubscribed, thus anticipates a future program will also see a very high demand. It will be important to have a process of receiving and approving applications that is easily understood by the truck owners and the repair shops and that provides funds in a fair and equitable process.

Conclusion

The Pilot Project

The HDVRP was successful in meeting its goals of collecting repair data as well as receiving feedback as to how a larger scale program would need to be implemented. CARB supplied the District with $1 million in grant funding which provided financial incentives for eligible heavy-duty truck repairs as well as funding for the District to administer the program. The District developed the program guidelines for the repair shops to follow in order for the eligibility of the repairs to be met as expected by CARB. Throughout the program, the District faced challenges and took necessary actions to overcome them, such as making amendments to shop contracts. Additionally, there were notable successes that were observed, giving the District assurance in its actions throughout the program. Although many of the contracted repair shops were not able to submit any applications for funding, the shops that did participate were thankful for being chosen for program implementation and expressed interest in future programs. The District used pre- and post-repair surveys to collect the applicant's feedback regarding HDVRP in addition to the issues their truck(s) have been experiencing. Data collected from the surveys represented the applicants' gratitude toward the program as the feedback response was overly positive. Even through the use of a limited number of shops, the District collected and funded 156 applications which shows that the public is willing to help reduce emissions affecting air quality by receiving financial assistance in repairing their broken emissions system. Though 156 projects is a small number of trucks compared to the one million trucks on the roads in California on any given day, the District believes that a future repair program is needed in assisting truck owners with repairing broken emissions systems and ultimately reducing air pollution throughout California.

A Future Program

Based on the data collected for the HDVRP pilot project, a future program will continue to draw interest from repair shops and truck owners. It is worth noting that 156 applications accounted for the $1 million (including administrative costs) in incentive funds provided through the grant. A future, larger scale program will need to take into account the amount of available funds and the percentage of funds provided per project to ensure the best use of funds and the most cost-effective outcome. This pilot project represents a very small subset of the total number of trucks operating in California that may be experiencing failures to their emission systems and thus be eligible for a future program. To ensure that funds are not expended too quickly, a future program should take into consideration the challenges and successes experienced by the District.

Appendix A – Pre-Repair and Post-Repair Survey

Customer Survey Pre-Repair

Answers to survey questions will not affect the funding amount received in any way

1. Annual miles your vehicle travels?

☐ less than 10,000 ☐10,001-25,000 ☐25,001-40,000 ☐40,001-60,000 ☐ more than 60,000

2. What type of repair(s) has your vehicle needed in the past (circle all that apply)

Injection System (DI, DDI,)	Exhaust Gas Recirculation (EGR)	Turbo Charger (TC) (CAC)	Computer System (ECM) (OBD)	Diesel Particulate Filter (DPF) (PTOX)	Catalyst (SCR)	Catalyst (OC) (TWC)	Sensors, switches, etc	Other Emission Control Systems (ECS)
Includes injectors, wiring, fuel pump, regulators, etc.	Includes EGR valve, cooler, controls	Includes Turbo Charger and Charge Air Cooler	Includes computers, modules, wiring, connectors warning lights	Includes filter, regeneration system (including 7th injector), monitoring system, warning lights	Included catalysts, DEF dosing system, monitoring systems, warning lights	Includes catalysts, monitoring systems, warning lights	Includes oxygen sensors (HO2S), air fuel sensors (HAFS), coolant temperature, air intake temperature, barometric pressure, intake manifold pressure, etc.	Includes intake and exhaust manifolds, valve adjustment, air filter, crankcase controls,

Other:

3. If this program was not available, how much money would you spend on after treatment repairs?

☐ $5000+ ☐ $4000-$2000 ☐ $2000-$1000 ☐ less than $1000

4. How did you learn about this program?

☐ the repair shop ☐ friends or family ☐ advertisement ☐ other_____

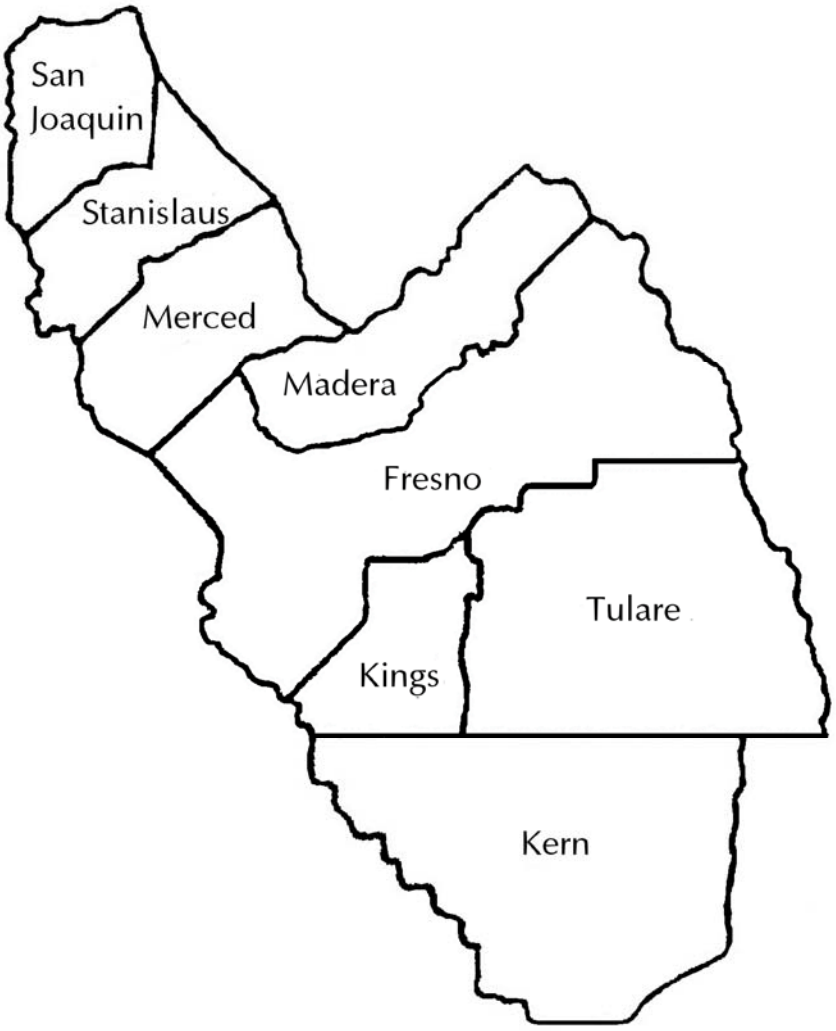
5. Is your engine/vehicle(circle all that apply):
   1. Frequently putting itself in low-power mode (limp mode)
   2. Currently have a DPF status warning light on
   3. Having trouble regenerating
   4. De-rating engine
   5. Clogged filter

6. What is your sense of urgency for the emission repairs currently needed (circle one)?
   1. No rush- vehicle will work without a filter
   2. Slight rush-next chance I can get it in when convenient for me
   3. Urgent-get the vehicle into shop before the next long haul
   4. Very urgent-vehicle cannot run without this repair

7. Do you normally use this shop for repairs? □ Yes □ No
8. Would you have been able to complete the repairs if you had not received assistance from the Truck Repair Program? □ Yes □ No

9. How often do you have issues with the following on your vehicle:	**Please rank the following by marking with an 'x': 1 (never) to 5 (very often)**				
	1	2	3	4	5
Diesel Particulate Filter (DPF)					
Turbocharger					
EGR Valve					
Charge air cooler (leakage)					

Map of San Joaquin Valley APCD Boundaries



CUSTOMER POST REPAIR SURVEY

Project Number:_____

Answers to survey questions *will* not affect the funding amount received in any way

1. When is the last time your truck has been in the shop?
□ Less than 1 month □ 1 -3 months ago □ 4 - 6 months ago □ 6 - 8 months ago

2. When is the last time your Diesel Particulate Filter (DPF) was cleaned before this shop visit?
□ Less than 6 months □ 6 – 12 months ago □ 12 - 18 months □ Over 18 months □ Never

3. How long did you wait to take your truck to the shop when emission issues started?
□ Less than 3 months □ 3 – 6 months ago □ 6 - 8 months □ Over 8 months

4. Are the repairs that were just completed necessary for your truck to be operational?
□ Yes □ No

5. Have you been prolonging any after treatment repairs to your truck due to associated costs?
□ Yes □ No

6. How much did you end up paying for the repair(s)?
□ $1 - $300 □ $301 - $500 □ $501 - $800 □ $801 - $1000 □ Over $1000

7. The repairs that were completed, have they been an issue in your truck previously?
□ Yes □ No

8. How long did the repairs take?

9. Did you forgo any days of work for the repairs? □ Yes □ No

9a. If yes, how many days?

Please rank the following by marking with an 'x': 1 (unsatisfied) to 10 (very satisfied)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
10. How satisfied are you with the repairs to your vehicle?										
11. How satisfied are you with the process to repair your vehicle?										
12. How satisfied are you with the level of customer service provided by the repair shop?										
13. How satisfied are you with the timeliness of your repair?										
14. How likely are you to use a program like this for future repairs? 1 (unlikely) to 10 (very likely)										

Comments:

_____

Appendix B – Eligible Costs Form

ELIGIBLE COSTS

- Please document which emissions parts will need to be repaired, the price per part, and which system they fall under using the chart below.

Injection System (DI, DDI,)	Exhaust Gas Recirculation (EGR)	Turbo Charger (TC) (CAC)	Computer System (ECM) (OBD)	Diesel Particulate Filter (DPF) (PTOX)	Catalyst (SCR)	Catalyst (OC) (TWC)	Sensors, switches, etc	Other Emission Control Systems (ECS)
Includes injectors, wiring, fuel pump, regulators, etc.	Includes EGR valve, cooler, controls	Includes Turbo Charger and Charge Air Cooler	Includes computers, modules, wiring, connectors warning lights	Includes filter, regeneration system (including 7th injector), monitoring system, warning lights	Included catalysts, DEF dosing system, monitoring systems, warning lights	Includes catalysts, monitoring systems, warning lights	Includes oxygen sensors (HO2S), air fuel sensors (HAFS), coolant temperature, air intake temperature, barometric pressure, intake manifold pressure, etc.	Includes intake and exhaust manifolds, valve adjustment, air filter, crankcase controls,

Eligible Labor (hours)	**Price $**

Labor Total: $_____

Materials Total: $_____

Total eligible cost (parts + labor):

$_____

Payment amount requested from District (90% of eligible cost):

$_____

Appendix C – Funded Project Data Set

Applciation #	Applciations Submitted For Same	Function/Vocation	City	ZIP	County	EJ	Truck.Make	Truck.Model	Truck.Model Year	Weight Class	Engine Make	Engine Model	Engine Model Year	Engine Duty Cycle	Horse Power	Fuel Type	Eligible Invoiced Cost	Repair Completion Date	Voucher Amount	Voucher Issued Date	Paid Amount	Fleet Size	Repair Shop Used	MIL	Active Codes
G-85359	Yes	Long Haul Trucking	Fresno	93722	Fresno	Yes	Volvo	VNL	2015	Class 8	Volvo	D13	2014	HHDD	455	DSL	$ 1,747.36	10/21/2019	$ 1,572.62	10/21/2019	$ (1,572.62)	1	Valley Truck Repair	Yes	Yes
G-87960		Agricultural	Fresno	93723	Fresno	Yes	Volvo	VN Series	2012	Class 8	Volvo	D13	2012	HHDD	425	DSL	$ 11,142.66	11/16/2019	$ 10,028.39	11/21/2019	$ (10,028.39)	14	Valley Truck Repair	No	No
G-88206		Produce Delivery	Clovis	93611	Fresno	No	Volvo	VNL 730	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,897.00	12/03/2019	$ 4,407.30	12/02/2019	$ (4,407.30)	2	Valley Truck Repair	Yes	No
G-88797	Yes	Long Haul Trucking	Fresno	93727	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,823.06	11/23/2019	$ 4,340.75	12/09/2019	$ (4,340.75)	1	Valley Truck Repair	Yes	No
G-89184		Truck Tractor	Fresno	93727	Fresno	Yes	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	DD15	2014	HHDD	455	DSL	$ 3,884.90	12/13/2019	$ 3,496.41	12/18/2019	$ (3,496.41)	1	Valley Truck Repair	Yes	Yes
G-90788		Long Haul Trucking	Fresno	93722	Fresno	Yes	Peterbilt	384	2011	Class 8	Paccar	MX13	2011	HHDD	500	DSL	$ 3,291.86	01/04/2020	$ 2,962.67	01/22/2020	$ (2,962.67)	14	Valley Truck Repair	Yes	Yes
G-91121		Agricultural	Sanger	93657	Fresno	Yes	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 4,676.90	12/16/2019	$ 4,209.21	01/30/2020	$ (4,209.21)	1	Valley Truck Repair	Yes	Yes
G-85497		Produce Delivery	Clovis	93611	Fresno	No	Volvo	VNL	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 12,270.51	10/22/2019	$ 10,613.66	10/22/2019	$ (10,613.66)	4	Valley Truck Repair	Yes	Yes
G-86135	Yes	Long Haul Trucking	Fowler	93625	Fresno	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 2,487.85	10/21/2019	$ 2,239.07	10/23/2019	$ (2,239.07)	3	Valley Truck Repair	Yes	Yes
G-86202		Long Haul Trucking	Fowler	93625	Fresno	Yes	Volvo	VN Series	2014	Class 8	Volvo	D13	2013	HHDD	455	DSL	$ 3,693.69	10/24/2019	$ 3,324.32	10/24/2019	$ (3,024.17)	1	Valley Truck Repair	Yes	Yes
G-86680	Yes	Long Haul Trucking	Fowler	93625	Fresno	Yes	Volvo	VNL 670	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 7,978.20	11/01/2019	$ 7,180.38	11/01/2019	$ (7,180.38)	1	Valley Truck Repair	No	Yes
G-86794	Yes	Long Haul Trucking	Fresno	93722	Fresno	No	Volvo	VNL 670	2013	Class 8	Volvo	D13	2013	HHDD	425	DSL	$ 1,175.63	11/01/2019	$ 1,040.08	11/01/2019	$ (1,040.08)	2	Valley Truck Repair	Yes	No
G-86821		Long Haul Trucking	Fresno	93725	Fresno	Yes	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	455	DSL	$ 8,133.77	11/01/2019	$ 7,320.39	11/01/2019	$ (7,320.39)	7	Valley Truck Repair	Yes	No
G-86989		Long Haul Trucking	Clovis	93611	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 6,927.31	11/06/2019	$ 6,234.58	11/05/2019	$ (6,234.58)	2	Valley Truck Repair	No	No
G-87108	Yes	Truck Tractor	Fresno	93722	Fresno	Yes	Volvo	VNL	2013	Class 8	Volvo	D13	2012	HHDD	500	DSL	$ 3,210.34	11/04/2019	$ 2,889.31	11/13/2019	$ (2,889.31)	1	Valley Truck Repair	No	Yes
G-87218	Yes	Long Haul Trucking	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 3,208.65	11/05/2019	$ 2,887.79	11/13/2019	$ (2,887.79)	1	Valley Truck Repair	Yes	Yes
G-87315		Reefer	Fresno	93722	Fresno	Yes	Volvo	670	2017	Class 8	Volvo	D13	2017	HHDD	455	DSL	$ 9,568.38	11/15/2019	$ 8,611.54	11/19/2019	$ (8,611.54)	2	Valley Truck Repair	No	Yes
G-87759		Produce Delivery	Clovis	93611	Fresno	No	Volvo	VNL 780	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 1,594.37	11/12/2019	$ 1,434.93	11/20/2019	$ (1,434.93)	2	Valley Truck Repair	Yes	Yes
G-87774		Long Haul Trucking	Fresno	93720	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 3,636.23	11/13/2019	$ 3,272.61	11/21/2019	$ (3,272.61)	4	Valley Truck Repair	No	Yes
G-87896		Long Haul Trucking	Los Banos	93635	Merced	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 8,111.63	11/19/2019	$ 7,300.47	11/20/2019	$ (7,300.47)	7	Valley Truck Repair	Yes	Yes
G-87911		Long Haul Trucking	Fresno	93722	Fresno	No	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 8,842.07	11/16/2019	$ 7,957.86	11/20/2019	$ (7,957.86)	1	Valley Truck Repair	Yes	Yes
G-87925		Long Haul Trucking	Los Banos	93635	Merced	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 9,990.91	12/09/2019	$ 8,991.82	11/21/2019	$ (8,991.82)	7	Valley Truck Repair	Yes	Yes
G-87993		Truck Tractor	Livingston	95334	Merced	Yes	Volvo	780	2013	Class 8	Volvo	D13	2013	HHDD	425	DSL	$ 2,397.75	11/21/2019	$ 2,157.98	12/12/2019	$ (1,286.17)	3	Valley Truck Repair	Yes	Yes
G-87994	Yes	Long Haul Trucking	Clovis	93619	Fresno	No	Volvo	VNL670	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 9,399.94	11/19/2019	$ 8,459.95	11/25/2019	$ (8,459.95)	2	Valley Truck Repair	Yes	Yes
G-87995		Reefer	Fresno	93722	Fresno	Yes	Volvo	VN Series	2017	Class 8	Volvo	D13	2017	HHDD	455	DSL	$ 6,360.41	11/20/2019	$ 5,724.37	12/11/2019	$ (5,724.37)	2	Valley Truck Repair	Yes	Yes
G-88005		Dry Van	Kerman	93630	Fresno	Yes	Peterbilt	388	2012	Class 8	Cummins	ISX	2011	HHDD	485	DSL	$ 2,121.51	11/11/2019	$ 1,909.36	12/13/2019	$ (1,909.36)	16	Valley Truck Repair	Yes	Yes
G-88211	Yes	Building or Construction Materials	Fresno	93723	Fresno	Yes	Volvo	VN Series	2008	Class 8	Volvo	D13	2008	HHDD	435	DSL	$ 4,924.03	11/23/2019	$ 4,431.63	12/02/2019	$ (4,431.63)	14	Valley Truck Repair	Yes	Yes
G-88431	Yes	Reefer	Fresno	93722	Fresno	Yes	Volvo	VNL	2017	Class 8	Volvo	D13	2017	HHDD	500	DSL	$ 2,043.11	11/26/2019	$ 1,838.80	12/04/2019	$ (1,838.80)	3	Valley Truck Repair	Yes	Yes
G-88489		Delivery Vehicle	Fresno	93727	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,897.00	12/03/2019	$ 4,407.30	12/09/2019	$ (4,407.30)	2	Valley Truck Repair	Yes	No
G-88637		Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	455	DSL	$ 3,772.40	12/04/2019	$ 3,395.16	12/09/2019	$ (3,395.16)	12	Valley Truck Repair	Yes	No
G-88792		Long Haul Trucking	Fresno	93722	Fresno	No	Volvo	VN Series	2017	Class 8	Volvo	D13	2017	HHDD	500	DSL	$ 10,444.96	12/05/2019	$ 9,400.46	12/09/2019	$ (9,400.46)	2	Valley Truck Repair	No	No
G-88859	Yes	Produce Delivery	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 2,144.08	12/10/2019	$ 1,929.67	12/13/2019	$ (1,929.67)	1	Valley Truck Repair	Yes	No
G-88874		Reefer	Fresno	93737	Fresno	No	Volvo	VN Series	2017	Class 8	Volvo	D13	2017	HHDD	455	DSL	$ 4,502.94	12/07/2019	$ 4,052.65	12/17/2019	$ (4,052.65)	3	Valley Truck Repair	No	No
G-88906		Reefer	Madera	93636	Madera	Yes	Volvo	VN Series	2014	Class 8	Volvo	D13	2014	HHDD	500	DSL	$ 9,806.37	12/27/2019	$ 8,825.73	12/12/2019	$ (8,825.73)	3	Valley Truck Repair	Yes	Yes
G-88985		Container	Hanford	93230	Kings	Yes	Volvo	VN Series	2014	Class 8	Volvo	D13	2014	HHDD	455	DSL	$ 5,121.34	12/12/2019	$ 4,609.21	12/17/2019	$ (4,609.21)	2	Valley Truck Repair	No	No
G-89180		Other	Fowler	93625	Fresno	Yes	Volvo	VNL 780	2014	Class 8	Volvo	D13	2014	HHDD	500	DSL	$ 2,465.79	12/13/2019	$ 2,219.21	12/17/2019	$ (2,219.21)	1	Valley Truck Repair	Yes	Yes
G-89312		Other	Bakersfield	93313	Kern	No	Volvo	VNL 64300	2013	Class 8	Volvo	D13	2012	HHDD	425	DSL	$ 13,044.93	12/31/2019	$ 11,740.44	12/19/2019	$ (11,740.44)	5	Meyers	Yes	Yes
G-89351		Produce Delivery	Fresno	93722	Fresno	No	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 5,960.86	12/17/2019	$ 5,364.77	12/19/2019	$ (5,364.77)	5	Valley Truck Repair	Yes	Yes
G-89352	Yes	Reefer	Fresno	93727	Fresno	No	Volvo	VNL 780	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 689.30	12/05/2019	$ 620.37	12/19/2019	$ (620.37)	2	Valley Truck Repair	Yes	Yes
G-89354		Reefer	Fresno	93727	Fresno	No	Volvo	VNL 780	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,294.43	12/16/2019	$ 3,864.99	12/19/2019	$ (3,711.98)	1	Valley Truck Repair	No	Yes
G-89368	Yes	Truck Tractor	Fresno	93722	Fresno	Yes	Volvo	VNL	2013	Class 8	Volvo	D13	2012	HHDD	500	DSL	$ 5,308.47	11/29/2019	$ 5,187.12	12/23/2019	$ (5,187.12)	4	Valley Truck Repair	Yes	Yes
G-89372	Yes	Gen. Contruction & Mining	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 3,648.59	11/27/2019	$ 3,283.73	12/23/2019	$ (3,283.73)	1	Valley Truck Repair	Yes	Yes
G-89374	Yes	Long Haul Trucking	Fresno	93722	Fresno	Yes	Volvo	VN Series	2014	Class 8	Volvo	D13	2014	HHDD	500	DSL	$ 349.98	12/09/2019	$ 314.98	12/23/2019	$ (314.98)	3	Valley Truck Repair	Yes	No
G-89393	Yes	Long Haul Trucking	Fowler	93625	Fresno	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 1,416.48	11/21/2019	$ 1,274.83	12/23/2019	$ (1,274.83)	3	Valley Truck Repair	Yes	Yes
G-89696		General Cargo	Hanford	93230	Fresno	No	Freightliner	Cascadia	2015	Class 8	Detroit Diesel	DD15	2015	HHDD	455	DSL	$ 11,813.95	12/17/2019	$ 10,632.56	01/07/2020	$ (10,632.56)	1	Valley Truck Repair	Yes	Yes
G-89789		Produce Delivery	Fresno	93727	Fresno	No	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	DD15	2014	HHDD	455	DSL	$ 12,166.62	12/21/2019	$ 10,949.96	01/07/2020	$ (10,949.96)	3	Valley Truck Repair	Yes	Yes
G-89793		Produce Delivery	Fresno	93722	Fresno	Yes	Volvo	780	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 8,779.50	12/19/2019	$ 7,901.55	01/13/2020	$ (7,901.55)	15	Valley Truck Repair	Yes	Yes
G-90113		Reefer	Los Banos	93635	Merced	Yes	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	DD15	2013	HHDD	505	DSL	$ 15,011.51	01/09/2020	$ 13,510.36	01/13/2020	$ (13,510.36)	2	Valley Truck Repair	No	No
G-90116		Long Haul Trucking	Fresno	93720	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,452.04	12/30/2019	$ 4,006.84	01/22/2020	$ (4,006.84)	4	Valley Truck Repair	No	No
G-90454		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 4,024.20	12/09/2019	$ 3,621.78	01/14/2020	$ (3,554.35)	1	Valley Truck Repair	Yes	Yes
G-90458		Delivery Vehicle	Madera	93636	Madera	Yes	Freightliner	Cascadia	2017	Class 8	Detroit Diesel	D13	2017	HHDD	5050	DSL	$ 807.02	12/11/2019	$ 726.32	01/14/2020	$ (726.32)	2	Valley Truck Repair	Yes	Yes
G-90460	Yes	Long Haul Trucking	Fresno	93722	Fresno	No	Volvo	VNL 670	2013	Class 8	Volvo	D13	2013	HHDD	425	DSL	$ 12,111.94	01/07/2020	$ 10,900.75	01/14/2020	$ (10,900.75)	2	Valley Truck Repair	Yes	Yes
G-90467	Yes	Delivery Vehicle	Fresno	93723	Fresno	Yes	Volvo	VN Series	2011	Class 8	Volvo	D13	2011	HHDD	425	DSL	$ 10,505.41	01/09/2020	$ 9,454.87	01/14/2020	$ (8,934.78)	1	Valley Truck Repair	Yes	Yes
G-90470	Yes	Reefer	Fresno	93722	Fresno	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2014	HHDD	455	DSL	$ 3,056.42	01/08/2020	$ 2,750.78	01/14/2020	$ (2,750.78)	1	Valley Truck Repair	Yes	Yes
G-90527	Yes	Produce Delivery	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 1,465.25	12/23/2019	$ 1,318.73	01/22/2020	$ (1,318.73)	1	Valley Truck Repair	Yes	Yes
G-90779		Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	455	DSL	$ 12,796.87	01/13/2020	$ 11,517.18	01/22/2020	$ (11,517.18)	12	Valley Truck Repair	Yes	Yes
G-91083	Yes	Long Haul Trucking	Fresno	93725	Fresno	Yes	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	DD15	2014	HHDD	400	DSL	$ 533.59	01/16/2020	$ 480.23	01/30/2020	$ (480.23)	2	Valley Truck Repair	Yes	Yes
G-91084	Yes	Long Haul Trucking	Fresno	93727	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,008.60	01/17/2020	$ 3,607.92	01/30/2020	$ (3,607.92)	1	Valley Truck Repair	No	No
G-91085		Agricultural Hauler	Reedley	93654	Fresno	Yes	Freightliner	Cascadia	2012	Class 7	Detroit Diesel	D13	2012	HHDD	410	DSL	$ 16,634.57	01/22/2020	$ 14,971.11	01/30/2020	$ (14,971.11)	5	Valley Truck Repair	Yes	Yes
G-91128	Yes	Agricultural	Fresno	93722	Fresno	Yes	Volvo	VN Series	2008	Class 8	Volvo	D13	2008	HHDD	435	DSL	$ 3,238.42	12/16/2019	$ 2,914.58	01/30/2020	$ (2,914.58)	17	Valley Truck Repair	Yes	Yes
G-91223	Yes	Long Haul Trucking	Clovis	93619	Fresno	No	Volvo	VNL670	2016	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 2,677.01	11/27/2019	$ 2,409.31	01/30/2020	$ (2,115.37)	2	Valley Truck Repair	Yes	No
G-91247	Yes	Reefer	Fresno	93727	Fresno	No	Volvo	VNL 780	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 259.03	12/06/2019	$ 233.13	02/06/2020	$ (166.35)	2	Valley Truck Repair	Yes	Yes
G-91250		Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2017	Class 8	Detroit Diesel	DD15	2017	HHDD	500	DSL	$ 373.51	01/24/2020	$ 336.16	02/07/2020	$ (336.16)	12	Valley Truck Repair	Yes	Yes
G-91251		Agricultural	Fresno	93722	Fresno	Yes	Peterbilt	unknown	2013	Class 8	Paccar	MX13	2013	HHDD	500	DSL	$ 3,097.34	01/10/2020	$ 2,787.61	02/06/2020	$ (2,787.61)	17	Valley Truck Repair	Yes	Yes
G-91260		Delivery Vehicle	Fresno	93722	Fresno	No	Kenworth	T680	2015	Class 8	Paccar	MX13	2015	HHDD	500	DSL	$ 3,817.38	01/17/2020	$ 3,435.64	02/07/2020	$ (3,435.64)	14	Valley Truck Repair	Yes	Yes
G-91295		Reefer	Fresno	93711	Fresno	Yes	Volvo	VN Series	2014	Class 8	Volvo	D13	2014	HHDD	500	DSL	$ 12,083.20	01/28/2020	$ 10,874.88	02/06/2020	$ (10,874.88)	5	Valley Truck Repair	Yes	Yes
G-91299		Reefer	Fresno	93722	Fresno	Yes	Volvo	VN Series	2014	Class 8	Volvo	D13	2014	HHDD	425	DSL	$ 5,308.06	01/24/2020	$ 4,777.25	02/06/2020	$ (4,777.25)	5	Valley Truck Repair	Yes	Yes
G-91321	Yes	Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2015	HHDD	505	DSL	$ 985.12	01/24/2020	$ 886.61	02/07/2020	$ (886.61)	3	Valley Truck Repair	Yes	Yes
G-91326		Reefer	Lodi	95240	San Joaquin	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 7,579.97	01/23/2020	$ 6,821.97	02/07/2020	$ (6,821.97)	2	Valley Truck Repair	No	No
G-91448		Reefer	Tracy	95377	San Joaquin	No	Volvo	760	2016	Class 8	Volvo	D13	2016	HHDD	455	DSL	$ 4,874.74	11/13/2019	$ 4,387.27	02/07/2020	$ (4,387.27)	6	Valley Truck Repair	Yes	No
G-91467		Agricultural Hauler	Madera	93636	Madera	No	Ford	F-450	2011	Class 4	Ford	4VF - Series	2011	LHDD	unk	DSL	$ 4,159.04	01/22/2020	$ 3,743.14	02/12/2020	$ (3,743.14)	1	Meyers	Yes	No
G-91511		Produce Delivery	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 2,742.53	01/29/2020	$ 2,468.28	02/18/2020	$ (2,468.28)	1	Valley Truck Repair	Yes	Yes
G-91551	Yes	Dump Truck	Madera	93638	Madera	Yes	Peterbilt	389	2013	Class 8	Cummins	ISX15	2012	HHDD	455	DSL	$ 892.26	01/29/2020	$ 803.03	02/07/2020	$ (803.03)	16	Valley Truck Repair	Yes	No
G-91574		Reefer	Fresno	93727	Fresno	Yes	Volvo	780	2016	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 714.54	01/29/2020	$ 643.09	02/07/2020	$ (616.09)	1	Valley Truck Repair	Yes	Yes
G-91661	Yes	Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 2,742.01	01/30/2020	$ 2,467.81	02/18/2020	$ (2,467.81)	14	Valley Truck Repair	Yes	Yes
G-91666		Agricultural	Fresno	93722	Fresno	No	Kenworth	T680	2015	Class 8	Cummins	ISX	2015	HHDD	550	DSL	$ 1,389.69	02/04/2020	$ 1,196.72	02/07/2020	$ (1,196.72)	14	Valley Truck Repair	Yes	Yes
G-91670		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 6,908.76	03/20/2020	$ 6,217.88	02/07/2020	$ (6,217.88)	14	Valley Truck Repair	Yes	Yes
G-91673		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 1,494.08	01/09/2020	$ 1,344.67	02/07/2020	$ (1,344.67)	14	Valley Truck Repair	Yes	Yes
G-91936		Delivery Vehicle	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	505	DSL	$ 12,077.49	02/06/2020	$ 10,869.74	02/13/2020	$ (10,869.74)	1	Valley Truck Repair	Yes	Yes
G-91939		Line Haul	Bakersfield	93313	Kern	No	Volvo	VNL 780	2016	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 12,727.49	03/12/2020	$ 11,454.74	02/24/2020	$ (11,454.74)	4	Meyers	Yes	Yes
G-91947		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 2,542.53	01/31/2020	$ 2,288.28	02/13/2020	$ (2,288.28)	3	Valley Truck Repair	Yes	Yes
G-91950	Yes	Refuse Truck	Merced	95348	Merced	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,411.83	02/05/2020	$ 3,970.65	02/13/2020	$ (3,957.15)	1	Valley Truck Repair	No	No
G-91951	Yes	Delivery Vehicle	Fresno	93722	Fresno	Yes	Volvo	VN Series	2012	Class 8	Volvo	D13	2012	HHDD	500	DSL	$ 5,104.14	12/16/2019	$ 4,593.73	03/18/2020	$ (4,593.73)	7	Valley Truck Repair	No	No
G-91953		Reefer	Fresno	93722	Fresno	No	Kenworth	T680	2015	Class 8	Cummins	ISX15	2015	HHDD	485	DSL	$ 4,125.62	02/01/2020	$ 3,713.06	02/18/2020	$ (3,697.11)	1	Valley Truck Repair	Yes	Yes
G-91974		Dump Truck	Bakersfield	93314	Kern	No	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	D13	2014	HHDD	410	DSL	$ 4,797.38	03/30/2020	$ 4,317.64	04/23/2020	$ (4,317.64)	1	Meyers	Yes	Yes
G-92089		Agricultural	Buttonwillow	93206	Kern	Yes	International	Prostar	2014	Class 8	Cummins	ISX15	2013	HHDD	400	DSL	$ 2,117.27	03/31/2020	$ 1,905.54	03/06/2020	$ (1,905.54)	5	Meyers	Yes	No
G-92210		Building or Construction Materials	Shafter	93263	Kern	Yes	International	Pro Star	2014	Class 8	Navistar	Maxxforce A430	2013	HHDD	430	DSL	$ 7,388.10	03/31/2020	$ 6,649.29	02/24/2020	$ (6,649.29)	3	Meyers	No	No
G-92214		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2016	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,490.19	01/03/2020	$ 4,041.17	03/20/2020	$ (4,041.17)	1	Valley Truck Repair	Yes	Yes
G-92326		Delivery Vehicle	Mc Farland	93250	Kern	Yes	Peterbilt	388	2012	Class 8	Cummins	ISX15	2011	HHDD	485	DSL	$ 7,341.44	03/19/2020	$ 7,341.44	03/11/2020	$ (7,341.44)	1	Meyers	No	No
G-92377	Yes	Reefer	Chowchilla	93610	Madera	Yes	Volvo	VN Series	2013	Class 8	Cummins	ISX15	2013	HHDD	500	DSL	$ 670.20	02/13/2020	$ 603.18	03/02/2020	$ (603.18)	3	Valley Truck Repair	Yes	No
G-92388		Reefer	Fresno	93722	Fresno	No	Kenworth	T680	2018	Class 8	Paccar	MX13	2017	HHDD	500	DSL	$ 8,433.64	02/15/2020	$ 7,590.28	04/22/2020	$ (7,590.28)	11	Valley Truck Repair	Yes	Yes
G-92413		Delivery Vehicle	Fresno	93662	Fresno	Yes	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	425	DSL	$ 12,726.29	02/24/2020	$ 11,453.66	02/27/2020	$ (11,453.66)	1	Valley Truck Repair	Yes	Yes
G-92423		Delivery Vehicle	Fowler	93625	Fresno	Yes	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	455	DSL	$ 2,234.05	02/07/2020	$ 2,010.65	03/02/2020	$ (2,010.65)	1	Valley Truck Repair	Yes	Yes
G-92429		Reefer	Fresno	93725	Fresno	Yes	Volvo	VN Series	2017	Class 8	Volvo	D13	2017	HHDD	425	DSL	$ 378.90	02/14/2020	$ 341.01	03/02/2020	$ (341.01)	15	Valley Truck Repair	Yes	Yes
G-92441	Yes	Long Haul Trucking	Fresno	93727	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 444.89	02/24/2020	$ 400.40	03/02/2020	$ (400.40)	1	Valley Truck Repair	Yes	No
G-92628		Agricultural Hauler	Fresno	93702	Fresno	Yes	Volvo	VN Series	2012	Class 8	Volvo	D13	2012	HHDD	455	DSL	$ 19,711.78	03/11/2020	$ 17,740.60	03/05/2020	$ (17,740.60)	2	RDM Diesel	Yes	Yes
G-92748	Yes	Reefer	Merced	95348	Merced	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 3,773.01	03/06/2020	$ 3,395.71	03/11/2020	$ (3,079.49)	1	Valley Truck Repair	Yes	No
G-92751	Yes	Agricultural	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2015	HHDD	505	DSL	$ 1,215.20	02/18/2020	$ 1,093.68	03/26/2020	$ (1,093.68)	3	Valley Truck Repair	Yes	Yes
G-92786		Reefer	Fresno	93711	Fresno	No	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	DD15	2014	HHDD	500	DSL	$ 14,138.44	03/04/2020	$ 12,724.60	03/11/2020	$ (12,724.60)	1	Valley Truck Repair	Yes	Yes
G-92788		Reefer	Fresno	93711	Fresno	Yes	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	475	DSL	$ 11,446.87	02/14/2020	$ 10,302.17	03/26/2020	$ (10,302.17)	5	Valley Truck Repair	Yes	No

G-92790		Agricultural	Fresno	93725	Fresno	Yes	Volvo	VN Series	2017	Class 8	Volvo	D13	2017	HHDD	455	DSL	$ 6,157.50	02/17/2020	$ 5,541.75	04/23/2020	$ (5,541.75)	19	Valley Truck Repair	Yes	Yes
G-92791	Yes	Reefer	Merced	95348	Merced	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 585.00	02/18/2020	$ 526.50	03/26/2020	$ (526.50)	1	Valley Truck Repair	Yes	No
G-92794	Yes	Agricultural	Fresno	93722	Fresno	Yes	Volvo	VN Series	2015	Class 8	Volvo	D13	2014	HHDD	455	DSL	$ 349.95	02/04/2020	$ 314.96	03/26/2020	$ (314.96)	1	Valley Truck Repair	Yes	Yes
G-92798		Reefer	Fresno	93720	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 3,361.35	02/14/2020	$ 3,052.22	03/20/2020	$ (3,025.22)	4	Valley Truck Repair	Yes	Yes
G-92808		Reefer	Fresno	93722	Fresno	Yes	Kenworth	T680	2016	Class 8	Paccar	MX13	2016	HHDD	500	DSL	$ 9,254.25	02/20/2020	$ 8,328.83	03/20/2020	$ (8,328.83)	8	Valley Truck Repair	Yes	No
G-92811		Produce Delivery	Fresno	93725	Fresno	Yes	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	425	DSL	$ 1,451.45	02/19/2020	$ 1,306.31	03/11/2020	$ (1,306.31)	15	Valley Truck Repair	Yes	No
G-92813		Reefer	Clovis	93612	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 7,364.58	02/21/2020	$ 6,628.12	03/11/2020	$ (6,628.12)	5	Valley Truck Repair	No	No
G-92815		Agricultural	Fresno	93720	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 4,806.39	02/12/2020	$ 4,325.75	03/26/2020	$ (3,920.75)	4	Valley Truck Repair	Yes	Yes
G-92816		Delivery Vehicle	Fresno	93706	Fresno	Yes	Volvo	VN Series	2012	Class 8	Volvo	D13	2012	HHDD	475	DSL	$ 16,711.28	03/23/2020	$ 15,040.15	03/18/2020	$ (15,040.15)	11	RDM Diesel	Yes	Yes
G-92926		Agricultural	Fresno	93722	Fresno	Yes	Freightliner	Cascadia	2011	Class 8	Detroit Diesel	D13	2011	HHDD	500	DSL	$ 11,767.94	03/06/2020	$ 10,591.15	03/19/2020	$ (10,591.15)	14	Valley Truck Repair	Yes	Yes
G-92927		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 2,091.09	02/04/2020	$ 1,881.98	04/22/2020	$ (1,881.98)	14	Valley Truck Repair	Yes	No
G-93070		Agricultural	Fowler	93625	Fresno	Yes	Kenworth	T680	2016	Class 8	Paccar	MX13	2016	HHDD	505	DSL	$ 9,341.58	03/26/2020	$ 8,407.42	03/26/2020	$ (8,407.42)	1	RDM Diesel	Yes	No
G-93071		Delivery Vehicle	Fresno	93722	Fresno	No	Volvo	VN Series	2016	Class 8	Volvo	D13	2016	HHDD	unk	DSL	$ 14,268.36	04/30/2020	$ 12,841.52	04/22/2020	$ (12,828.11)	1	RDM Diesel	Yes	No
G-93107		Long Haul Trucking	Sanger	93657	Fresno	Yes	Volvo	760	2016	Class 8	Volvo	D13	2016	HHDD	455	DSL	$ 10,743.70	03/24/2020	$ 9,669.33	04/22/2020	$ (9,450.26)	17	RDM Diesel	No	No
G-93108		Delivery Vehicle	Clovis	93619	Fresno	No	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	455	DSL	$ 11,603.72	04/27/2020	$ 10,443.35	04/22/2020	$ (10,443.35)	1	RDM Diesel	Yes	Yes
G-93130		Reefer	Fresno	93722	Fresno	No	Volvo	780	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 10,753.25	03/11/2020	$ 9,677.93	04/09/2020	$ (9,677.93)	1	Valley Truck Repair	No	No
G-93195	Yes	Dump Truck	Madera	93638	Madera	Yes	Peterbilt	389	2013	Class 8	Cummins	ISX15	2012	HHDD	455	DSL	$ 12,442.85	03/05/2020	$ 11,198.57	04/09/2020	$ (11,198.57)	16	Valley Truck Repair	Yes	Yes
G-93207		Agricultural	Reedley	93654	Fresno	Yes	Freightliner	Cascadia	2012	Class 8	Detroit Diesel	D13	2012	HHDD	410	DSL	$ 16,674.74	03/23/2020	$ 15,007.27	04/09/2020	$ (15,007.27)	5	Valley Truck Repair	Yes	No
G-93209		Agricultural	Kerman	93630	Fresno	Yes	Freightliner	Cascadia	2009	Class 8	Mercedes-Benz	0M460	2009	HHDD	476	DSL	$ 8,181.82	03/20/2020	$ 7,363.64	04/09/2020	$ (7,363.64)	16	Valley Truck Repair	Yes	Yes
G-93210		Delivery Vehicle	Stockton	95206	San Joaquin	No	Freightliner	Cascadia	2014	Class 8	Cummins	ISX15	2014	HHDD	600	DSL	$ 3,653.18	03/18/2020	$ 3,287.86	04/27/2020	$ (3,287.86)	18	Valley Truck Repair	Yes	Yes
G-93217		General Cargo	Fresno	93726	Fresno	Yes	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 1,673.26	03/14/2020	$ 1,505.93	04/09/2020	$ (1,505.93)	4	Valley Truck Repair	No	No
G-93220		Boom Truck	Del Rey	93616	Fresno	Yes	Mack	GU713	2011	Class 8	Mack	MP7	2011	HHDD	405	DSL	$ 9,202.24	03/26/2020	$ 8,282.02	04/27/2020	$ (8,120.32)	1	Valley Truck Repair	Yes	Yes
G-93221		Reefer	Fresno	93727	Fresno	No	Freightliner	Cascadia	2013	Class 8	Detroit Diesel	DD15	2013	HHDD	560	DSL	$ 12,545.28	03/11/2020	$ 11,290.75	04/09/2020	$ (11,290.75)	2	Valley Truck Repair	Yes	Yes
G-93226		Reefer	Fresno	93727	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 1,967.66	03/14/2020	$ 1,770.89	04/09/2020	$ (1,770.89)	9	Valley Truck Repair	Yes	Yes
G-93229		Agricultural	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	425	DSL	$ 5,619.32	01/17/2020	$ 5,057.39	04/23/2020	$ (5,057.39)	14	Valley Truck Repair	Yes	Yes
G-93231	Yes	Reefer	Fresno	93727	Fresno	No	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 2,276.27	03/14/2020	$ 2,048.64	04/23/2020	$ (2,048.64)	9	Valley Truck Repair	Yes	No
G-93248		Reefer	Fresno	93727	Fresno	No	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 7,299.08	03/18/2020	$ 6,584.10	04/09/2020	$ (6,569.17)	9	Valley Truck Repair	Yes	Yes
G-93401		Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2017	Class 8	Detroit Diesel	DD15	2017	HHDD	560	DSL	$ 807.02	02/28/2020	$ 726.32	04/22/2020	$ (726.32)	12	Valley Truck Repair	Yes	No
G-93406	Yes	Reefer	Chowchilla	93610	Madera	Yes	Volvo	VN Series	2013	Class 8	Cummins	ISX15	2013	HHDD	500	DSL	$ 13,424.93	03/21/2020	$ 12,082.44	04/22/2020	$ (12,082.44)	1	Valley Truck Repair	Yes	Yes
G-93462		Delivery Vehicle	Fresno	93725	Fresno	Yes	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	unk	DSL	$ 1,432.55	02/24/2020	$ 1,289.30	04/23/2020	$ (1,289.30)	2	Valley Truck Repair	Yes	Yes
G-93463	Yes	Delivery Vehicle	Fowler	93625	Fresno	Yes	Volvo	VNL 670	2015	Class 8	Volvo	D13	2015	HHDD	455	DSL	$ 2,360.36	03/27/2020	$ 2,124.32	04/22/2020	$ (2,124.32)	1	Valley Truck Repair	No	Yes
G-93477		Delivery Vehicle	Bakersfield	93308	Kern	No	Peterbilt	384	2012	Class 8	Cummins	ISX11	2011	HHDD	425	DSL	$ 2,653.10	03/31/2020	$ 2,387.79	04/22/2020	$ (2,387.79)	16	Meyers	Yes	Yes
G-93619		Delivery Vehicle	Fresno	93725	Fresno	Yes	Volvo	VNL64T-760	2017	Class 8	Volvo	D13	2019	HHDD	455	DSL	$ 4,270.76	03/23/2020	$ 3,843.68	04/23/2020	$ (3,843.68)	4	Valley Truck Repair	Yes	No
G-93620		Reefer	Fresno	93728	Fresno	Yes	Volvo	880	2016	Class 8	Volvo	D13	2016	HHDD	unk	DSL	$ 18,977.65	04/30/2020	$ 17,079.89	04/22/2020	$ (17,079.89)	5	RDM Diesel	Yes	Yes
G-93627		Produce Delivery	Fresno	93725	Fresno	No	Kenworth	T680	2017	Class 8	Paccar	MX13	2017	HHDD	500	DSL	$ 5,917.52	02/25/2020	$ 5,325.77	04/22/2020	$ (5,325.77)	15	Valley Truck Repair	Yes	No
G-93824		Long Haul Trucking	Los Banos	93635	Merced	No	Freightliner	Cascadia	2014	Class 8	Detroit Diesel	DD15	2014	HHDD	560	DSL	$ 12,449.69	03/06/2020	$ 11,204.72	04/22/2020	$ (11,204.72)	7	Valley Truck Repair	Yes	Yes
G-93825		Reefer	Fowler	93625	Fresno	No	Volvo	VNL	2017	Class 8	Volvo	D13	2017	HHDD	500	DSL	$ 2,717.42	03/30/2020	$ 2,445.68	04/28/2020	$ (2,445.68)	3	Valley Truck Repair	Yes	Yes
G-93826		Reefer	Fresno	93727	Fresno	No	Volvo	VNL780	2017	Class 8	Volvo	D13	2017	HHDD	500	DSL	$ 4,468.72	03/25/2020	$ 4,021.85	04/22/2020	$ (4,021.85)	1	Valley Truck Repair	Yes	Yes
G-93831		Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	560	DSL	$ 12,908.09	03/24/2020	$ 11,617.28	04/27/2020	$ (11,617.28)	12	Valley Truck Repair	Yes	Yes
G-93833		Hauler	Fresno	93703	Fresno	Yes	Volvo	VNL	2014	Class 8	Volvo	D13	2014	HHDD	500	DSL	$ 2,541.58	04/01/2020	$ 2,287.42	04/23/2020	$ (2,287.42)	1	Valley Truck Repair	Yes	Yes
G-93835		Reefer	Fresno	93722	Fresno	No	Peterbilt	389	2015	Class 8	Cummins	ISX15	2014	HHDD	450	DSL	$ 3,763.16	03/25/2020	$ 3,386.84	04/22/2020	$ (3,386.84)	1	Valley Truck Repair	Yes	No
G-93854		Reefer	Fresno	93725	Fresno	Yes	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 10,574.50	04/01/2020	$ 9,517.05	04/23/2020	$ (9,517.05)	7	Valley Truck Repair	Yes	Yes
G-93859		Long Haul Trucking	Fresno	93722	Fresno	No	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 4,017.49	03/27/2020	$ 3,615.74	04/23/2020	$ (3,615.74)	2	Valley Truck Repair	Yes	No
G-93860	Yes	Reefer	Fresno	93722	Fresno	No	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	505	DSL	$ 12,329.57	03/03/2020	$ 11,096.61	04/23/2020	$ (11,096.61)	3	Valley Truck Repair	Yes	Yes
G-93863		Reefer	Fresno	93727	Fresno	No	Volvo	VNL	2017	Class 8	Volvo	D13	2017	HHDD	500	DSL	$ 3,255.86	03/28/2020	$ 2,930.27	04/23/2020	$ (2,930.27)	9	Valley Truck Repair	Yes	Yes
G-93867		Reefer	Fresno	93727	Fresno	No	Volvo	VNL	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 2,391.13	03/31/2020	$ 2,152.02	04/27/2020	$ (2,152.02)	2	Valley Truck Repair	Yes	No
G-93868		Dry Van	Fresno	93723	Fresno	Yes	Freightliner	Cascadia	2015	Class 8	Detroit Diesel	DD15	2015	HHDD	560	DSL	$ 13,161.41	04/04/2020	$ 11,845.27	04/23/2020	$ (11,845.27)	1	Valley Truck Repair	Yes	Yes
G-93888		Reefer	Fresno	93722	Fresno	Yes	Volvo	VNL	2017	Class 8	Volvo	D13	2017	HHDD	500	DSL	$ 6,583.42	04/07/2020	$ 5,925.08	04/23/2020	$ (5,925.08)	2	Valley Truck Repair	Yes	Yes
G-93889	Yes	Reefer	Fresno	93725	Fresno	Yes	Freightliner	Cascadia	2015	Class 8	Detroit Diesel	D13	2015	HHDD	400	DSL	$ 13,125.86	04/17/2020	$ 11,813.27	04/23/2020	$ (11,813.27)	2	Valley Truck Repair	Yes	Yes
G-93905	Yes	Delivery Vehicle	Fresno	93723	Fresno	Yes	Volvo	unknown	2011	Class 8	Volvo	D13	2011	HHDD	425	DSL	$ 671.91	04/01/2020	$ 604.72	04/23/2020	$ (604.72)	1	Valley Truck Repair	Yes	Yes
G-93935		Agricultural Hauler	Fresno	93722	Fresno	Yes	Peterbilt	384	2013	Class 8	Paccar	MX	2013	HHDD	500	DSL	$ 3,942.93	04/08/2020	$ 3,548.64	04/23/2020	$ (3,411.24)	17	Valley Truck Repair	Yes	Yes
G-93991		Delivery Vehicle	Fresno	93722	Fresno	No	Volvo	VNL64T	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 1,480.20	04/02/2020	$ 1,332.18	04/27/2020	$ (1,332.18)	3	Valley Truck Repair	Yes	Yes
G-94128		Drag Line	Parlier	93648	Fresno	Yes	Volvo	VNL	2011	Class 8	Volvo	D13	2011	HHDD	500	DSL	$ 5,302.81	04/04/2020	$ 4,772.53	04/27/2020	$ (4,772.53)	3	Valley Truck Repair	Yes	No
G-94132	Yes	Reefer	Fresno	93727	Fresno	No	Volvo	VNL	2016	Class 8	Volvo	D13	2016	HHDD	500	DSL	$ 4,175.08	04/02/2020	$ 3,757.57	04/30/2020	$ (3,757.57)	9	Valley Truck Repair	Yes	Yes
G-94189	Yes	Agricultural Hauler	Fresno	93722	Fresno	No	Volvo	VN Series	2015	Class 8	Volvo	D13	2015	HHDD	500	DSL	$ 6,696.81	04/08/2020	$ 6,027.13	05/04/2020	$ (5,883.19)	14	Valley Truck Repair	Yes	Yes
G-94208		Delivery Vehicle	Fresno	93722	Fresno	Yes	Freightliner	Cascadia	2016	Class 8	Detroit Diesel	DD15	2016	HHDD	505	DSL	$ 13,113.96	04/14/2020	$ 11,802.56	04/22/2020	$ (11,802.56)	1	Valley Truck Repair	Yes	Yes

Appendix D – Staff Notes for Invoices with Lack of Specificity

Project #	Affected System	Reason for pilot program eligibility
G- 91084	DPF filter	Codes for DPF overtemp, found DPF to be melted, along with all sensors around DPF.
G-87995	DPF sensor. And NOx sensor	Shop replaced the DPF due to finding internal damage upon inspection. Likely caused by progressive damage and needed to be replaced.
G-90116	Chassis and DPF harness	Truck has multiple OBD codes posted, and the shop had replaced the DEF pump last repair. DEF pump replacement was not needed as the chassis harness along with the DPF harness were the initial cause of failures. Shop replaced DEF pump but it did not fix the issue, the harnesses were the reason for the truck not operating the DEF pump which affects the regens of the unit and emissions as a whole. Replacing the harnesses fixed the emissions related issue and should be covered. The shop did not turn in the invoice for the DEF pump because, as mentioned, it did not fix the initial issue.
G-90527	DPF	Truck asking for regen too often, shop checked soot level and it was high. Pulled DPF and had cleaned as it was causing the truck to not complete a regen.
G-90779	DOC kit and NOx sensors	MIL indicator on displaying codes for SCR NOx conversion efficiency low *see attached transposed DTC printout
G-91083	Outlet NOx sensor	Had permeant inactive fault codes for SCR NOx efficiency low *see attached transposed DTC printout
G-91085	DPF, EGR cooler, and NOx sensors	Multiple counts of code for SCR NOx conversion efficiency very low led to replacement of NOx sensors. Found EGR cooler leaking into the DPF as well. *see attached transposed DTC printout
G-91121	Incomplete regen	Truck would not complete regen and displays codes showing incomplete regen due to bad injectors. Shop ran fuel test to confirm the injectors were bad, once injectors replaced the truck was able to regen. Repairs deemed complete due to injectors being an eligilbe item on the eligible costs list.
G-91128	Low regen temps	Truck kept asking for regen due to failed 7th injector. Engine and wiring harness also had to be replaced due to the harness' function in controlling the sensors. The engine harness carries the input information from the sensors and outputs it to the actuators, so when the engine harness is at fault, it causes the truck to malfunction including the after treatment system.
G-91223	NOx sensors, AHI module, 7th injector	When all initial repairs were done, shop ran regen and regen would not complete. Shop hooked up and found multiple codes for NOx sensors and AHI module only. Rejecting pressure regulator and coalescing cartridge due to not being emission related.
G-91250	NOx sensor	Codes for SCR outlet NOx sensor heater circuit failed open, along with other multiple SCR faults *see attached transposed DTC printout
G-91251	NOx sensor and lambda sensor	Unit had 2 active codes for both NOx sensors and code for the Lambda sensor which is claiming reimbursement through
G-91295	DPF codes	Unit came in the shop with DPF codes, shop found DPF to be plugged and after running further diagnostics found the EGR valve to be leaking into the DPF. EGR related parts are all on invoice needed for the repair. Injectors replaced due to language on the "eligible repairs sheet" provided at the time.
G-91299	EGR valve, AHI module, and 7th injecto	Truck came into shop with codes for EGR system as well as for the 7th injector. When inspecting the 7th injector mechanic found the fuel line from the AHI module to the 7th injector stuck and the module itself had failed. Failure of fuel going from Wher the ECM and ACM request truck to run regen, the engine is not loaded heavily enough for a passive regen. The AHI module send fuel through the fuel line to the 7th injector which then sprays it into the exhaust system. This saturates the doc to run the regen as the truck is requesting. Therefore, the repairs on this invoice were needed to be made as is to assure the emissions system functions correctly.
G-91321	Bellows pipe	Truck came into shop for active codes for SCR efficiency low to DEF quality. Shop found exhaust leak at the turbo bellows pipe, which can also plug up the DPF, but in this case it was throwing the code. After repairs shop ran regen to verify the issue was fixed, the truck passed regen with no codes returning.*see attached transposed DTC printout
G-91326	Turbo, clogged EGR cooler, and DPF	Unit went into the shop with a a no start issue but when the truck was being diagnosed, the shop found the turbo to be the issue. When inspecting the turbo, the mechanic found the turbo stuck open and leaking into the EGR, which progressively leaked into the DPF. Thus, the EGR cooler and DPF were cleaned while the turbo was replaced. The truck did not throw a check engine light because it was not able to start, and so the sensors were not able to detect anything without power. Had the shop only replaced the turbo, the plugged DPF and EGR cooler would not have allowed it to run a regen that would be needed, which would then throw the truck in derate. The turbo was the cause of failure and it is all related to the emissions, which is why it is eligible for program funding.
G-91448	NOx sensors and DPF	Truck came into shop with check engine light for aftertreatment codes for SCR low efficiency codes. Shop ran regen and determined the DPF needed to be cleaned due to high soot level which was related to SCR code. NOx sensors replaced due to their levels not being at the correct amount during and following the regen.

G-91511	NOx sensor and CAC	Shop found active codes for NOx sensors which needed to be replaced. Shop also preformed diagnostics to find holes in the charge air cooler system which is program eligible.
G-91661	NOx sensors and AHI module	Truck came in for codes for AHI module and NOx sensors. Although there was only 1 count for AHI module and 7th injector code, the regen would not pass without replacement after NOx sensor repairs.
G-91670	NOx sensors, AHI module, and DPF	After replacing the NOx sensors, shop ran a regen to verify repairs, but regen would not complete. DPF was pulled for inspection where it did not pass and needed to be replaced. DPF was also causing the SCR NOx catalyst efficiency below threshold code as the NOx sensor repairs resolved the NOx sensor performance code.
G-91936	NOx sensors and DOC	DOC was replaced due to a large crack on top of the original part. Shop also ran a regen to monitor parameters and verify repairs, no codes returned and the DOC was confirmed to be part of the cause of failure.
G-91947	EGR valve	Many cases of inactive codes for EGR temperature too high with the most recent being recorded on 1/23/2020, 2 days before truck was brought into shop. After replacing EGR valve and cleaning EGR cooler, shop verified repairs with a regen and no codes returned.
G-91950	Reductant quality	Codes received showing reductant quality due to EGR cooler leaking. This work was not preventative maintenance - the truck would not immediately fail an emission test however the repairs were completed based upon aftertreatment codes and damaged parts on the eligible parts list.
G-91951	Incomplete regen	With each regen shop watches the temperatures go up and down indicating that something is not correct and the regen does not complete. This fault is not electrical and will not throw a code, truck completes regen after injector kit was replaced.
G-92214	Reductant quality	Codes for Reductant Quality were found, shop suggested to replace Venturi pipe, EGR pressure sensors, and cooler. Shop only replaced injector kit and ran a regen - able to regen without a problem. No other repairs were sent through the program.
G-92348	NOx efficiency and DPF	Internal damage of the filter causing the temperature during a regen to not get hot enough. Replaced DOC.
G-92388	DPF and EGR valve	Truck had multiple counts of DPF codes and shop found EGR valve leaking soot into the DPF. Although had other faults, once repairs were made and shop ran regen to verify repairs, codes did not come back as issue was resolved.
G-93107	EGR valve and DPF repairs	EGR temp sensors were damaged due to progressive damage due to coolant leaking.
G-93195	DPF	Dyno used as part of diagnostic. Excessive smoke at 1200-1300 RPM - snap test confirmed excessive smoke. Injectors are over fueling causing smoke to come out at certain RPM, verified through Dyno, and was clogging up the DPF. This caused the filter to crack. Injectors and DPF are part of emission failure.
G-93207	DPF and EGR	Sensors needed to be replaced due to damage - DEF awning kit document provided and uploaded into GMS
G-93627	Nox sensor	Inactive codes for Nox sensor before catalyst with a count of 126 and DPF soot level moderately severe shown multiple times and explains engine light. Codes also found for EGR cooler, when pulled off it was found leaking and needed to be cleaned. After a regen no leaking was found and temperatures were normal - no codes found after regen.