Appendix D

Costs and Economic Analysis

Date of Release: April 3, 2018

I. Baseline Information

To estimate the economic impacts of the proposed amendments, a baseline or business-as-usual (BAU) characterization was developed. The cost and economic impact of the proposed amendments is then evaluated against the BAU scenario.

The current in-use opacity limits for the California Heavy-Duty Vehicle Inspection Program (HDVIP) and Periodic Smoke Inspection Program (PSIP) regulations are used for the baseline. To establish the BAU, staff gathered repair shop opacity testing data (CARB, 2017g) and recently performed roadside opacity tests during HDVIP enforcement activities (CARB, 2017d) to determine the percentage of the statewide trucking fleet that operates at opacity levels above the current opacity limits. Staff did the same analysis for the proposed opacity limits. In 2011, 2014, and 2016, staff embarked on intensive months long roadside testing campaigns, randomly pulling over thousands of vehicles and performing opacity tests conducted using the Society of Automotive Engineers (SAE) J1667 testing protocol (SAE, 1996). Staff travelled to multiple locations throughout the state, including rural and urban areas in both Northern and Southern California, to ensure an unbiased sampling of vehicles. The random sampling of thousands of vehicles enabled an accurate depiction of the current state of opacity levels for the statewide fleet to help estimate emissions and costs for both the BAU and the proposed amendments. Staff used the 2016 campaign results to establish the current BAU.

Table 1 shows the percentage of trucks that are estimated to be operating above the current opacity limits. There is a small percentage of vehicles, estimated at less than 1 percent overall, that presently do not meet the current opacity limit requirements and need repairs. Extrapolating the opacity data collected from the 2016 opacity testing campaign to statewide heavy-duty (HD) vehicle populations, staff estimates that there will be just under 3000 vehicles above the current opacity limits statewide in 2019, with the majority of these being non-diesel particulate filter (DPF) equipped vehicles. Only about 670 DPF-equipped vehicles are estimated to be above the current opacity limits. For calendar year 2010, staff previously estimated an average repair cost of $581 for all vehicles above the current 40 and 55 percent opacity limits to obtain repairs and get into compliance (CARB, 1997). After adjusting this repair cost for inflation (DOF, 2017a), staff estimated the repair costs to comply with the current regulation (or BAU) following the methodology described in the “Direct Costs” section. Table 2 projects the annual repair costs to meet the current opacity requirements. Staff will subtract these baseline costs from the total regulatory costs estimated for the proposed amendments because it is assumed these repairs would occur in the BAU, and these costs are not a consequence of the proposed amendments.

Table 1: Percentage of HD Diesel Vehicles Operating in California above the Current Opacity Limits Based on Roadside Testing

Non-DPF Engines	Current Opacity Limit	Vehicles Operating Above the Current Opacity Limits
Pre-1991 MY	55%	1%
1991-1996 MY	40%	2%
1997-2007 MY	40%	2%
DPF Equipped Engines	**Current Opacity Limit**	**Vehicles Operating Above the Current Opacity Limits**
Pre 2007 MY	40%	0%
2007-2009 MY	40%	1%
2010+ MY	40%	0%

Table 2: Estimated Repair Costs Associated with the Baseline Regulatory Requirements for the Statewide Fleet

Year	Repair Cost ($)
2019	934,000
2020	685,000
2021	401,000
2022	378,000
2023	130,000
2024	119,000
2025	108,000
Total	2,755,000

The proposed amendments reduce the opacity limit for HD vehicles starting in 2019. See Table 3 for the proposed opacity limits. To come into compliance, vehicles with opacity levels above the proposed limits would need to repair damaged emission control components.[1] Table 4 shows the percentage of vehicles that are expected to be operating above the opacity limits once the proposed amendments are implemented. These percentages will be used to assess both the repair costs and emission benefits associated with the proposed amendments. Although the HDVIP can target both HD gasoline and diesel engines for inspection, the proposed amendments are only expected to impact diesel engines. Staff does not anticipate any impact on HD gasoline vehicles due to the proposed amendments. Gasoline vehicles of all sizes and diesel vehicles below 14,000 pounds gross vehicle weight rating (GVWR) are subject to the Bureau of Automotive Repair's (BAR) light-duty smog check program and are assumed

[1] For purposes of the analysis, vehicles equipped with a Level 2 VDECS and two engine cranes operating with a off-road engine are considered negligible because there are so few such vehicles.

to be compliant and in working condition. Thus, for the current analysis, staff projects repair estimates based only on diesel vehicles with a GVWR above 14,000 pounds.

Table 3: Proposed Opacity Limits for the HDVIP and PSIP

2006 MY and Older Engines without DPFs	
Pre-1991 MY	40% Opacity Limit
1991-1996 MY	30% Opacity Limit
1997-2006 MY	20% Opacity Limit
2007 MY and Newer Engines and Engines Equipped with a Level 3 Verified Diesel Emissions Control System (VDECS) DPF	
5% Opacity Limit	
Engines Equipped with Level 2 VDECS[1]	
20% Opacity Limit	
Two Engine Cranes Driven by a Non-DPF Off-Road Engine[1]	
40% Opacity Limit	

Table 4: Percent of Vehicles Operating Above the Proposed Opacity Limits Based on Roadside Testing Campaigns

DPF Equipped Engines	Proposed Opacity Limit	Percent of Vehicles Above the Proposed Opacity Limits
Pre 2007 MY (Level 3 VDECS)	5%	14%
2007-2009 MY	5%	25%
2010+ MY	5%	3%
Non-DPF Engines	20%-40%	10%

Staff is also proposing to require new smoke tester training requirements for PSIP smoke testers. Contracted smoke testers would be required to receive training through a California Air Resources Board (CARB) approved training facility, such as the training class offered by the California Council on Diesel Education and Technology (CCDET) at local community colleges. Owners or employees who perform their own vehicle fleet testing would be required to take an online training course developed by CARB. Staff conducted a survey to identify the current tester training rates for development of the BAU, as discussed below. Any additional costs to comply with the proposed amendments are assessed compared to the BAU of current training conditions.

Some smoke testers already receive CCDET training, and would not be required to do anything differently to comply with the proposed amendments. To identify this number for the BAU, staff conducted a phone survey, reaching out to approximately 50 companies that offer smoke testing services. CCDET is currently the only program in California that offers a smoke tester training course that would meet the requirements of the proposed amendments. CCDET smoke tester certification is valid for 4 years, whereupon retraining is needed. Based on the survey results (CARB, 2016b), staff

estimates that about 90 percent of contracted PSIP smoke testers already receive CCDET training every 4 years. This existing training rate is accounted for in the BAU.

To identify the total number of contracted PSIP smoke testers throughout the state (both trained and untrained), CARB analyzed historical CCDET training rates. CCDET has given out 2,133 certificates between 2014 and 2016 (CCDET, 2016). Staff scaled up this data to estimate the total number of CCDET certificates in the last 4 years. CCDET provided 2,133 certificates over three years, or an average of 711 per year. Therefore, over four years CCDET would provide 2,844 certifications (2,133 plus 711). Using the assumption above that 90 percent of testers are already CCDET trained, the total number of smoke testers (both trained and untrained) is approximately 3,160.

Staff also reached out to large fleets to estimate the percentage of mechanics and employees who perform smoke testing for their fleet which may have already received smoke tester training through CCDET. A small percentage of fleet employees who do smoke testing as a side business have received CCDET training; however, the majority of fleet employees have not received any smoke tester training. Since the percentage of trained fleet employees is small, staff is taking a conservative approach for the purposes of setting the BAU for this proposed training requirement and assuming no individuals who perform smoke testing for their fleets have received training and all of them would need to take the online training course. In summary, staff assumes 90 percent of contracted smoke testers already receive the required training under the BAU, however, no individuals who test their own fleet vehicles have received the required training.

II. Direct Costs

The proposed amendments are expected to only affect HD diesel vehicles, as described previously. The transportation and goods movement industry is expected to face increased costs due to vehicle repairs, roadside citations, training, additional testing, and reporting. The following sections describe the detailed methodology used to estimate each of these direct costs.

A. Repair Costs Assumptions

Vehicles that exceed the proposed opacity limits would need to repair or replace emission control components. Staff contacted manufacturers, repair shops, and analyzed 1.5 years of HD repair shop invoices (CARB, 2017c) to estimate repair costs of the typical emission control technologies which may need to be repaired to meet the lower opacity limits.

DPF equipped vehicles with a properly functioning DPF measure at opacity levels at or near 0 percent. Staff assumed that a DPF equipped vehicle with excess opacity

emissions has a compromised DPF, which must be replaced to meet the proposed opacity limits. Table 5 shows the current estimated market costs an owner must pay to get a replacement DPF (CARB, 2017h). DPF replacement costs vary by engine model year (MY). All costs are rounded to the nearest hundred dollars.

Table 5: Estimated DPF Replacement Costs Based on Engine MY

Engine Model Year	Replacement DPF Cost
2010+ MY Engine	$2,600
2007-2009 MY Engine	$2,400
Pre-2007 MY Engine (Level 3 VDECS DPF)	$5,400

A compromised DPF is typically thought to result from an upstream engine issue which significantly increases engine-out PM emissions (CARB, 2015a) and overloads the DPF. When this occurs, the upstream engine component creating excess PM emissions should also be repaired when the DPF is replaced. Staff analyzed HD repair invoices and talked to industry experts to estimate which upstream engine issues typically lead to a compromised DPF and the typical costs owners incur to remedy these issues. Table 6 lists the major engine components that lead to a compromised DPF and estimates the repair costs and relative frequencies at which these upstream issues occur. The average upstream repair cost shown in Table 6 weighs each individual part cost with its relative frequency of getting repaired. For example, the diesel oxidative catalyst is repaired most frequently when replacing a DPF based on the HD repair invoices, thus is weighted more heavily in the estimated average cost of an upstream repair than the other upstream engine parts.

Table 6: Costs and Relative Frequency of Upstream Repairs

Upstream Engine Part	Repair Cost	Relative Frequency of Repair
Diesel Oxidative Catalyst (DOC)	$3,800	45%
Exhaust Gas Recirculation (EGR) Valve	$1,300	21%
EGR Cooler	$3,100	9%
Turbocharger	$5,100	16%
Fuel Injector	$1,900	9%
Weighted Average Upstream Repair	**$3,200***	

*rounded from $3,249

Repairing the upstream engine issue helps ensure the durability of the replacement DPF. However, some owners choose to forgo the upstream repair and only replace the DPF. Staff further analyzed the HD repair invoices to estimate the rate of occurrence of an upstream engine repair relative to a DPF replacement. The data suggest that at about 62 percent of the time, owners repair an upstream issue in addition to replacing the DPF. This ratio (0.62) is applied to the average upstream repair cost ($3,249 x

0.62) for DPF equipped vehicles to estimate the average overall repair cost (Table 7). For a non-DPF equipped vehicle, the weighted average upstream repair cost shown in Table 6 is assumed for repairs.

Table 7: Estimated Average Repair Cost for a Non-Compliant Vehicle to Meet the Proposed Opacity Limits

Engine Model Year	DPF Cost	Average Upstream Repair Cost	Average Total Repair Cost
2010+ MY Engine	$2,600	$2,000	$4,600
2007-2009 MY Engine	$2,400	$2,000	$4,400
Pre-2007 MY Engine (Level 3 VDECS DPF-Equipped)	$5,400	$2,000	$7,400
Non-DPF Engine	N/A	$3,200	$3,200

B. Vehicles Operating Above the Proposed Opacity Limits

To estimate the population of vehicles operating above the proposed opacity limits, intensive roadside testing campaigns were performed by CARB staff throughout the state. Staff randomly pulled over thousands of DPF equipped HD vehicles and performed an opacity test following the Society of Automotive Engineers (SAE 1667) testing protocol. Testing was performed in calendar year (CY) 2011, 2014, and 2016 to document trends over time. Figure 1 shows the percent of vehicles that tested above the proposed 5 percent opacity limit by engine model year. Staff estimated the percentage of DPF equipped vehicles operating above the proposed 5 percent opacity limit upon rule implementation (Table 8) by extrapolating the data in Figure 1 out to CY 2019, the year the proposed opacity limits are expected to become effective.

Some vehicles are likely to need repairs in subsequent years beyond 2019. These include vehicles with emission control components that degrade over time and also vehicles that have reoccurring problems resulting in excess emissions at a later date. The percentage of vehicles exceeding the 5 percent opacity limit in subsequent years (Table 8) is estimated based on the annual rate of increase (slope of the line) of the opacity data presented in Figure 1.

Figure 1: Percent of DPF-Equipped Vehicles Above a 5 Percent Opacity Level from CARB Roadside Testing Campaigns in 2011, 2014, and 2016

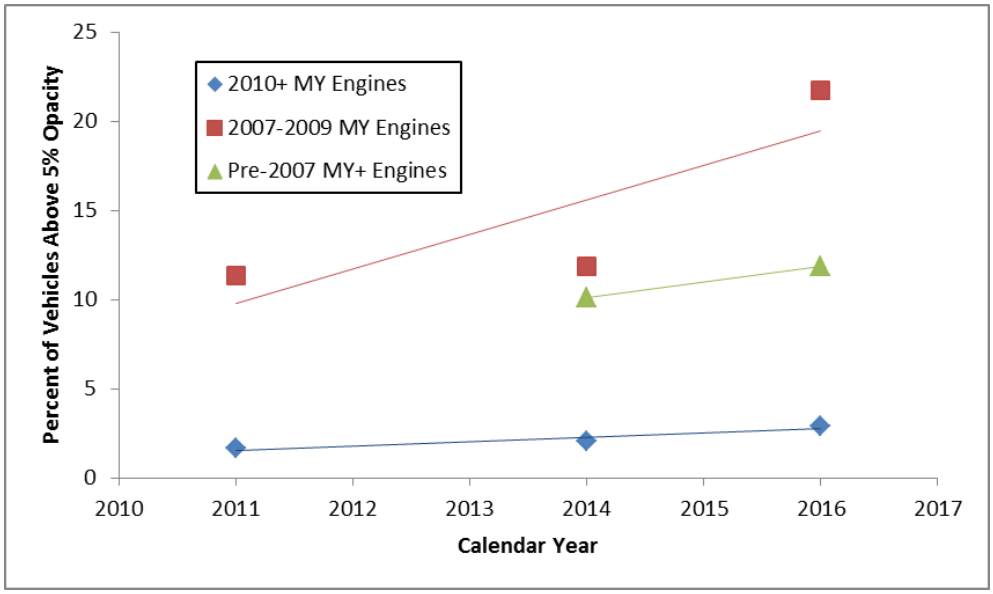

Table 8: Percentage of DPF Equipped Vehicles Estimated to be Above the Proposed Opacity Limit Based on Field Testing Campaigns in 2011, 2014, and 2016

Engine Type	Implementation Year (2019)	Subsequent Years
2010+ MY Engine	3%	0.2%
2007-2009 MY Engine	25%	2%
Pre-2007 MY Engines	14%	1%

The percentages of non-DPF equipped vehicles projected to be above the proposed opacity limits are estimated from testing data supplied by participating HD repair shops (CARB, 2017g). Opacity test data from thousands of non-DPF equipped vehicles were gathered by CARB staff for analysis. Segregating data for non-DPF equipped vehicles by calendar year was not feasible, so staff estimated subsequent year rates based on engineering judgment and analysis of the DPF equipped vehicle data. The estimated percentage of non-DPF equipped vehicles above the proposed opacity limits in CY 2019 and subsequent years are provided in Table 9.

Table 9: Percentage of Non-DPF Equipped Vehicles Estimated to be Above the Proposed Opacity Limits

Engine Type	Implementation Year (CY 2018)	Subsequent Years
Non-DPF Vehicles	10%	1%

C. Repair Rate Estimates

The percentage of vehicles that get repaired is expected to be dependent on which regulatory programs (HDVIP and PSIP) each fleet is subject to. Some fleets are only subject to the HDVIP, whereas others are subject to both the HDVIP and PSIP. Owner operators and out-of-state fleets are only subject to the HDVIP, whereas California based fleets of 2 or more diesel vehicles are subject to both the HDVIP and PSIP. According to recent Department of Motor Vehicles (DMV) data, owner operators represent about 20 percent of the registered HD vehicles in California, whereas multiple vehicle fleets account for about 80 percent of the total registered vehicles in the state (CARB, 2017a).

i. Fleets subject only to HDVIP

Currently, CARB staff annually tests about 3 percent of the statewide vehicle population through roadside testing. In addition to the roadside testing, some owners independently identify vehicles that need repairs and voluntarily repair those vehicles due to the deterrent effect provided by active HDVIP enforcement. Based on experience with light-duty inspection and maintenance (I/M) programs, staff estimates that this deterrent effect results in about 33 percent of the tampered and malmaintained vehicles getting repairs to meet the opacity requirements (CARB, 1990). Between these two factors, an active HDVIP enforcement program and the deterrent effect, CARB staff projects that about 35 percent of vehicles above the proposed opacity limits that are subject only to the HDVIP get repaired.

ii. Fleets subject to HDVIP and PSIP

Fleets subject to PSIP have additional testing requirements compared to those only subject to HDVIP. Fleets subject to PSIP can be audited by CARB enforcement staff at any time. Staff estimates that fleets subject to both the HDVIP and PSIP repair their vehicles at a higher rate than those subject only to HDVIP. Based on current PSIP auditing records, where staff audits fleets to ensure they are testing and repairing their vehicles, staff estimates that about 50 percent of fleets are in compliance with PSIP (CARB, 2016a). Based on these data, staff estimates that about 50 percent of vehicles with excess opacity emissions subject to both the HDVIP and PSIP get repaired.

The proposed amendments require fleets to submit vehicle data and opacity test strips starting with CY 2022 testing. Reporting requirements are expected to increase the repair rates associated with broken vehicles. Staff used other CARB programs to project potential compliance rates. For the Truck and Bus Rule, reporting is required for vehicles which are exempted from the program requirements or have applied for a compliance extension. Truck and Bus Rule compliance is currently about 70 percent. This data suggests that the repair rate would increase to about 70 percent for fleets

subject to PSIP reporting requirements. Table 10 details the estimated repair rates expected for vehicles with excess opacity emissions in the HDVIP and PSIP.

Table 10: Repair Rate Estimates for Vehicles Subject to HDVIP and PSIP

Programs Fleets are Subject To	Repair Rate Estimate
Only HDVIP	35%
HDVIP and PSIP	50%
HDVIP and PSIP with Reporting	70%

D. Projected Number of Repairs

Statewide vehicle populations for future years were projected using CARB's emission factors (EMFAC) model (CARB, 2017f). Estimates of vehicles with excess opacity emissions and repair rate assumptions (sections II.b and II.c) are applied to the statewide vehicle population projections to estimate the number of repairs per year.

Because implementation of the proposed amendments is projected to begin during early 2019, the repair estimates are projected for only 9 months of 2019. The majority of repairs are expected to occur in the first two years after implementation. The repair rate increases starting in 2022 due to the reporting requirements. Additionally, some 2010 MY and newer engines not repaired in previous years are expected to be repaired in 2022 due to the implementation of the reporting requirements. 2009 MY and older engines still unrepaired from previous years before the reporting requirements take effect are assumed to be retired or sold out of state due to the Truck and Bus Rule turnover requirements (CARB, 2014). Table 11 shows the estimated annual number of vehicle repairs from 2019 to 2025.

Table 11: Estimated Annual Vehicle Repairs

Year	2010+ MY Engines	2007-2009 MY Engines	Pre-2007 MY DPF Equipped Engines	Non-DPF Engines	Total Vehicle Repairs
2019	4,222	9,867	3,159	4,005	21,253
2020	1,872	4,248	1,278	1,694	9,092
2021	542	908	190	157	1,797
2022	2,794	1,142	199	199	4,334
2023	933	144	150	107	1,334
2024	978	138	136	96	1,348
2025	1,018	130	122	86	1,357

E. Additional Citation Costs

All vehicles are subject to the HDVIP if they are operating within the state of California. Drivers pulled over during a roadside inspection would receive a citation if their vehicle tests at an opacity level above the proposed limits with exception for the first 6 months of implementation, where they would receive a notice of violation. A notice of violation is essentially a "fix-it ticket." The citation penalty is waived if the problem is demonstrated to be fixed with 45 days. The citation fine for an opacity violation is $300 for the first offense and $1800 for a second offense within a 12 month period. Roadside inspections are only able to target about 3 percent of the vehicle population per year; therefore, staff anticipates that it would be rare for a vehicle to receive two opacity citations in a 12 month period. Staff assumes that all citations issued for an opacity violation result in a $300 fine.

Under the current HDVIP, about 1 percent of vehicles that are inspected are cited (CARB, 2016a). This rate has been constant for the last 8 years. When the HDVIP was first established in 1991, however, approximately 45 percent of vehicles that were inspected were cited. This historical data indicates that citation rates should increase once the proposed opacity limits are implemented as more vehicles would be out of compliance due to the more stringent standards. However, staff does not expect the citation rate to increase to 45 percent following the implementation of these proposed amendments. The 45 percent citation rate was achieved the first year the HDVIP was in existence. As this program has been established for more than 20 years and stakeholders are more aware of the upcoming changes to the opacity limits than they were when the program was first established, staff expects the citation rate to be somewhere between 1 percent and 45 percent once the proposed amendments are implemented. As staff assumes the citation rate would fall somewhere in the middle of the high and low citation rate percentages seen in the current program, a citation rate of 23 percent for vehicles subject to roadside inspections is used following the implementation of the proposed amendments.

HDVIP citation rates dropped by about 50 percent from 1991 to 1992 following the establishment of the HDVIP as trucking companies adapted to the required opacity limits. Based on this, staff assumes the citation rate would drop by 50 percent each year following the establishment of the lower opacity limits until it reaches an equilibrium rate of about 1 percent as seen today.

Staff projects the lower opacity limits to take effect in March of 2019. Following implementation, CARB enforcement teams would issue notices of violations for the first 6 months before writing citations for vehicles that fail the opacity limits. Based on this, staff estimates that citations would only be written for 3 months in 2019. Table 12

shows the estimated increase in HDVIP citations that would be given out each year and the cost to industry that would occur as a result of these citations.

Table 12: Additional Citation Costs due to the Proposed Lower Opacity Limits

Year	HDVIP Citations	Cost ($)
2019	1,035	311,000
2020	2,070	621,000
2021	1035	311,000
2022	518	155,000
2023	259	78,000
2024	180	54,000
2025	180	54,000
Total	5,277	1,584,000

F. PSIP Smoke Tester Training Costs

i. Contracted Smoke Testers

Under the proposed amendments, contracted smoke testers who perform PSIP testing services for a fee would be required to receive hands-on training on how to properly perform the SAE J1667 opacity test. Contracted smoke testers are projected to take the CCDET I training course on HDVIP and PSIP requirements, which is a 6-hour course costing $175. Currently, the CCDET course is the only course in the state meeting the proposed training requirements. The training course is valid for 4 years. Staff assumes $67 per hour for the time lost to take the training class, an estimate of a repair shop's lost revenue due to sending a mechanic to the training. The labor rate of a typical repair shop is estimated to be $100 per hour (DMS, 2017; Quora, 2017). Technicians and mechanics at an average repair shop are able to report billable hours about 67 percent of the time they are on the job (Frederick, 2007). This results in about $67 of billable work per hour for the average mechanic. Table 13 lists the estimated costs for an individual to take the CCDET I course.

Table 13: Estimated Costs for CCDET Training

Cost of CCDET I Course	$175
Opportunity Cost Lost by Trainee per Hour	$67
Class Hours	6
Total Cost of Training per Trainee	**$577**

As discussed in the baseline section, survey data showed that 90 percent of the estimated 3,160 contracted smoke testers in California already receive hands-on

training through CCDET. The additional 10 percent of contracted smoke testers throughout the state would face an added cost due to this regulatory requirement every 4 years. It is assumed that costs would not be passed through to the customer as smoke testers facing these additional training costs are not expected to raise prices since the vast majority of testers already incur this cost.

ii. Self-Testers

Self-testers are those that perform the annual PSIP smoke tests on their own fleet vehicles. Under the proposed amendments, these testers would be required to take a 1 hour online training course designed by CARB to perform the annual PSIP tests. Once this training is successfully completed, there would be no requirements to repeat the training course at a later date. The hourly opportunity cost to take the online training course is assumed to be the same as for contracted PSIP testers. Table 14 shows the estimated costs per trainee to attend the online training course. CARB assumes that fleets of 20 or more vehicles would perform PSIP testing themselves, whereas, smaller fleets would contract out for this service. This is due to the fact that opacity smoke meters can cost around $3,500-$5,000 and it is not cost effective for a small fleet to buy a meter for themselves.

Recent DMV registration data was analyzed to determine fleet sizes throughout the state (CARB, 2017a). Based on this analysis, there are 2,516 fleets of 20 or more vehicles in California. These fleets represent about half of the HD vehicles registered in California. Using EMFAC vehicle population projections, staff estimates California fleets containing 20 or more vehicles account for about 237,000 vehicles in 2019. Larger fleets often have vehicles spread over multiple base locations. These fleets would likely require multiple employees due to the distance between base locations. Smaller fleets with a limited vehicle population and a single base would likely only require one employee to receive the training.

The industry standard is typically one technician for every 12.3 trucks on the road (Boyce, 2009). Not every technician would need to receive smoke tester training. Thus, staff assumes a ratio lower for the number of trained smoke testers per truck and estimates a vehicle to tester ratio of about 20 to 1, which results in an average of about 5 trainees per fleet. Staff assumes the same opportunity cost structure as for those individuals taking the CCDET training course and assumes none of these employees currently has the required training to perform the PSIP opacity tests. Table 15 shows the total annual costs estimated for training, combining both contracted smoke testers and self-testers.

Table 14: Estimated Costs for Online Self-Tester Training Class

Cost of Online Training Course	$0
Opportunity Cost Lost by Trainee per Hour	$67
Class Hours	1
Total Cost of Training per Trainee	**$67**

Table 15: Total Annual Cost for All Smoke Tester Training Courses

Year	Cost ($)
2019	976,000
2020	0
2021	0
2022	0
2023	182,000
2024	0
2025	0
Total	1,158,000

G. Reporting Costs

The current PSIP regulation requires California fleets of two diesel vehicles or more to perform annual opacity tests on their vehicles to ensure compliance. Fleets must maintain these test records for two years and at any time, CARB enforcement staff can audit fleets to ensure compliance. The proposed amendments require new reporting requirements for all fleets with deadlines starting in 2023. Fleets would submit company information such as company address and contact information and vehicle information such as VIN, engine family, license plate etc. Additionally, fleets would submit opacity test strips for all vehicles subject to the PSIP on an annual basis. During the first year the reporting requirements take effect, fleets would need to input all the required fleet and vehicle information into the CARB database and submit copies of test strips. In subsequent years, fleets would not have to input vehicle information already on file in the database. Fleets would only need to add vehicle information for those vehicles new to the fleet or delete vehicles which are no longer part of the fleet in addition to submitting copies of PSIP test strips.

Staff estimates that the proposed reporting requirements would require a larger time commitment in the first year than in subsequent years. Staff assumes a cost of $50 per hour for a clerical employee to input data to meet the PSIP reporting requirements. Time estimates for the first year of reporting are based on reporting cost assumptions

used in the development of the Truck and Bus Rule (CARB, 2008) and are assumed to decrease by 50 percent in subsequent years.

Table 17: Time Estimates for Annual Reporting Requirements

Fleet Size	First Year Estimates	Subsequent Year Estimates
50+ Vehicles	8 hours	4 hours
20-49 Vehicles	4 hours	2 hours
2-19 Vehicles	2 hour	1 hours

Staff used DMV registration data to estimate the number of vehicles and fleets that would be affected by the reporting requirements (Table 18). The majority of fleets in California have fleet sizes between 2 and 19 vehicles. Based on these estimates, staff projects reporting costs statewide for the proposed PSIP reporting requirements (Table 19).

Table 18: Estimated Number of Fleets Subject to PSIP Reporting Requirements

Fleet Size	Amount in California	Percent of PSIP Vehicle Population
50+ Vehicles	764	37%
20-49 Vehicles	1,752	13%
2-19 Vehicles	47,078	50%

Table 19: Statewide Annual Reporting Costs

Year	Cost ($)
2019	0
2020	0
2021	0
2022	0
2023	5,364,000
2024	2,682,000
2025	2,682,000
Total	10,728,000

H. Additional PSIP Testing Costs

Compliance with the current PSIP regulations is about 50 percent. Staff expects the proposed reporting requirements would increase compliance with the annual testing requirements by an additional 20 percent. This increase in testing would lead to additional costs to fleets that currently do not test their vehicles on an annual rate.

Staff assumes that fleets of 20 vehicles or more would purchase a smoke meter and do their own testing. The cost of a smoke meter runs between $3,500 and $5,000. For purposes of this estimate, staff will assume a cost of $5,000. The smoke meter is a one-time purchase for fleets which is expected to occur in 2022, the first year for which PSIP records must be submitted to CARB. Staff estimated costs based on statewide fleet numbers shown in Table 18.

Purchasing a smoke meter is typically not cost-effective for fleets of less than 20 vehicles. Staff expects these fleets to contract out their annual testing needs to trained smoke testers. Based on discussions with stakeholders, staff estimates a cost of $65 per vehicle for an annual PSIP smoke test. DMV registration data (Table 18) suggests that about 50 percent of vehicles subject to the PSIP regulation reside in fleets of less than 20 vehicles. Based on these assumptions, staff projects the increased PSIP testing costs statewide. Table 20 breaks down the additional statewide testing costs.

Table 20: Additional PSIP Testing Costs

Year	Fleets of less than 20 Vehicles ($)	Fleets of 20 Vehicles or More ($)
2018	0	0
2019	0	0
2020	0	0
2021	0	0
2022	3,316,000	2,516,000
2023	3,332,000	0
2024	3,457,000	0
2025	3,567,000	0
Total	13,672,000	2,516,000

I. Total Costs

The total regulatory cost to industry for the proposed amendments is the summation of the repair costs, citation costs, smoke tester training costs, reporting costs, and additional testing costs relative to the baseline repair costs. Table 21 breaks down the estimated yearly costs of the proposed amendments. The majority of costs are expected to come from the repair or replacement of damaged emission control components to meet the more stringent opacity limits. The repair costs estimated to have occurred in the baseline are subtracted from the projected repair costs to meet the proposed opacity limits to get the estimated new cost due to the proposed amendments. As described previously, these baseline repair costs represent vehicles that are out of compliance with the existing opacity limits, and would be repaired to the current opacity limits regardless of the proposed amendments. Because these repair costs would

already occur in the future baseline scenario, they are subtracted from the overall cost of the proposed amendments.

The amendments are projected to go into effect in March, 2019. Staff projects costs for 9 months in 2019. Between the years 2019 and 2025, the proposed amendments to the HDVIP and PSIP are estimated to cost the regulated entities about $217 million, with a maximum annual cost of $100 million in 2019.

Table 21: Annual Costs for the Proposed Regulatory Amendments

Year	Repair Costs	Baseline Repair Costs[2]	Smoke Tester Training Costs	Citation Costs	Reporting Costs	Additional Testing Costs	Total Costs
2019	$99,474,000	$934,000	$976,000	$311,000	$0	$0	$99,827,000
2020	$42,374,000	$685,000	$0	$621,000	$0	$0	$42,310,000
2021	$8,428,000	$401,000	$0	$311,000	$0	$0	$8,338,000
2022	$20,055,000	$378,000	$0	$155,000	$0	$5,832,000	$25,664,000
2023	$6,402,000	$130,000	$182,000	$78,000	$5,364,000	$3,332,000	$15,228,000
2024	$6,440,000	$119,000	$0	$54,000	$2,682,000	$3,457,000	$12,514,000
2025	$6,461,000	$108,000	$0	$54,000	$2,682,000	$3,567,000	$12,656,000
Total	**$189,634,000**	**$2,755,000**	**$1,158,000**	**$1,584,000**	**$10,728,000**	**$16,188,000**	**$216,537,000**

III. Economic Impacts

1. Methodology for Determining Economic Impacts

Regional Economic Models, Inc. (REMI) Policy Insight Plus Version 2.1.1 is used to estimate the macroeconomic impacts of the proposed amendments on the California economy. REMI is a structural economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric and economic geography methodologies.

REMI Policy Insight Plus provides year-by-year estimates of the total impacts of the proposed amendments. CARB uses the REMI single-region, 160-sector model with the model Reference case adjusted to reflect the Department of Finance conforming forecasts dated June 2017. These forecasts include California population figures, U.S. real gross domestic product forecast, and civilian employment growth numbers.

The proposed amendments are simulated in REMI by adjusting production costs to regulated industries to reflect the change in repair and maintenance costs to fleets operating in California, additional citation costs for fleets operating in California, training

[2]Baseline repair costs are not a result of the proposed amendments and are subtracted from repair costs when determining the total costs of the regulation. Total Costs = Repair Costs – Baseline Repair Costs + Smoke Tester Training Costs + Citation Costs

costs for contracted PSIP smoke testers, reporting costs to California fleets, and additional testing costs associated with the reporting requirements. The additional CARB staff resources requested to enforce is modeled through changes in REMI's State spending variable.

2. Inputs of the Assessment

Vehicle repair costs, smoke testing costs, citation costs, reporting costs, additional testing costs, additional state and local spending, and monetized health benefits are analyzed below. Costs, as outlined in the cost section previously, are translated into REMI inputs as illustrated in Table 17, and described below:

1. Change in Production Costs
    a. HD vehicle repair costs and citation costs are represented as production cost increases. DPF and upstream engine component repairs and replacements, as a result of the proposed amendments, result in an increase in operating costs relative to the BAU. These production cost increases are applied to three industries: Truck Transportation, Transit and Ground Passenger Transportation, and Waste Management and Remediation Services.
    b. Smoke tester training costs are modeled as an increase in production cost to automotive repair facilities and fleets.
    c. New reporting requirements are reflected as an increase in production cost to California fleets of 2 or more. These reporting costs would apply to a segment of fleets subject to the repair costs mentioned above.
    d. Additional testing costs are reflected as an increase in production cost to California fleets of 2 or more.
2. Change in Exogenous Final Demand (changes in the demand faced by industries as an indirect impact of the proposed amendments)
    a. Manufacturers of heavy duty vehicle parts would see an increase in exogenous final demand as a result of the repair costs required for trucks with high opacity levels.
    b. Office administrative resources would see additional demand for services to collect and submit documentation verifying compliance to meet the reporting requirements as described in the changes to the PSIP.
    c. Independent repair shops and repair departments in HD vehicle dealerships would see an increase in demand as a result of the increase in HD vehicle repairs.
    d. Community colleges would see a slight increase in demand for CCDET smoke tester training courses.

e. Demand would increase for smoke testing equipment, which is represented by the navigational, measuring, electromedical, and control instruments manufacturing industry.

3. State and Local Spending
   a. There are anticipated to be increases in State spending in response to the need for additional staff resources.
   b. Public sector fleets would be subject to the proposed amendments, resulting in increased spending for repairs, training, reporting, and testing.
   c. Staff anticipates an increase in citation revenue resulting from the amendments to the HDVIP. This revenue is returned in this analysis by simulating additional state spending. Citation revenue increases are outlined in Table 12.

Health Benefits

a. The decrease in acute respiratory, cardiovascular, and asthma related emergency room visits results in less household spending in the healthcare industry. This decrease in consumer spending allows for an increase in spending in all other consumption categories.

The production cost changes for the industries operating HD fleets in California are calculated by applying the incremental cost of repairs to the population of HD trucks with compromised emission control components, using the methods of estimating described in the Direct Costs section above. Population volumes, including private and public fleets, in future years were projected using CARB's EMFAC model (CARB, 2017f), allowing REMI inputs representing these repair costs to be directed to specific industries, including State-owned fleets.

Table 17: REMI Inputs

Primary Industries	Explanation	REMI Category	2019	2020	2021	2022	2023	2024	2025
Truck Transportation	Repair, reporting, and testing costs	Production Cost (2016M$)	$94.11	$39.67	$7.89	$18.78	$11.54	$8.71	$8.73
Transit and Ground Passenger Transportation		Production Cost (2016M$)	$6.34	$2.70	$0.54	$1.28	$0.41	$0.41	$0.41
Waste Management and Remediation Services		Production Cost (2016M$)	$2.29	$0.97	$0.19	$0.46	$0.15	$0.15	$0.15
Motor Vehicle Body and Trailer Manufacturing*	OEM labor opacity testing certification, labor demand for repairs	Production Cost (2016M$)	$0.36	$0.00	$0.00	$0.00	$0.07	$0.00	$0.00
Automotive Repair and Maintenance*	Repair labor opacity testing certification, labor demand for repairs	Production Cost (2016M$)	$0.62	$0.00	$0.00	$0.00	$0.11	$0.00	$0.00
State Government	Staff Resources, State Fleet Repairs, and Citation Revenue	State Spending (2016M$)	$3.79	$1.72	$0.50	$1.13	$0.75	$0.65	$0.66
Local Government	Local Fleet Repairs	Local Spending (2016M$)	$9.94	$4.21	$0.83	$2.56	$1.52	$1.25	$1.26
Secondary Industries	**Explanation**	**REMI Category**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Engine, Turbine, and Power Transmission Equipment Manufacturing	Parts sales	Exogenous Final Demand (2016M$)	$28.06	$11.95	$2.38	$5.66	$1.81	$1.82	$1.82

Motor Vehicle Body and Trailer Manufacturing*	Parts sales & dealership labor	Exogenous Final Demand (2016M$)	$49.48	$21.08	$4.19	$9.98	$3.18	$3.20	$3.21
Automotive Repair and Maintenance*	Labor	Exogenous Final Demand (2016M$)	$21.93	$9.34	$1.86	$4.42	$1.41	$1.42	$1.42
Educational Services	CCDET Certification Course	Exogenous Final Demand (2016M$)	$0.98	$0.00	$0.00	$0.00	$0.18	$0.00	$0.00
Health Benefits	**Explanation**	**REMI Category**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Consumer Spending Hospitals	Health benefits savings	Consumer Spending (2016M$)	-$0.16	-$0.18	-$0.18	-$0.14	-$0.10	-$0.12	-$0.13
Consumption Reallocation	Increase consumption resulting from health benefits savings	(2016M$)	$0.16	$0.18	$0.18	$0.14	$0.10	$0.12	$0.13

REMI input values are rounded to the nearest $10,000. Values for primary industries are representative of the net of multiple costs, and a positive value indicates an increased cost. Positive values for secondary industries are representative of absolute increases in demand.

***** Industries that incur both direct and indirect impacts as a result of the proposed amendments, making them a candidate for both primary and secondary industries.

3. Assumptions and Limitations of the Model

The estimated economic impacts of the proposed amendments are sensitive to modeling assumptions made by CARB. The list below outlines the key assumptions made in estimating the economic impacts of the proposed amendments in REMI:

1. The primary impacted industries are broken into the following categories using the North American Industry Classification System (NAICS):
    a. NAICS 484 (Truck Transportation): This NAICS code is used to represent the majority, roughly 94 percent, of affected fleets that are subject to the proposed amendments. The costs are primarily due to increased repair costs, citation costs, training costs, reporting costs, and additional PSIP testing costs.
    b. NAICS 485 (Transit and Ground Passenger Transportation): This NAICS code is used to represent a small subset, less than 5 percent, of fleets that are subject to the proposed amendments. The costs are primarily due to increased repair costs, citation costs, training costs, reporting costs, and additional testing costs.
    c. NAICS 562 (Waste Management and Remediation Services): This NAICS code represents the smallest population, roughly 2 percent, of HD fleets that are subject to the proposed amendments. The costs are primarily due to increased repair costs, citation costs, training costs, reporting costs, and additional testing costs.
    d. NAICS 8111 (Automotive Repair and Maintenance): This industry would be required to obtain hands-on smoke tester training (CCDET) for their repair technicians if they plan to offer PSIP testing services.
    e. NAICS 3362 (Motor Vehicle Body and Trailer Manufacturing): This NAICS code is representative of the original equipment manufacturer (OEM) dealers that perform on-site repairs at dealerships. The primary impact is an increase in costs related to the requirement for OEM repair technicians to obtain hands-on smoke tester training if they plan to offer PSIP testing services.
2. Secondary industries that see an increase in demand for parts manufacturing, clerical, and educational services are broken down into:
    a. NAICS 3336 (Engine, Turbine, and Power Transmission Equipment Manufacturing): This industry represents the manufacturing of parts that are used to replace and repair malfunctioning DPFs and upstream engine components. The increase in demand for these parts is considered a secondary impact for this analysis.
    b. NAICS 3362 (Motor Vehicle Body and Trailer Manufacturing): Similar to NAICS 3336, this industry also provides parts for replacing or repairing DPFs and upstream engine components, but manufactured

for specific OEMs. Additionally, this NAICS code represents the labor for repairs at HD dealerships. The increase in demand here is considered a secondary impact for this analysis.

c. NAICS 8111 (Automotive Repair and Maintenance): This NAICS code represents the labor for repairs at independent auto body shops. The increase in demand for repair labor is considered a secondary impact for this analysis.
d. NAICS 3345 (Navigational, Measuring, Electromedical, and Control Manufacturing): This NAICS code represents the industry that manufactures opacity testing equipment, assumed to be in higher demand due to the changes to the PSIP.
e. NAICS 5611 (Office Administrative Services): This NAICS code represents bookkeeping services that may be contracted due to the reporting requirements.
f. NAICS 61 (Educational Services): This NAICS code represents community colleges that offer the smoke tester training courses required for PSIP testing.

3. Other impacts not associated with NAICS classification:
    a. State and Local Government Spending: Additional staff resources, public fleet repairs and additional citations, along with PSIP smoke tester training and additional testing costs for public fleets would increase spending at the state and local level.
    b. Consumer Spending on Hospitals: The estimated reduction in PM from the proposed amendments would result in decreases in acute respiratory and cardiovascular hospitalizations and emergency room visits for asthma. This is modeled as a decrease in consumer spending on hospitals.
    c. Consumption Reallocation: The decrease in consumer spending on hospital visits results in a reallocation of spending to all other consumption categories.

4. Results of the Assessment

a) California Employment Impacts

As illustrated in Table 18, the proposed amendments would have a negligible impact on employment relative to the BAU scenario. The California economy is growing, therefore the changes in employment growth are not declines relative to today, but incremental results from growth forecasts in future years. Some industries experience job growth that is slightly higher than enjoyed under the BAU while other industries take slightly longer to reach anticipated employment levels. There is a slight slowing of employment

growth concentrated in directly impacted industries that face direct costs as a result of the proposed amendments. These industries include truck transportation, transit and ground passenger transportation, and waste management and remediation services. Industries that see an increase in demand as a result of the proposed amendments see positive employment growth. These industries include parts manufacturing, auto body labor, and office administration services. The impact to employment in these industries would not be affected by more than two-tenths of one percent relative to the baseline in any one year. Thus, employment in these industries would be at least 99.98-100.02 percent of what it would be in absence of the proposed amendments.

HD fleets would be expected to make the most repairs in the first two years in response to the proposed regulatory action, which would translate into higher demand for parts manufacturing, auto body labor, and office administration services. As costs are reduced over the subsequent years and incremental parts and labor demand declines, rate of change in employment begins to slow down starting in 2021.

Table 18: Change in Employment Growth

	2019	2020	2021	2022	2023	2024	2025
Change (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Change in Jobs	-500	-600	-475	-400	-375	-300	-250
Total Jobs Anticipated under the BAU (Millions)	23.537	23.727	23.910	24.101	24.294	24.488	24.684

b) California Business Impacts

The proposed amendments are anticipated to have a small impact on growth in final product output, referred to here as output growth, relative to the BAU. As modeled, fleets would have slightly higher operating costs as a result of vehicle repairs, training, reporting, additional testing costs, and potential increases in citation costs. Table 19 shows a slight decline in the growth of output for primary industries that operate fleets in California throughout the years of this assessment. Although compliance costs are highest in the first two years of implementation, operating costs for fleets would be slightly higher through 2025.

Secondary industries that manufacture the parts needed for fleets to come into compliance enjoy output growth higher than the BAU throughout all years of the

assessment. This is due to the increase in demand for goods and services as a result of the proposed amendments. Other secondary industries that see an increase in demand see a slight slowing of output growth, likely due to the impact of higher operating costs to California fleets that outweigh some benefits to secondary industries. Table 19 shows the impact to the growth in output for industries impacted by the proposed amendments, and represents a minor percentage change from output levels estimated under the BAU scenario.

Table 19: Change in Output Growth Relative to the BAU

		2019	2020	2021	2022	2023	2024	2025
Primary Industries								
Truck Transportation	**Change (%)**	-0.05%	-0.06%	-0.05%	-0.04%	-0.05%	-0.04%	-0.04%
	Change (2016M$)	-$19.5	-$23.3	-$20.3	-$20.5	-$19.0	-$17.3	-$10.6
Transit and Ground Passenger Transportation	**Change (%)**	-0.03%	-0.02%	-0.01%	-0.01%	0.01%	0.01%	0.00%
	Change (2016M$)	-$2.1	-$1.2	-$0.5	-$0.7	-$0.4	-$0.4	-$0.3
Waste Management and Remediation Services	**Change (%)**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2016M$)	-$0.3	-$0.3	-$0.2	-$0.3	-$0.2	-$0.2	-$0.2
Motor Vehicle Body and Trailer Manufacturing*	**Change (%)**	0.82%	0.34%	0.07%	0.16%	0.05%	0.05%	0.05%
	Change (2016M$)	$5.5	$2.3	$0.4	$1.0	$0.3	$0.3	$0.3
Automotive Repair and Maintenance*	**Change (%)**	0.10%	0.04%	0.01%	0.02%	0.01%	0.01%	0.01%
	Change (2016M$)	$20.2	$8.4	$1.5	$3.9	$1.1	$1.2	$1.2
Secondary Industries								
Engine, Turbine, and Power Transmission Equipment Manufacturing	**Change (%)**	0.22%	0.09%	0.02%	0.04%	0.01%	0.01%	0.01%
	Change (2016M$)	$14.1	$5.7	$1.0	$2.5	$0.7	$0.7	$0.7
Educational Services	**Change (%)**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2016M$)	$0.2	-$0.6	-$0.5	-$0.4	-$0.3	-$0.3	-$0.3

The value in each year is interpreted as the reference year value less that BAU value in that same year. The values presented above are rounded to the nearest $100,000. The percentages are rounded to the nearest hundredth.

*Industries that incur both direct and indirect impacts as a result of the proposed amendments, making them a candidate for both primary and secondary industries.

c) Impacts to Investments in California

As modeled, the proposed amendments would produce very small impacts to California private business investment from 2019 to 2025. Table 20 shows a slight decline in annual investments in California, which can be linked to incremental increases in production costs to HD fleets operating in California, restricting potential investments in new capital purchases. As compliance costs decline, slowing of gross domestic private investment growth is anticipated to decline through 2025. The relative changes to growth in private investment, however, are imperceptible from the BAU of the current HDVIP and PSIP programs.

Table 20: Change in Gross Domestic Private Investment Growth

	2019	2020	2021	2022	2023	2024	2025
Change (%)	-0.01%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Change (2016M$)	-$27.1	-$29.1	-$19.2	-$14.2	-$9.6	-$5.2	-$2.6

d) Impacts to Individuals in California

The proposed amendments produce no noticeable change in personal income growth in any year of the assessment as seen in Table 21. The greatest annual change in personal income is a reduction of about $103 million relative to the BAU, which does not represent a perceptible change. The change in personal income growth follows in the same pattern as employment, and the growth impacts decline after 2019 as a result of decreased output to the primary sectors operating fleets in California as seen in Table 19.

Table 21: Change in Personal Income Growth

	2019	2020	2021	2022	2023	2024	2025
Change (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Change (2016M$)	-$103.0	-$66.1	-$34.4	-$40.5	-$34.3	-$28.0	-$26.3
Personal Income Anticipated under the BAU (Trillions)	$2.282	$2.338	$2.392	$2.458	$2.506	$2.557	$2.617

e) Impacts on Gross State Product

As presented in Table 22, Gross State Product (GSP) growth levels are estimated to be insignificantly less throughout all years of the analysis, likely resulting from the initial repair costs to California fleets which are highest in the first two years of implementation. The analysis estimates that, under the proposed amendments, the California economy grows at a rate indistinguishably less than anticipated levels through 2025. This change in growth, however, does not represent a discernable change from the GSP projections under BAU.

Over 65 percent of the compliance costs of this regulation occur within the first two years of implementation, which decreases GSP through reductions in the output of regulated fleets. While some industries in California would experience higher demand as a result of the proposed amendments, the increases are outweighed by the impact of higher operating costs to regulated fleets, resulting in a slightly lower GSP overall. CARB interprets the impact of the proposed amendments on GSP as being indiscernible in California's $2.6 trillion economy (DOF, 2017b).

Table 22: Change in Gross State Product Growth

	2019	2020	2021	2022	2023	2024	2025
Change (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Change (2016M$)	-$44.8	-$58.1	-$47.2	-$40.6	-$38.0	-$30.7	-$26.6

5) Creation or Elimination of Businesses

Due to the proposed amendments, there is anticipated to be growth in industries that support fleets operating in California. Increases in repair costs induce demand for the industries that manufacture parts for HD vehicles and those that provide labor for required repairs. This growth is estimated to increase major economic indicators discussed previously (GSP, personal income, and employment growth), which may expand businesses through the implementation of the proposed amendments. This is supported by the increases in output growth among some secondary industries impacted in this analysis, as outlined in Table 19. This does not necessarily incentivize more businesses to enter the market, but it does strengthen market reliability for these goods and services throughout all years in this analysis. Given the small impact on these industries, however, it is unlikely that there would be any significant creation or elimination of businesses in California.

6. Incentives for Innovation

The proposed amendments would provide similar incentives to innovate as the original regulations. There is still opportunity to improve upon existing HD vehicle emission reduction technology, but staff assumes there would be no directly induced increases in technological innovation as a result of the proposed amendments since the technology that allows compliance has already been available for many years. The proposed amendments do not require a specific technology to be used. If a less costly alternative is developed in the future, the costs could be lower than estimated here.

7. Competitive Advantage or Disadvantage

Staff considered whether some California state fleets would be competitively advantaged or disadvantaged compared to other California-based fleets. Staff also considered whether California-based fleets would be competitively advantaged or disadvantaged compared to out-of-state fleets that travel in California. Staff found little reason to believe there was a competitive advantage or disadvantage in either case.

California based intrastate fleets and interstate fleets are treated equally under the proposed amendments. All fleets, regardless of fleet size or primary service location, are held to the same opacity standards. Older vehicles are subject to less stringent opacity standards than newer vehicles, however, these opacity limits are based on what is technologically feasible for each vehicle. The opacity limits are more stringent for vehicles equipped with more technologically advanced emission control systems, for example, a DPF. The proposed opacity limits do not require any upgrading or retrofitting of emission control capability and do not provide a competitive advantage or disadvantage for any emission control technology.

The proposed amendments are expected to help level the playing field in the trucking sector by ensuring more fleets perform adequate maintenance on their vehicles. Those fleets that currently do not maintain the emission control systems on their vehicles to a sufficient level would have to improve their maintenance practices in an effort to meet the requirements of the proposed amendments. Therefore, intrastate and interstate fleets which already maintain their vehicles properly should benefit from the proposed amendments as it will help equalize costs compared to fleets that were previously spending less to maintain their vehicles. As such, staff expects any competitive advantage for certain in-state fleets, vis-à-vis other in-state fleets, to be lessened because of this more even playing field.

Owner operators in California however, are not subject to the PSIP and would not be impacted by the reporting requirements. This would likely result in a slight advantage to owner operators in California compared to other California fleets. Nevertheless, the

costs of reporting are minor relative to the total costs of the proposed amendments, so this competitive advantage is not expected to be significant.

Similar to owner operators, out-of-state fleets are not subject to the PSIP, and are thus, not affected by the proposed reporting requirements. This results in a slight advantage for out-of-state fleets relative to California based fleets, but as was discussed for owner operators, this advantage is not expected to be significant because reporting costs are only a minor portion of the projected regulatory costs.

8. Inclusion of Monetized Health Benefits

As mentioned earlier, monetized health benefits affect two separate variables in the REMI model: Consumer Spending on Hospitals and Consumption Reallocation. These variables provide slightly higher spending power to consumers, as they are expected to spend less on healthcare related costs.

The impact of the monetized cost-savings for avoided acute respiratory and cardiovascular hospitalization and avoided ER department visits on the macroeconomic analysis of the proposed amendments is negligible, as the spread of roughly $0.9 million in cost-savings between 2019 and 2025 does not noticeably change any economic indicators in the model output.

9. Summary and Interpretation of the Results of the Economic Impact Assessment

Regulated fleets would see a slight increase in operating costs due to the proposed amendments, but the overall impact to these industries would be negligible given the changes in output growth shown in Table 19. The primary industries would make repairs that produce emissions benefits, all while creating demand for goods and services in supporting industries, resulting in increased output and employment in those industries.

As modeled, the proposed amendments are unlikely to have significant impacts on the California economy, including the growth of employment, investment, personal income, and production compared to the BAU. All of these economic indicators do not exhibit a significant change when comparing the impact of the proposed amendments to the current HDVIP and PSIP regulations.