

Attachment to Public Notice

Responses to DOF's Comments on SRIA

DOF Comment 1: While we appreciate the discussion on the interactions of the proposed regulations with other proposed regulations, the main impact analysis must be done relative to the legal baseline, which only accounts for existing regulations. The SRIA must incorporate a comprehensive discussion of impacts relative to the legal baseline, done in level of details similar to the current analysis which includes the proposed clean truck regulations as part of the baseline.

The response to DOF's Comment 1 is provided below in Section I, SRIA Analysis based on Legal Baseline, which provides a cost and benefit impact analysis based on the legal baseline and done in a level of detail similar to that in the SRIA. In Section II, Impact of the Regulation on Affected Businesses, further relevant information concerning the lifetime cost and savings impact versus the legal baseline on vehicles of various model years is presented as well.

DOF Comment 2: The SRIA must discuss the disparate impacts of the regulations on businesses and individuals. This should be done by clearly describing the number and concentration of affected entities by region, business and fleet size, and industry, and by expanding the cost analysis from the up to \$9,000 cost per truck to cost per affected entity.

The response to DOF's Comment 2 is provided below in Section II, Impact of the Regulation on Affected Businesses.

I. SRIA Analysis based on Legal Baseline

In the SRIA, cost and benefit impacts were evaluated against the baseline scenario for the analysis period from 2022 through 2032. The baseline vehicle inventory includes the vehicle sales and population growth assumptions currently reflected in CARB's EMFAC emissions inventory model for combustion engines that are certified and intended for use in vehicles greater than 10,000 pounds GVWR and is the "legal baseline" for the Proposed Amendments. The current EMFAC model reflects implementation of currently existing state and federal laws and regulations including the Truck and Bus Regulation, Drayage Truck Regulation, idling restrictions and the Certified Clean Idle Regulation, Phases 1 and 2 GHG Regulation, ICT Regulation, and the Optional Low NOx Program. However, staff modified the legal baseline to reflect the proposed ACT Regulation, which would affect the same manufacturers and vehicle categories as the Proposed Amendments, and which would be implemented in approximately the same timeframe as the Proposed Amendments. The modified legal baseline was referred to as the "modeled baseline." CARB staff included the proposed ACT Regulation in the "modeled baseline" to allow for a more realistic analysis, as excluding it would have increased the apparent benefits and costs and decrease cost-effectiveness assigned to the Proposed Amendments. Including the proposed ACT

Regulation in the modeled baseline provides results that are more informative and likely to reflect the real impacts of the Proposed Amendments. To address DOF’s comment that “the SRIA must incorporate a comprehensive discussion of impacts relative to the legal baseline;” discussed below is a cost and benefit impact analysis based on the legal baseline and done in a level of detail similar to that in the SRIA. (Note: The Proposed Amendments for which the cost and benefit impact analysis are presented below are for the Proposed Amendments as described in Tables A-2 to A-4 in the originally submitted SRIA. The stringency levels and other requirements differ in some ways compared to the Proposed Amendments discussed in the Staff Report. The differences between the Proposed Amendments in the originally submitted SRIA and the Proposed Amendments in the Staff Report are described in the Staff Report, Chapter IX. All cost and benefit impact analyses’ methodologies remain the same as in the originally submitted SRIA.)

1. Benefits

a. Emission Benefits

The Proposed Amendments are designed to reduce NOx emissions from medium- and heavy-duty engines in vehicles with GVWR greater than 10,000 pounds by establishing more stringent emission standards and updating durability testing procedures, in-use testing procedures, warranty and useful life periods, as well as emission warranty information reporting. Table 1 shows the projected statewide NOx emission benefits for each calendar year 2022 through 2032. In 2031, NOx emission benefits are estimated to be approximately 25.7 tons per day statewide relative to the legal baseline. This table can be compared to Table B-1 in the SRIA, which by comparison, shows a 21.9 tons per day NOx benefit in 2031 relative to the modeled baseline.

Table 1: Projected Statewide NOx Emission Benefits from the Proposed Amendments for 2022 through 2032 Relative to the Legal Baseline

Calendar Year	NOx Benefits (tons per day)
2022	0.0
2023	0.1
2024	0.6
2025	2.7
2026	5.7
2027	9.0
2028	12.7
2029	17.0
2030	21.3
2031	25.7
2032	30.2

b. Health Benefits

The Proposed Amendments would result in health benefits for individuals in California through reducing NOx emissions. The value of these health benefits is due to fewer instances of premature mortality, fewer hospital and emergency room visits, and fewer lost days of work. Table 2 shows the estimated avoided premature mortality, hospitalizations, and emergency room visits as a result of the Proposed Amendments for 2022 through 2032 by California air basin, relative to the legal baseline. Table 3 shows the annually estimated statewide-avoided premature mortality, hospitalization, and emergency room visits relative to the legal baseline. Table 4 shows statewide valuation of health benefits for 2022 through 2032 relative to the legal baseline.

Table 2: Regional and Statewide Avoided Mortality and Morbidity Incidents from 2022 through 2032 under the Proposed Amendments Relative to the Legal Baseline

Air Basin	Cardiopulmonary mortality	Hospitalizations for cardiovascular illness	Hospitalizations for respiratory illness	Emergency room visits
Great Basin Valleys	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Lake County	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Lake Tahoe	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Mojave Desert	3 (2 - 4)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Mountain Counties	1 (0 - 2)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
North Central Coast	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
North Coast	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Northeast Plateau	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Sacramento Valley	17 (13 - 20)	1 (0 - 4)	1 (0 - 4)	6 (4 - 9)
Salton Sea	1 (0 - 2)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
San Diego County	16 (13 - 19)	1 (0 - 4)	2 (0 - 4)	6 (4 - 9)
San Francisco Bay	30(23 - 38)	4 (0 - 9)	5 (0 - 9)	17 (10 - 23)
San Joaquin Valley	82 (63 - 99)	9 (0 - 17)	10 (2 - 18)	29 (19 - 42)
South Central Coast	5 (4 - 6)	0 (0 - 0)	0 (0 - 0)	2 (0 - 3)
South Coast	228 (178 - 277)	36 (0 - 70)	43 (10 - 74)	118 (74 - 162)
Statewide	388 (303 - 475)	55 (0 - 109)	65 (16 - 117)	187 (118 - 254)

*Values in parentheses represent the 95% confidence interval. Totals may not add due to rounding but are within the 95% confidence interval.

Table 3: Annual Statewide Avoided Mortality and Morbidity Incidents under the Proposed Amendments Relative to the Legal Baseline

Calendar Year	Cardiopulmonary mortality	Hospitalizations for cardiovascular illness	Hospitalizations for respiratory illness	Emergency room visits	Total Incidents
2022	0	0	0	0	0
2023	0	0	0	0	0
2024	2	0	0	1	3
2025	8	1	1	4	14
2026	17	2	3	8	30
2027	27	4	4	13	48
2028	39	5	6	19	69
2029	52	7	9	25	93
2030	66	10	11	32	119
2031	81	12	14	39	146
2032	96	14	17	46	173
Total	388	55	65	187	695

*Rounded to whole numbers

Table 4: Statewide Valuation from Avoided Health Outcomes under the Proposed Amendments Relative to the Legal Baseline

Outcome	Avoided Incidents	Valuation (Million 2018\$)
Avoided Premature Mortality	388	\$3,660.90
Avoided Cardiovascular Hospitalizations	55	\$3.15
Avoided Acute Respiratory Hospitalizations	65	\$3.28
Avoided Emergency Room Visits	187	\$0.15
Total	695	\$3,667.48

c. Cost Savings

Although overall the Proposed Amendments would increase vehicle prices and DEF consumption and thereby impose costs on vehicle owners, the Proposed Amendments would provide savings to the vehicle owners as well through the proposed lengthened warranty periods, lengthened useful life periods, and EWIR. Table 5 shows estimates of the average lifetime savings per vehicle due to the Proposed Amendments for vehicle purchases made between 2022 and 2032. Vehicles purchased in 2022-2026 would only incur EWIR savings as the proposed warranty amendment would not be in effect until the 2027 engine model year. Vehicles purchased in 2027 and later would incur both EWIR and warranty savings. Lifetime savings estimates include savings from warranty and the EWIR amendments. The longer useful life would encourage development of more durable components; however, it is not possible to determine how many fewer repairs would result from the improved durability; hence, staff did not quantify savings from longer useful life.

Table 5: Lifetime Savings to Vehicle Owners from a Vehicle Purchased in 2022-2032 (2018\$ Per Vehicle) Relative to the Legal Baseline

Vehicle Service Class	Warranty Savings (2027 and later engine model year)	EWIR Savings (2022 and later engine model year)	Total Savings (2027 and later engine model year)
HHDD	\$2,576	\$247	\$2,823
MHDD	\$3,034	\$1,310	\$4,344
LHDD	\$1,678	\$280	\$1,958
HDO	\$715	\$130	\$845
MDDE-3	\$871	\$0	\$871
MDOE-3	\$155	\$0	\$155

2. Costs

The Proposed Amendments would require engine manufacturers to produce lower-emitting medium- and heavy-duty combustion engines, which would increase upfront production and operational costs, compared to preexisting engines. These costs would likely be passed on to the engine/vehicle operators (i.e., medium- and heavy-duty fleets).

a. Direct Cost

Table 6 summarizes the total statewide cost on California businesses due to the Proposed Amendments by each proposed amendment from 2022 to 2032. All costs are evaluated relative to the legal baseline scenario in 2018 dollars. As shown, the total cost impact from 2022 to 2032 was estimated at approximately \$1.15 billion. The estimated incremental cost per truck by truck class for the 2025 and 2028 model years is shown in Table 7.

**Table 6: Projected Statewide Costs under the Proposed Amendments from 2022 through 2032
Relative to the Legal Baseline (2018\$)**

Calendar Year	Standards, Certification, and New Technology	In-Use Amendments	Lengthened Warranty	Lengthened Useful Life	Durability Demonstration	EWIR	CA-ABT	NOx Data Reporting	Total Costs to Manufacturers	DEF Cost to CA Fleets	Total Costs to CA Fleets
2022	\$0	\$0	\$0	\$0	\$0	\$17,494,116	\$0	\$0	\$17,494,116	\$0	\$17,494,116
2023	\$0	\$0	\$0	\$0	\$8,718,820	\$18,410,592	\$0	\$850,000	\$27,979,412	\$0	\$27,979,412
2024	\$2,007,079	\$104,000	\$0	\$0	\$0	\$18,729,578	\$98,000	\$140,816	\$21,079,472	\$4,628	\$21,084,100
2025	\$34,579,808	\$104,000	\$0	\$0	\$0	\$19,584,709	\$19,600	\$246,631	\$54,534,748	\$935,015	\$55,469,762
2026	\$34,687,265	\$104,000	\$0	\$0	\$8,244,920	\$19,746,632	\$19,600	\$972,912	\$63,775,329	\$1,910,397	\$65,685,726
2027	\$30,283,327	\$104,000	\$77,391,830	\$17,520,131	\$0	\$4,949,006	\$19,600	\$704,874	\$130,972,769	\$2,903,499	\$133,876,268
2028	\$60,465,060	\$104,000	\$78,123,318	\$17,664,909	\$0	\$5,027,136	\$19,600	\$1,460,279	\$162,864,301	\$4,121,943	\$166,986,244
2029	\$50,838,784	\$104,000	\$79,856,282	\$18,048,951	\$0	\$5,127,612	\$19,600	\$2,232,311	\$156,227,538	\$5,357,507	\$161,585,045
2030	\$50,205,085	\$104,000	\$80,957,476	\$18,279,468	\$0	\$5,215,188	\$19,600	\$3,015,610	\$157,796,427	\$6,621,002	\$164,417,428
2031	\$49,549,170	\$104,000	\$82,061,911	\$18,522,646	\$0	\$5,284,879	\$19,600	\$3,809,648	\$159,351,854	\$7,906,821	\$167,258,675
2032	\$49,565,229	\$104,000	\$84,299,358	\$19,017,987	\$0	\$5,439,667	\$19,600	\$4,625,944	\$163,071,785	\$9,211,216	\$172,283,001
Total	\$362,180,806	\$936,000	\$482,690,175	\$109,054,091	\$16,963,740	\$125,009,114	\$254,800	\$18,059,025	\$1,115,147,751	\$38,972,027	\$1,154,119,778

Table 7: Estimated Incremental Cost Per Truck by Truck Class for 2025 and 2028 for the Proposed Amendments Relative to the Legal Baseline (2018\$)

Truck Class	2025 Model Year total Incremental Costs	2028 Model Year Total Incremental Costs
HHDD	\$2,031	\$6,153
MHDD	\$1,875	\$6,919
LHDD	\$1,559	\$4,767
HDO	\$557	\$1,568
MDDE-3	\$1,486	\$3,223
MDOE-3	\$482	\$624
New Sales Population Weighted Average	\$1,667	\$5,503

b. Macroeconomic

For the legal baseline scenario, the Macroeconomic analysis utilized the updated cost and benefit figures provided in Table 4, 5, and 6. This Macroeconomic analysis utilized the same methodology and REMI version as described in the original SRIA. The results of this analysis show similar positive output and employment gains for Motor Vehicle Parts Manufacturing (3363) and Vehicle Repair and Maintenance (8111). However, across other industries and sectors, the results of this analysis show negative trends and growth as a result of the Proposed Amendments (see Table 8). Many sectors such as Gross State Product (GSP), output, and employment show a reduction of negative impacts to neutral impacts in year 2032, which is due to the increased savings for industry generated at this year of the implementation of the Proposed Amendments and employment gains in the Vehicle Repair and Maintenance Industry (8111).

**Table 8: Summary of Macroeconomic Impact of the Proposed Amendments from 2022 through 2032
Relative to the Legal Baseline**

Sector	Year of Change	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
GSP	% Change	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	-40.61	-67.55	-53.62	-133.62	-157.08	-146.81	-229.32	-215.98	-221.16	-223.24	-131.05
Personal Income	% Change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	-36.43	-65.82	-58.60	-138.90	-174.28	-151.80	-241.25	-240.68	-254.69	-265.56	-172.38
Employment	% Change	0.00%	0.00%	0.00%	-0.01%	-0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change in Jobs	-438	-717	-556	-1382	-1604	-1144	-1928	-1739	-1741	-1719	-806
Output	% Change	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	-69.12	-115.10	-91.97	-226.54	-266.80	-262.61	-402.39	-382.30	-392.20	-397.27	-237.35
Private Investment	% Change	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.02%	-0.01%	-0.01%
	Change (2018M\$)	-10.68	-20.35	-19.04	-37.57	-46.76	-49.57	-67.15	-64.93	-61.10	-55.88	-29.60

3. Fiscal Impact

a. Local Government

The Proposed Amendments are expected to have a fiscal impact on local government fleets who would purchase California-certified vehicles. Local government would also have increased sales tax revenue through the increased cost of the new vehicles. Table 9 shows the estimated fiscal impact to local government due to the Proposed Amendments relative to the legal baseline.

Table 9: Fiscal Impact on Local Government under the Proposed Amendments Relative to the Legal Baseline (2018\$)

Calendar Year	Local Government Fleet Costs	Local District Sales Tax Revenue	Net Fiscal Impact
2022	\$1,871,870	-\$149,225	\$1,722,646
2023	\$2,993,797	-\$238,664	\$2,755,133
2024	\$2,255,999	-\$179,847	\$2,076,151
2025	\$5,935,265	-\$473,157	\$5,462,107
2026	\$7,028,373	-\$560,299	\$6,468,073
2027	\$14,324,761	-\$1,141,965	\$13,182,796
2028	\$17,867,528	-\$1,424,393	\$16,443,135
2029	\$17,289,600	-\$1,378,320	\$15,911,279
2030	\$17,592,665	-\$1,402,481	\$16,190,184
2031	\$17,896,678	-\$1,426,716	\$16,469,962
2032	\$18,434,281	-\$1,469,574	\$16,964,707
Total	\$123,490,816	-\$9,844,642	\$113,646,175

*Negative values indicate revenue to local government.

b. State Government

The Proposed Amendments are expected to have a fiscal impact on state government agencies from purchasing the California-certified vehicles, increased sales tax revenue, and CARB staffing required to coordinate and enforce the Proposed Amendments with engine manufacturers. Table 10 shows the estimated fiscal impact to state government due to the Proposed Amendments relative to the legal baseline.

Table 10: Fiscal Impact on State Government under the Proposed Amendments Relative to the Legal Baseline (2018\$)

Calendar Year	CARB Staffing	State Government Fleet Costs	State Sales Tax Revenue	Net Fiscal Impact
2022	\$0	\$577,306	-\$1,268,323	-\$691,018
2023	\$0	\$923,321	-\$2,028,507	-\$1,105,187
2024	\$1,134,000	\$695,775	-\$1,528,597	\$301,178
2025	\$1,128,000	\$1,830,502	-\$4,021,558	-\$1,063,056
2026	\$1,128,000	\$2,167,629	-\$4,762,215	-\$1,466,586
2027	\$1,488,000	\$4,417,917	-\$9,706,029	-\$3,800,113
2028	\$1,486,000	\$5,510,546	-\$12,106,503	-\$5,109,957
2029	\$1,486,000	\$5,332,306	-\$11,714,916	-\$4,896,609
2030	\$1,486,000	\$5,425,775	-\$11,920,264	-\$5,008,488
2031	\$1,486,000	\$5,519,536	-\$12,126,254	-\$5,120,718
2032	\$1,486,000	\$5,685,339	-\$12,490,518	-\$5,319,179
Total	\$12,308,000	\$38,085,953	-\$83,673,684	-\$33,279,731

*Negative values indicate revenue to state government

4. Alternatives

a. Alternative 1:

Alternative 1 would have the same elements contained in staff’s Proposed Amendments but would be implemented on an earlier timeline than the schedule outlined in staff’s proposal.

Table 11 summarizes the total statewide cost on California businesses due to Alternative 1 by each proposed amendment from 2022 through 2032. All costs are evaluated relative to the legal baseline scenario in 2018 dollars. As shown, the total cost impact from 2022 to 2032 was estimated at approximately \$1.28 billion.

**Table 11: Projected Statewide Costs under Alternative 1 from 2022 through 2032 Relative to the Legal Baseline
(2018\$)**

Calendar Year	Standards, Certification, and New Technology	In-Use Amendments	Lengthened Warranty	Lengthened Useful Life	Durability Demonstration	EWIR	CA-ABT	NOx Data Reporting	Total Costs to Manufacturers	DEF Cost to CA Fleets	Total Costs to CA Fleets
2022	\$1,973,877	\$0	\$0	\$0	\$0	\$17,494,116	\$0	\$0	\$19,467,993	\$4,373	\$19,472,367
2023	\$33,367,961	\$0	\$0	\$0	\$8,718,820	\$18,410,592	\$0	\$850,000	\$61,347,373	\$918,086	\$62,265,459
2024	\$33,420,156	\$104,000	\$0	\$0	\$0	\$18,729,578	\$98,000	\$140,816	\$52,492,549	\$1,884,621	\$54,377,170
2025	\$58,020,922	\$104,000	\$0	\$0	\$0	\$19,584,709	\$19,600	\$246,631	\$77,975,862	\$2,815,007	\$80,790,869
2026	\$58,672,669	\$104,000	\$0	\$0	\$8,244,920	\$19,746,632	\$19,600	\$972,912	\$87,760,734	\$3,790,390	\$91,551,123
2027	\$49,493,598	\$104,000	\$77,391,830	\$17,520,131	\$0	\$4,949,006	\$19,600	\$704,874	\$150,183,040	\$4,783,491	\$154,966,531
2028	\$48,784,021	\$104,000	\$78,123,318	\$17,664,909	\$0	\$5,027,136	\$19,600	\$1,460,279	\$151,183,263	\$6,001,936	\$157,185,199
2029	\$48,552,910	\$104,000	\$79,856,282	\$18,048,951	\$0	\$5,127,612	\$19,600	\$2,232,311	\$153,941,665	\$7,237,499	\$161,179,164
2030	\$47,986,769	\$104,000	\$80,957,476	\$18,279,468	\$0	\$5,215,188	\$19,600	\$3,015,610	\$155,578,111	\$8,500,995	\$164,079,105
2031	\$47,408,094	\$104,000	\$82,061,911	\$18,522,646	\$0	\$5,284,879	\$19,600	\$3,809,648	\$157,210,778	\$9,786,814	\$166,997,592
2032	\$47,465,391	\$104,000	\$84,299,358	\$19,017,987	\$0	\$5,439,667	\$19,600	\$4,625,944	\$160,971,947	\$11,091,208	\$172,063,155
Total	\$475,146,368	\$936,000	\$482,690,175	\$109,054,091	\$16,963,740	\$125,009,114	\$254,800	\$18,059,025	\$1,228,113,313	\$56,814,422	\$1,284,927,735

Table 12 presents emission benefits for Alternative 1. The accelerated implementation schedule would provide additional NOx benefits as compared to the Proposed Amendments. Table 13 presents valuation of the health benefits resulting from Alternative 1. Table 14 presents the change in growth of economic indicators for Alternative 1.

Table 12: NOx Benefits with Alternative 1 Relative to the Legal Baseline

Calendar Year	NOx Benefits (tons per day)
2022	0.4
2023	2.5
2024	5.3
2025	8.6
2026	12.3
2027	16.1
2028	19.9
2029	24.1
2030	28.2
2031	32.4
2032	36.6

Table 13: Valuation of Statewide Health Benefits for Alternative 1 Relative to the Legal Baseline

Outcome	Avoided Incidents	Valuation (Million 2018\$)
Avoided Premature Mortality	576	\$5,422.30
Avoided Cardiovascular Hospitalizations	82	\$4.61
Avoided Acute Respiratory Hospitalizations	97	\$4.80
Avoided Emergency Room Visits	276	\$0.22
Total	1,031	\$5,431.94

Table 14: Change in Growth of Economic Indicators for Alternative 1 Relative to the Legal Baseline

Sector	Year of Change	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
GSP	% Change	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	-86.22	-193.21	-184.89	-255.37	-281.98	-224.07	-233.98	-237.42	-239.81	-244.56	-148.77
Income	% Change	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	-76.94	-185.44	-195.82	-276.27	-321.58	-258.03	-273.26	-283.48	-292.97	-305.37	-207.94
Employment	% Change	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	-924	-2053	-1921	-2620	-2860	-1902	-1951	-1943	-1926	-1931	-984
Output	% Change	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
	Change (2018M\$)	-148.62	-330.32	-317.26	-436.08	-481.94	-395.65	-413.23	-421.15	-426.89	-436.62	-270.35
Private Investment	% Change	-0.01%	-0.01%	-0.02%	-0.02%	-0.02%	-0.02%	-0.02%	-0.01%	-0.01%	-0.01%	-0.01%
	Change (2018M\$)	-22.65	-56.18	-61.90	-78.11	-84.80	-72.57	-66.54	-60.29	-54.52	-50.15	-24.32

Although Alternative 1 would achieve greater NOx reductions sooner, the accelerated schedule of Alternative 1 would not provide enough lead time for the development of the interim engines in 2022 and the low NOx engines in 2024. Without sufficient time for engine manufacturers to conduct research, development, and durability testing, products will not be able to meet the stringent criteria. Manufacturers have identified that five to six years of lead time would be required for full product development, from proof of concept to production product. The Proposed Amendments provide manufacturers with necessary lead time for engineering development for the changes required in 2024 and the more significant changes needed in 2027 (i.e., cylinder deactivation and light-off SCR). Because Alternative 1 did not provide the necessary lead time for engineering development, it was rejected.

b. Alternative 2:

Under Alternative 2, engine manufacturers would volunteer to nationally certify to a NOx standard that would be less stringent than the standard in the Proposed Amendments.

Table 15 summarizes the total statewide cost on California businesses due to Alternative 2 by each proposed amendment from 2022 through 2032. All costs are evaluated relative to the legal baseline scenario in 2018 dollars. As shown, the total cost impact from 2022 to 2032 was estimated at approximately \$0.20 billion.

Table 15: Projected Statewide Costs under Alternative 2 from 2022 through 2032 Relative to the Legal Baseline (2018\$)

Calendar Year	Standards, Certification, and New Technology Cost to Manufacturers	DEF Cost to CA Fleets	Total Costs to CA Fleets
2022	\$0	\$0	\$0
2023	\$0	\$0	\$0
2024	\$414,500	\$1,543	\$416,043
2025	\$6,369,900	\$311,672	\$6,681,572
2026	\$6,443,200	\$636,799	\$7,079,999
2027	\$8,173,154	\$969,010	\$9,142,164
2028	\$35,910,460	\$1,645,923	\$37,556,383
2029	\$31,973,487	\$2,332,347	\$34,305,835
2030	\$31,813,901	\$3,034,289	\$34,848,191
2031	\$31,654,813	\$3,748,633	\$35,403,446
2032	\$31,917,160	\$4,473,297	\$36,390,457
Total	\$184,670,576	\$17,153,512	\$201,824,088

Table 16 presents emission benefits for Alternative 2. Table 17 presents valuation of the health benefits resulting from Alternative 2. Table 18 presents the change in growth of economic indicators for Alternative 2.

Table 16: NOx Benefits with Alternative 2 Relative to the Legal Baseline

Calendar Year	NOx Benefits (tons per day)
2022	0
2023	0
2024	0.2
2025	1.3
2026	3.1
2027	5.2
2028	8.3
2029	12.1
2030	16.1
2031	20.2
2032	24.3

Table 17: Valuation of Statewide Health Benefits for Alternative 2 Relative to the Legal Baseline

Outcome	Avoided Incidents	Valuation (Million 2018\$)
Avoided Premature Mortality	283	\$2,668.27
Avoided Cardiovascular Hospitalizations	41	\$2.31
Avoided Acute Respiratory Hospitalizations	49	\$2.40
Avoided Emergency Room Visits	136	\$0.11
Total	508	\$2,673.09

Table 18: Change in Growth of Economic Indicators for Alternative 2 Relative to the Legal Baseline

Sector	Year of Change	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
GSP	% Change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2018M\$)	0.49	0.47	-0.36	-12.90	-12.96	-18.01	-74.16	-70.97	-75.44	-76.99	-78.44
Income	% Change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2018M\$)	0.47	0.50	-0.25	-12.36	-13.88	-19.98	-79.15	-83.59	-93.31	-99.90	-105.93
Employment	% Change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2018M\$)	5	5	-4	-137	-135	-184	-753	-704	-732	-735	-738
Output	% Change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2018M\$)	0.77	0.73	-0.68	-21.96	-22.26	-30.75	-126.29	-121.33	-128.82	-131.61	-134.29
Private Investment	% Change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.01%	-0.01%	0.00%
	Change (2018M\$)	0.09	0.10	-0.13	-3.52	-4.58	-6.00	-20.24	-22.90	-23.79	-23.03	-21.72

Although Alternative 2 would be more cost-effective than the Proposed Amendments, it was rejected for not achieving the NOx emission reductions needed to achieve California's air quality goals. Alternative 2 provides less health benefits for Californians, and EMA's proposal to include reductions from a voluntary national standard for out-of-state trucks operating in California could not be enforced since California does not have the authority over engines sold outside of California. To ensure engines outside of California meet the proposed Alternative 2 standards, the engine manufacturers would need to develop a legally binding agreement. The enforceability of such an agreement is unclear. It is also unclear if U.S. EPA could enforce a voluntary national program agreement without a new rulemaking. For all the reasons described above, and most importantly because it is not clear how EMA's proposal for a voluntary national standard could be enforced in California, Alternative 2 was rejected.

II. Impact of the Regulation on Affected Businesses

CARB staff has added information in response to DOF's request that, "the SRIA must discuss the disparate impacts of the regulations on businesses and individuals. This should be done by clearly describing the number and concentration of affected entities by region, business and fleet size, and industry, and by expanding the cost analysis from the up to \$9,000 cost per truck to cost per affected entity." Detailed information on impacted businesses is discussed further below.

Medium- and heavy-duty engine/vehicle manufacturers (NAICS 3363 and 3361) would be the regulated entities under the Proposed Amendments. Staff estimated the number of impacted engine/vehicle manufacturers based on CARB's certification data, which indicated that there are 31 medium- and heavy-duty engine and vehicle manufacturers certifying their new engines and vehicles with CARB, among which there are 10 small businesses (or 32 percent).

Since all of these manufacturers are located outside of California,¹ staff assumes the direct cost impact on these manufacturers would be passed on to California fleets (Truck Transportation – NAICS 484) that purchase California-certified vehicles. Staff estimated the number of impacted California fleets using 2017 DMV registration data, which indicated that there are 290,775 fleets (GVWR >10,000 pounds, including owner operators) registered in California, among which there are 267,718 small businesses (or 92 percent). Table 19 shows the number of affected fleets and fleet distribution by California air basin.² As Table 19 shows, the highest proportion of affected fleets would be registered in the South Coast air basin, with the next highest portion in San Joaquin Valley and San Francisco Bay Area.

¹ All the affected engine manufacturers are located outside California. However, a number of heavy-duty ZEV manufacturers who could generate credits under the Proposed Amendments are located in California.

² A map of California air basins is available on CARB's website at <https://ww3.arb.ca.gov/ei/maps/2017statemap/abmap.htm>.

Table 19: Number of Medium- and Heavy-Duty California Fleets Impacted by the Proposed Amendments by Air Basin

Air Basin	Number of Small Fleets (fleets of 3 vehicles or less)	Percent of All Statewide Small Fleets Registered in Air Basin	Number of Typical Fleets (fleets of 4 vehicles or more)	Percent of All Statewide Typical Fleets Registered in Air Basin	Total Number of Fleets Registered with DMV	Total Fleet Distribution (% of All Statewide Fleets Registered in the Air Basin)
Great Basin Valley	615	0.23%	32	0.14%	647	0.22%
Lake County	1,006	0.38%	38	0.16%	1,044	0.36%
Lake Tahoe	455	0.17%	27	0.12%	482	0.17%
Mojave Desert	10,203	3.81%	436	1.89%	10,639	3.66%
Mountain Counties	7,212	2.69%	278	1.21%	7,490	2.58%
North Central Coast	6,557	2.45%	571	2.48%	7,128	2.45%
North Coast	5,125	1.91%	326	1.41%	5,451	1.87%
Northeast Plateau	1,783	0.67%	91	0.39%	1,874	0.64%
Sacramento Valley	23,809	8.89%	2,016	8.74%	25,825	8.88%
Salton Sea	4821	1.80%	416	1.80%	5,237	1.80%
San Diego	18,901	7.06%	1,482	6.43%	20,383	7.01%
San Francisco Bay	36,432	13.61%	3,426	14.86%	39,858	13.71%
San Joaquin Valley	36,936	13.80%	4,068	17.64%	41,004	14.10%
South Central Coast	13,670	5.11%	962	4.17%	14,632	5.03%
South Coast	98,277	36.71%	8,585	37.23%	106,862	36.75%
Out-of-State Based	1,916	0.72%	303	1.31%	2,219	0.76%
Total	267,718	100.00%	23,057	100.00%	290,775	100%

The actual cost impact on fleets would depend on the number of new California-certified vehicles that fleets would purchase during the lifetime of the analysis. However, there is insufficient data to estimate the actual number of new vehicles each fleet would purchase per year, given that purchasing habits of each particular fleet is difficult to predict. Due to this data limitation, the average annual cost per impacted business was estimated by dividing the annual statewide costs by the number of impacted California fleets regardless of fleet size. Table 20 and 21 (which correspond to Table C-46 and C-47 in the SRIA) show examples of lifetime cost and savings impacts on fleets per each vehicle purchase in 2025 and 2028. Table 22 summarizes the estimated average annual cost per impacted fleet from 2022 to 2032. The average annual cost for an impacted business (small or typical business) would range from \$60 to \$592 within the considered regulation’s lifetime of 11 years, with the highest cost in 2032.

Table 20: Lifetime Cost and Savings Impact on a 2025 MY Vehicle Purchased under the Proposed Amendments (Relative to Legal Baseline) (2018\$)

Vehicle Class	Lifetime Costs	Lifetime Savings	Lifetime Net Impact
HHDD	\$3,706	\$247	\$3,458
MHDD	\$2,261	\$1,310	\$951
LHDD	\$1,820	\$280	\$1,541
HDO	\$557	\$130	\$427
MDDE-3	\$1,839	\$0	\$1,839
MDOE-3	\$482	\$0	\$482

Table 21: Lifetime Cost and Savings Impact on a 2028 MY Vehicle Purchased under the Proposed Amendments (Relative to Legal Baseline) (2018\$)

Vehicle Class	Lifetime Costs	Lifetime Savings	Lifetime Net Impact
HHDD	\$8,163	\$2,823	\$5,340
MHDD	\$7,383	\$4,344	\$3,039
LHDD	\$5,081	\$1,958	\$3,123
HDO	\$1,568	\$845	\$723
MDDE-3	\$3,647	\$871	\$2,776
MDOE-3	\$624	\$155	\$469

Table 22: Average Annual Incremental Cost per Impacted California Fleet from 2022 to 2032 under the Proposed Amendments (Relative to Legal Baseline) (2018\$)

Calendar Year	Annual Statewide Costs on California Fleets	Number of California Fleets	Annual Statewide Cost per California Fleet
2022	\$17,494,116	290,775	\$60
2023	\$27,979,412	290,775	\$96
2024	\$21,084,100	290,775	\$73
2025	\$55,469,762	290,775	\$191
2026	\$65,685,726	290,775	\$226
2027	\$133,876,268	290,775	\$460
2028	\$166,986,244	290,775	\$574
2029	\$161,585,045	290,775	\$556
2030	\$164,417,428	290,775	\$565
2031	\$167,258,675	290,775	\$575
2032	\$172,283,001	290,775	\$592