October 7, 2021
TAC Agenda Item 9.2
Continued From: New
Action Requested: APPROVE

NAPA VALLEY TRANSPORTATION AUTHORITY
TAC Agenda Letter

TO:	Technical Advisory Committee
FROM:	Kate Miller, Executive Director
REPORT BY:	Diana Meehan, Senior Planner (707) 259-8327 / Email: dmeehan@nvta.ca.gov
SUBJECT:	Transportation Fund for Clean Air (TFCA) Program Manager Fund Project List for Fiscal Year Ending (FYE) in 2022

RECOMMENDATION

That the TAC recommend the Napa Valley Transportation Authority (NVTA) Board approve the Transportation Fund for Clean Air (TFCA) Program Manager Project List for Fiscal Year Ending (FYE) in 2022.

EXECUTIVE SUMMARY

On February 17, 2021 the NVTA Board approved the expenditure plan and opened a call for projects for the TFCA Program Manager Funds which closed on March 19, 2021. One project was submitted by the City of Napa for FYE 2022, no projects were submitted for FYE 2023 or FYE 2024. NVTA is proposing to use the remaining portion of the 2022 TFCA funds for the City of St. Helena Main Street Pedestrian Improvements project.

The proposed final list of projects for FYE 2022 is shown in Table 1 below. Projects have undergone a cost effective analysis and are eligible to receive funds. Approved projects must be submitted to the BAAQMD by November 1, 2021 to meet the programming deadline. If funds are not programmed by the Air District deadline, funds may be reprogrammed to another county.

Table 1: Proposed FYE 2022 TFCA Program Manager Projects

FYE 2022 TFCA Expenditures	**Amount**
Administration Costs for FYE 2022	$17,485
City of Napa-Westwood Sidewalk Project	$40,360
City of St. Helena-Main St. Sidewalk Project	$149,344
TOTAL	**207,189**

*FYE 2022 funds must be programmed no later than November 1, 2021.

FISCAL IMPACT

Is there a Fiscal Impact? Yes, TFCA eligible projects totaling $207,189 (including administrative costs) will be funded with FYE 2022 TFCA Program Manager funds.

Is it currently budgeted? Yes.

Where is it budgeted? TFCA FYE 2022 funds.

Future fiscal impact? No.

Consequences if not approved? TFCA FYE 2022 Projects will not be funded and Napa County funds may be programmed to another county.

BACKGROUND AND DISCUSSION

The Transportation Fund for Clean Air (TFCA) is a grant program, funded by a $4 surcharge on motor vehicles registered in the Bay Area. This generates approximately $22 million per year in revenues. The purpose of the TFCA program is to provide grants to implement the most cost-effective projects in the Bay Area that will decrease motor vehicle emissions, and thereby improve air quality. Forty percent of the DMV funds generated in Napa are returned to the NVTA for distribution to local projects. The remaining sixty percent is allocated by the BAAQMD under the Regional Program. Projects must have an air quality benefit and be cost effective. Air District rules and statutes only allow funds to be retained for two years unless an extension is requested. Bicycle projects are not allowed an extension and funds programmed to bicycle projects must be expended in two years.

NVTA adopts a list of projects annually to be funded by the TFCA Program Manager funds. In 2018, staff proposed programming TFCA funds for a three-year cycle similar to the State Transportation Improvement Program (STIP) in order aid in local planning processes. The first three-year programming cycle was successful because jurisdictions submitted project applications for the first year, and NVTA had larger capital projects that were eligible for TFCA in the outer two years of the cycle. However, in this cycle, only a single application was received requesting funds in the first year, and no requests were made for the outer years. Staff reviewed existing projects within the county that have funding shortfalls, and is recommending programming the remaining FYE 2022 funds to the City of St. Helena Main Street Sidewalk Project. If the additional funds are not programmed, Napa County may lose them to another county.

The TFCA program can fund a wide range of project types, including the construction of new bicycle lanes; shuttle and feeder bus services to train stations; ridesharing programs to encourage carpool and transit use; bicycle facility improvements such as bicycle racks and lockers; electric vehicles and electric vehicle infrastructure; and arterial management projects that reduce traffic congestion such as signal interconnect projects.

SUPPORTING DOCUMENT

Attachment: (1) FYE 2022 TFCA Application

Project Information Form

A. Project Number: 22NAP01

B. Project Title: Westwood Avenue Sidewalk Improvements

C. Project Category (project will be evaluated under this category): 9b.

D. TFCA County Program Manager Funds Allocated: $40,360

E. TFCA Regional Funds Awarded (if applicable): $______________

F. Total TFCA Funds Allocated (sum of C and D): $40,360

G. Total Project Cost: $640,360

H. Project Description:

The City of Napa will use TFCA funds to construct sidewalks on both sides of Westwood Avenue between Laurel Street and Chelsea Avenue. This project is located in the Westwood neighborhood of the City of Napa. Westwood Avenue does not currently have continuous sidewalks. This project would construct approximately 2,000ft of pedestrian facilities to close gaps in the existing pedestrian network in order to connect with nearby transit stops, Napa Valley Language Academy elementary school, employment destinations, and neighborhood serving retail.

Per 2019 American Community Survey 5-year data and local school data, the population of workers aged 16+ in the project area is 2670 and the student body of Napa Valley Language Academy is 658.

I. Final Report Content: Final Report form and final Cost Effectiveness Worksheet

The "Trip Reduction" final Report form and final Cost Effectiveness Worksheet will be completed and submitted after project completion.

J. Attach a completed Cost-Effectiveness Worksheet and any other information used to evaluate the proposed project.

See attached for the project's completed Cost-Effectiveness Worksheet.

K. If a **ridesharing, shuttle and feeder bus service, transit information, or smart growth project,** explain how the number of vehicle trips that will be reduced by the project was estimated, and provide supporting information and data to justify the estimate.

The project assumed 53 one-way commute trips and 26 one-way school trips. The following supporting information and data was used to justify those estimates:

Commute Trips:

- *Per 2019 American Community Survey (ACS) 5-year data, there are 2670 workers ages 16+ in the project area.*
- *Per 2019 ACS data, 1.5% of workers in the project area currently commute via walking compared to 2.5% Citywide.*

- *Per 2019 ACS data, 9.3% of workers in the project area have a commute of <10 minutes and 9.9% have a commute of 10-14 minutes.*
- *Project assumes a 1% commute mode shift**
- *Calculation: 2670 x 1% = 26.7 (two-way trips) = 53.4 (one-way trips)*

School Trips:

- *Napa Valley Language Academy (NVLA) elementary school has 658 students.*
- *Based on pre-pandemic hand count tallies and parent surveys, the percent of students at NVLA who walk to school is 2.32% lower than the district average.*
- *Project assumes a 2% walk mode shift**
- *Calculation: 658 x 2% = 13.16 (two-way trips) = 26.32 (one-way trips)*

**The project area is located within a regionally designated Community of Concern, which was included in the Napa Valley Community Based Transportation Plan (CBTP). Community outreach conducted as part of the CBTP identified that nearly 20% of comments received indicated a desire for increased pedestrian safety and improved pedestrian access to schools and transit stops. Thus there is high-demand for pedestrian improvements in the project area which supports the mode shift assumptions used.*

L. If an **arterial management or signal timing project**, confirm that the data for traffic volume and average vehicle speed be generated concurrently (i.e., during the exact same day and time period).

N/A.

M. Has or will this project receive any other TFCA funds, such as Regional Funds?

No.

N. Comments (if any):

The project area is located within a regionally significant Community of Concern (census tract 2008.04) as designated by the Metropolitan Transportation Commission. The project area meets this designation because it exceeds the established concentration thresholds for the disadvantage factors of minority, low-income households, limited English proficiency, and single-parent family.

O. Please indicate if the project is located in a SB535 Disadvantaged Community and/or AB1550 Low-income Community (Please use the map to find your project's location: https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/communityinvestments.htm)

Yes, the project is located within an AB1550 Low-income Community.

RIDESHARING, BICYCLE, SHUTTLE, AND SMART GROWTH PROJECTS
FYE 2022 TFCA County Progam Manager Fund Worksheet
Version 2022.2, Updated 1/4/21

General Information Tab: Complete areas shaded in yellow.

Project Number (22XXXYY)	22NAP01
Project Title	Westwood Avenue Sidewalk Improvements
Project Type Code (e.g., 7a)	9b
County (2-3 character abbreviation)	NAP
Worksheet Calculated By	Lorien Clark
Date of Submission	3/19/2021
Project Sponsor	
Project Sponsor Organization	City of Napa
Public Agency? (Y or N)	Y
Contact Name	Rosalba Ramirez
Email Address	rramirez@cityofnapa.org
Phone Number	707-257-9520
Mailing Address	P.O. Box 660
City	Napa
State	CA
Zip	94559
Project Schedule	
Project Start Date	10/1/2021
Project Completion Date	6/30/2022
Final Report to CMA	10/31/2022

RIDESHARING, BICYCLE, SHUTTLE, AND SMART GROWTH PROJECTS

FYE 2022 TFCA County Progam Manager Fund W

Version 2022.2, Updated 1/4/21

Program Manager Proj.#:	22NAP01
Route Name:	Westwood Ave

Cost Effectiveness Inputs	
Project Operational Start Year:	2022
# Years Effectiveness:	10
Project Operational End Year:	2032
Total Cost for route:	640,360
Total Cost for route 40%:	40,360
Total Cost for route 60%:	NA
Total TFCA Cost for route:	$40,360.00

Calculations Tab: Complete areas shaded in yellow only.

SAMPLE ENTRIES ARE SHOWN IN LIGHT BLUE

Emission Reduction Calculations

Step 1 - Emissions for Eliminated Trips

A	B	C	D	E	F	G	H	I
# Trips/Day (1-way)	Days/Yr	Trip Length (1-way)	VMT	ROG Emissions (gr/yr)	NOx Emissions (gr/yr)	Exhaust &Trip End PM10 Emissions (gr/yr) *	Other PM10 Emissions (gr/yr) *	CO2 Emissions (gr/yr)
100	250	16	304294	28,483	20,992	596	76,739	73,119,878
53	240	1	12,720	4,157	1,689	83	3,208	3,644,107
26	180	1	4,680	1,530	622	30	1,180	1,340,756
			0	0	0	0	0	0
			0	0	0	0	0	0
		Total	17,400	5,687	2,311	113	4,388	4,984,863

Step 2 - Emissions for New Trips to Access Transit/Ridesharing

50	250	3	304294	25,307	20,123	534	76,739	72,490,780
			0	0	0	0	0	0
			0	0	0	0	0	0
		Total	0	0	0	0	0	0

Step 3A - Emissions for Shuttle/Vanpool Vehicles up to GVW of 14,000 lbs.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
		0.1	See Emission Factor Tab, ARB Table 2 or 7										
# Vehicles, Model Year	Emission Std.	Vehicle GVW	ROG Factor (gr/mi)	NOx Factor (g/mi)	Exhaust PM10 Factor (g/mi)	**Total** PM10 Factor (g/mi)	CO2 Factor (g/mi) (See CO2 Table for LD and LHD)	Total Annual VMT (sum all vehicles)	ROG Emissions (gr/yr)	NOx Emissions (gr/yr)	Exhaust PM10 Emissions (gr/yr)	Other PM10 Emissions (gr/yr)	CO2 Emissions (gr/yr)
2, 2005	LEV	10,001-14,000	0.23	0.40	0.12	0.32	860	8000	1,840	3,200	960	1,600	6,880,000
									0	0	0	0	0
									0	0	0	0	0
							Total	0	0	0	0	0	0

Step 3B - Emissions for Buses

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
			See Emission Factors Tab, Emissions for Buses Table													
Vehicle Ref #	Engine Year, Make, & Model	Odometer reading	ROG Factor (gr/mi)	ROG DR (g/10k miles)	NOx Factor (g/mi)	Nox DR (g/10k miles	Exhaust PM10 Factor (g/mi)	Exhaust PM DR (g/10k miles)	**Other** PM10 Factor (g/mi)	CO2 Factor (g/mi)	Total Annual VMT (sum all vehicles)	ROG Emissions (gr/yr)	NOx Emissions (gr/yr)	Exhaust PM10 Emissions (gr/yr)	Other PM10 Emissions (gr/yr)	CO2 Emissions (gr/yr)
												0.00	0	0	0	0
												0.00	0	0	0	0
												0.00	0	0	0	0
										Total	0	0	0	0	0	0

Cost Effectiveness Results	Annual	Lifetime	
1. VMT Reduced	17,400.00	174,000.00	Miles
2. Trips Reduced	12,720.00	127,200.00	Trips
3. ROG Emissions Reduced	0.0063	0.063	Tons
4. NOx Emissions Reduced	0.0025	0.025	Tons
5. PM Emissions Reduced	0.0050	0.050	Tons
6. PM Weighted Emissions Reduced	0.0073	0.073	Tons
7. CO2 Emissions Reduced	5.4948	54.948	Tons
8. Emission Reductions (ROG, NOx & PM)	0.0138	0.138	Tons
9. TFCA Project Cost - Cost Effectiveness (ROG, Nox & PM)		292,946.25	/Ton
10. TFCA Project Cost - Cost Effectiveness (ROG, NOx & Weighted PM). THIS VALUE MUST MEET POLICY REQUIREMENTS.		**$249,992**	**/Ton**

Notes & Assumptions

Provide all assumptions, rationales, and references for figures used in calculations.

Two key compoonents in calculating cost-effectiveness are the number of vehicle trips eliminated per day and the trip length.
A frequently used proxy is the % of survey respondents who report they would have driven alone if not for the service being provided.
If survey data is not available, alternative **supporting documentation must be provided to justify the inputs used in the CE calculations**.

Trips Eliminated Per Day
This is number of trips by participants that would have driven as a single occupant vehicle if not for the service; **it is not the same as the total number of riders or participants**.

Trip Length
Only use the trip length of the **vehicle trip avoided** by only the riders or participants that would otherwise have driven alone.

Policy 11. Duplication
MTC's regional ridehsaring program provides funding to counties. This funding may contain TFCA funding, which, if used in combination with TFCA funding, may violate Policy 11. Duplication.

Project Assumptions:	**Rationales:**
Years of Effectiveness = 10	10 years is consistent with the max years of effectiveness for a Class I project. Concrete sidewalk typically has a longer life than an asphalt path.
Commute Trips:	
Trip Length (1-way) = 1 mile	
Days/Year = 240	
# trips/day (1-way) = 53	Per 2019 American Community Survey (ACS) 5-year data, there are 2670 workers ages 16+ in the project area. Per 2019 ACS data, 1.5% of workers in the project area currently commute via walking compared to 2.5% Citywide. Per 2019 ACS data, 9.3% of workers in the project area have a commute of <10 minutes and 9.9% have a commute of 10-14 minutes. Project assumes a 1% commute mode shift* *calculation:* 2670 x 1% = 26.7 (two-way trips) = 53.4 (one-way trips)
School Trips:	
Trip Length (1-way) = 1 mile	
Days/Year = 180	
# trips/day (1-way) = 26	Napa Valley Language Academy (NVLA) elementary school has 658 students. Based on pre-pandemic hand count tallies and parent surveys, the percent of students at NVLA who walk to school is 2.32% lower than the district average. Project assumes a 2% walk mode shift* *calculation:* 658 x 2% = 13.16 (two-way trips) = 26.32 (one-way trips)
	*The project area is located within a regionally designated Community of Concern, which was included in the Napa Valley Community Based Transportation Plan (CBTP). Community outreach conducted as part of the CBTP identified that nearly 20% of comments received indicated a desire for increased pedestrian safety and improved pedestrian access to schools and transit stops. Thus there is high-demand for pedestrian improvements in the project area which supports the mode shift assumptions used.

RIDESHARING, BICYCLE, SHUTTLE, AND SMART GROWTH PROJECTS

FYE 2022 Worksheet, Version 2022.1, Updated 1/4/21

Average Auto (passenger cars, light duty trucks, and motorcycles) Emission Factors

	ROG		NOx		PM_{10}			CO2		CH4	
Emission Year	Trip Fac.	Run Emis. (VMT)	Trip Fac.	Run Emis. (VMT)	Exhaust	Tire,Brakes, Road PM	PM Commute Trip End	Trip Fac.	Run Emis. (VMT)	Trip Fac.	Run Emis. (VMT)
2021	0.325	0.085	0.095	0.086	0.002	0.252186	0.005438	60.049283	282.164944	0.067090	0.005642
2022	0.325	0.085	0.095	0.086	0.002	0.252186	0.005438	58.242517	273.490495	0.062092	0.005202
2023	0.267	0.075	0.074	0.067	0.002	0.252186	0.005438	56.442597	264.762115	0.057566	0.004826
2024	0.267	0.075	0.074	0.067	0.002	0.252186	0.005438	54.647913	256.042015	0.053422	0.004508
2025	0.267	0.075	0.074	0.067	0.002	0.252186	0.005438	52.858848	247.313875	0.049589	0.004239
2026	0.267	0.075	0.074	0.067	0.002	0.252186	0.005438	51.212913	239.653340	0.046197	0.004022
2027	0.267	0.075	0.074	0.067	0.002	0.252186	0.005438	49.715023	232.749083	0.043219	0.003835
2028	0.227	0.068	0.060	0.055	0.001	0.252186	0.004350	48.351677	226.576243	0.040579	0.003676
2029	0.227	0.068	0.060	0.055	0.001	0.252186	0.004350	47.109586	221.068316	0.038219	0.003539
2030	0.227	0.068	0.060	0.055	0.001	0.252186	0.004350	45.988842	216.181726	0.036097	0.003423
2031	0.227	0.068	0.060	0.055	0.001	0.252186	0.004350	44.974267	211.856042	0.034182	0.003322
2032	0.227	0.068	0.060	0.055	0.001	0.252186	0.004350	44.062562	208.050360	0.032473	0.003235
2033	0.196	0.063	0.049	0.048	0.001	0.252186	0.004350	43.247236	204.721787	0.030956	0.003161
2034	0.196	0.063	0.049	0.048	0.001	0.252186	0.004350	42.518682	201.821812	0.029593	0.003096
2035	0.196	0.063	0.049	0.048	0.001	0.252186	0.004350	41.872073	199.315739	0.028374	0.003040
2036	0.196	0.063	0.049	0.048	0.001	0.252186	0.004350	41.301898	197.166261	0.027286	0.002991

Sources: ROG, NOX and PM10 (converted from PM2.5) are from CARB Cost Effectiveness Tables November 2020 - Table 3. CO2 and CH4 are from EMFAC2017 (v1.0.2) Emission Rates. Weighted averages of LDA, LDT1, LDT2, MCY. Data extracted on 9/18/19 and QA'd on 9/19/19 by SN

Light duty auto fuel efficiency (modeled)

	Gasoline Fuel Efficiency				Diesel Fuel Efficiency			
	LDA	LDT1	LDT2	MCY	LDA	LDT1	LDT2	MCY
Emission Year	mile/ gal	mile/ gal	mile/ gal	mile/ gal	mile/ gal	mile/ gal	mile/ gal	mile/ gal
2021	31.07612823	26.7382681	24.52000756	37.16842229	47.50148	47.50148	47.5014804	47.5014804
2022	31.91570522	27.4093657	25.32896617	37.1769972	48.69225	48.692245	48.6922451	48.6922451
2023	32.80780426	28.1215955	26.18301387	37.18511856	49.97029	49.970289	49.9702887	49.9702887
2024	33.75016315	28.8726975	27.08037502	37.18776969	51.34233	51.342333	51.3423333	51.3423333
2025	34.74943753	29.669728	28.02740702	37.1838482	52.81715	52.81715	52.8171499	52.8171499
2026	35.70276228	30.4283507	28.94505849	37.18143797	54.2386	54.238603	54.238603	54.238603
2027	36.61144906	31.1569872	29.83915017	37.18000332	55.60675	55.60675	55.6067496	55.6067496
2028	37.46475361	31.8457267	30.69605943	37.17481405	56.89743	56.89743	56.8974299	56.8974299
2029	38.25949121	32.4959074	31.51362317	37.1671075	58.08745	58.08745	58.0874499	58.0874499
2030	38.99143456	33.1032794	32.28632034	37.16253599	59.18851	59.18851	59.1885097	59.1885097
2031	39.65997599	33.6705511	33.01345588	37.15805629	60.17224	60.172238	60.1722383	60.1722383
2032	40.26564771	34.1917657	33.68858339	37.14959129	61.07857	61.078569	61.0785686	61.0785686
2033	40.80891655	34.6690038	34.30774599	37.13542319	61.87757	61.877571	61.8775708	61.8775708
2034	41.2920562	35.1070206	34.87076695	37.12277776	62.58723	62.587232	62.5872324	62.5872324
2035	41.71753484	35.5021795	35.37546177	37.10770642	63.20997	63.209969	63.2099692	63.2099692
2036	42.08743484	35.8597771	35.8213026	37.0925393	63.74876	63.748758	63.7487583	63.7487583
2037	42.40401627	36.1769667	36.20890636	37.0772538	64.20806	64.208063	64.2080631	64.2080631
2038	42.67125672	36.458369	36.54328402	37.06111268	64.59407	64.594071	64.5940708	64.5940708

Sources: EMFAC2017 (v1.0.2) Emissions. Data extracted on 9/18/19 and QA'd on 9/19/19 by SN

CARB - Table 2 Emission Factors for Cleaner Vehicles

For Light-Duty and Medium-Duty Trucks/SUVs (Chassis-Certified)

Baseline (Older) Technology Vehicle

Baseline is California Vehicle Exhaust Standards ("LEV II") for average chassis-certified trucks for model year 2010. Factors assume emissions at 50,000 mile standard for the first 50,000 miles of the car's life (assumed to be 120,000 miles) and emissions at the 120,000 mile standard for the last 70,000 miles of the car's life.

Average New Truck in 2010
Emission factors in grams/mile

Weight (lbs.)[1]	ROG	NOx	PM2.5		PM10		CO_2
			Exhaust	Total[note]	Exhaust	Total	
Up to 8500	0.051	0.06	0.01	0.06	0.01	0.29	546
8501-10,000	0.148	0.195	0.07	0.13	0.07	0.68	735
10,001-14,000	0.173	0.39	0.07	0.14	0.07	0.70	824

Source: Draft CARB Emission Factors Tables - September 2019 - Methods for the Cost-Effectiveness of Funding Air Quality Projects

Note: Total PM factors include motor vehicle exhaust, tire wear, brake wear, and entrained road dust

Replacement (Newer) Technology Cleaner Vehicle

Cleaner Vehicle Emission Factors are from the California Vehicle Exhaust Standards for MYs after 2016 ("LEV III") evaluated for calendar year 2019.

Project Average New Trucks in 2019
Emission factors in grams/mile

Weight (lbs.)[1]	ROG	NOx	PM2.5		PM10		CO_2
			Exhaust	Total	Exhaust	Total	
Up to 8500	0.04	0.054	0.003	0.049	0.00	0.25	546
8501-10,000	0.104	0.149	0.008	0.072	0.01	0.37	735
10,001-14,000	0.155	0.245	0.010	0.079	0.01	0.41	824

Zero-emission light-duty and medium-duty vehicle (ZEV)

Emission factors in grams/mile

Weight (lbs.)[1]	ROG	NOx	PM2.5		PM10		CO_2
			Exhaust	Total[3]	Exhaust	Total	
Up to 8500	0	0	0	0.046	0.00	0.24	92
8501-10,000	0	0	0	0.064	0.00	0.34	92
10,001-14,000	0	0	0	0.069	0.00	0.37	144

Source: California Air Resources Board - Methods to Find the Cost-Effectiveness of Funding Air Quality Projects, Table 2. Document updated May 2013.

[1] Gross vehicle weights can be associated with passenger capacity as follows: 5751-8500, roughly 8 passengers; 8501-10,000, roughly 10-15 passengers; 10,001-14,000, roughly 20 passengers or more.

[3] Total PM factors include exhaust, brake wear, and entrained road dust.

Table 3.2-16 PM Size Fraction Profiles for Gasoline and Diesel Vehicles in EMFAC 2014

	PM10			PM2.5			PM2.5 to PM10		
Process	GAS - CAT	GAS - NCAT	Diesel	GAS - CAT	GAS - NCAT	Diesel	GAS - CAT	GAS - NCAT	Diesel
Running Exhaust	0.894	0.961	0.994	0.822	0.917	0.917	1.087591241	1.0479826	1.083969466
Idle Exhaust	0.894	0.961	0.994	0.822	0.917	0.917	1.087591241	1.0479826	1.083969466
Start Exhaust	0.894	0.961	0.994	0.822	0.917	0.917	1.087591241	1.0479826	1.083969466
Brake Wear	1	1	1	0.25	0.25	0.25	4	4	4
Tire Wear	0.98	0.98	0.98	0.42	0.42	0.42	2.333333333	2.3333333	2.333333333

Other PM10, Diesel Fleet

	PM10	PM10	PM10	PM10
	LHDT1	LHDT2	MHDT	HHDT
	8501-10000 lbs	10001-14000 lbs	14-33	33+
Brake wear (BW)	0.07644	0.08918	0.13034	0.06079
Tire wear (TW)	0.01200	0.01200	0.01200	0.03545
Road Dust (RD)	0.14667	0.14667	0.14667	0.14667
BW + TW + RD:	**0.2351**	**0.2478**	**0.2890**	**0.2429**

Source for BW and TW: EMFAC 2017, Average of statewide BAAQMD fleet (all model years), aggregate all model years, aggregate all speeds

Source for RD: Methods to Find the Cost-Effectiveness of Funding Air Quality Projects (May 2013), Table 1, PM2.5 converted to PM10

Other PM10, Gasoline Fleet

	PM10
	MDV, LHD1, LHD2, Urban Buses
Brake wear (BW)	0.04188
Tire wear (TW)	0.00800
Road Dust (RD)	0.14667
BW + TW + RD:	**0.1965**

Other PM10, Natural

	PM10
	HHDT + Urban Buses
Brake wear (BW)	0.06520
Tire wear (TW)	0.03478
Road Dust (RD)	0.14667
BW + TW + RD:	**0.2466**

Other PM10, Electric

	PM10
	MDV + Urban Buses
Brake wear (BW)	0.03731
Tire wear (TW)	0.00863
Road Dust (RD)	0.14667
BW + TW + RD:	**0.1926**

Source for BW and TW: EMFAC 2017, Average of BAAQMD Gasoline Fleet
Source for RD: Methods to Find the Cost-Effectiveness of Funding Air Quality Projects (May 2013), Table 1, PM2.5 converted to PM10

Conversion from PM2.5 to PM10, Autos

Process	Proportion distribution	PM2.5	Conversion factor PM2.5 to PM10	PM10
Exhaust	N/A	0.002	1.087591241	**0.00218**
BW + TW	100%	0.024	N/A	N/A
Brake we	82%	0.019704	4	0.0788
Tire wear	18%	0.004296	2.333333333	0.0100
Road Dus	N/A	0.028	6.666666667	0.1867
			Total PM2.5	**0.0540**
			Total PM10	**0.2777**
			Total conversion factor PM2.5 to PM 10	**5.1423**
			BW TW RD only conversion factor PM2.5 to PM 10	**5.2982**

Sources:
Proportion distribution of BW and TW - EMFAC 2014 Emission Inventory, Calendar Year 2015, LDA, LDT1, LTD2, and MYC, PMTW and PMBW

Conversion factor for RD - methodology and factor from Dennis Wade, ARB, confirmed by Amir Fanai, 2014, Conversion = PM2.5/Factor
PM2.5 figures from Table 3A, email from Dennis Wade, 1/28/16

Additional Resources:

Dennis Wade: ARB - 916-327-2963 (EMFAC)

Annie Huang: ARB - 916-323-8475 (emissions inventory)

Emission Factors from Appendix D: Tables for Emission Reduction and Cost-Effectiveness Calculations (Carl Moyer Program)

Table D-1 Heavy Duty Vehicles 14,001 - 33,000 pounds (GVWR)

Engine Model Year	NOx(b)		ROG(b),(c)		PM(b),(i)	
	EF(d)	DR(e)	EF(d)	DR(e)	EF(d)	DR(e)
Pre-1987	14.52	0.031	0.89	0.051	0.713	0.0283
1987-90	14.31	0.041	0.7	0.06	0.774	0.0252
1991-93	10.7	0.054	0.37	0.031	0.425	0.0193
1994-97	10.51	0.063	0.27	0.036	0.241	0.0129
1998-02	10.33	0.072	0.28	0.036	0.266	0.0116
2003-06	6.84	0.071	0.23	0.021	0.175	0.0067
2007-09	3.99	0.09	0.18	0.007	0.014	0.0008
2007+(f)(0.21-0.50 g/l	1.27	0.079	0.06	0.002	0.002	0.0001
2010-12(0.20 g/bhp-h	1.03	0.079	0.06	0.002	0.002	0.0001
2013+(g)(0.20 g/bhp-l	1.03	0.045	0.06	0.001	0.002	0.0001
2016+(h)(0.10 g/bhp-l	0.52	0.023	0.06	0.001	0.002	0.0001
2016+(h)(0.05 g/bhp-l	0.26	0.011	0.06	0.001	0.002	0.0001
2016+(h)(0.02 g/bhp-l	0.1	0.005	0.06	0.001	0.002	0.0001

Table D-2 Heavy-Duty Vehicles
Over 33,000 pounds GVWR
Emission Factors (g/mile)(a) (EF) and Deterioration Rates (g/mile-10k miles) (DR)

Engine Model Year	NOx(b)		ROG(b),(c)		PM(b),(i)	
	EF(d)	DR(e)	EF(d)	DR(e)	EF(d)	DR(e)
Pre-1987	21.37	0.018	1.38	0.031	1.26	0.02
1987-90	21.07	0.024	1.08	0.037	1.369	0.0178
1991-93	18.24	0.037	0.78	0.027	0.574	0.0104
1994-97	17.92	0.043	0.58	0.031	0.377	0.008
1998-02	17.61	0.049	0.6	0.031	0.415	0.0073
2003-06	11.66	0.049	0.49	0.018	0.267	0.0041
2007-09	6.8	0.077	0.39	0.007	0.022	0.0006
2007+(f)(0.21-0.50 g/l	2.17	0.068	0.13	0.002	0.004	0.0001
2010-12(0. 2 g/bhp-hr	1.76	0.068	0.13	0.002	0.004	0.0001
2013+(g)(0. 2 g/bhp-h	1.76	0.039	0.13	0.001	0.004	0.0001
2016+(h)(0.10 g/bhp-l	0.88	0.019	0.13	0.001	0.004	0.0001
2016+(h)(0.05 g/bhp-l	0.44	0.01	0.13	0.001	0.004	0.0001
2016+(h)(0.02 g/bhp-l	0.18	0.004	0.13	0.001	0.004	0.0001

(a) EMFAC 2014 Zero-Mile Based Emission Factors. Factors are based on diesel engines. Same factors used for alternative fuel engines due to limited alternative fuel data in EMFAC.
(b) Emission factors incorporate the ultra low-sulfur diesel fuel correction factors listed in Table D-22.
(c) EMFAC provides HC emission factors which are converted into ROG. ROG = HC * 1.26639.
(d) Emission Factors are based on zero-mile rates contained in EMFAC 2014.
(e) Deterioration Rate are per 10,000 miles.
(f) All model year 2007 and newer engines with Family Emission Limits (FEL) from 0.21 g/bhp-hr to
0.50 g/bhp-hr NOx must use different emission factors from those listed for model years 2010 and newer engines certified to 0.20 g/bhp-hr NOx standards. FEL emission factors are based on EMFAC factors for model year 2010-2012 engines that include weighted averaging of 0.5, 0.35, and 0.20 g/bhp- hr NOx standards based on sales.
(g) Deterioration rates for 2013+ engines incorporate use of on-board diagnostic system.
(h) Factors for 2016+ engines are reduced values of 2013 factors by 50 percent, 75 percent, and
90 percent to correspond with 0.10 g/bhp-hr NOx, 0.05 g/bhp-hr NOx, and 0.02 g/bhp-hr NOx optional low NOx standards, respectively.
(i) Factors for 2006 or older engines are for unfiltered trucks.

Table D-3 Diesel Urban Buses (g/mile)

Engine Model Year	NOx(b)	ROG(b),(c)	PM(b),(e)
Pre-1987	42.97	1.88	0.929
1987-1990	37.39	1.87	0.878
1991-1993	23.72	1.84	0.835
1994-1995	27.71	1.81	1.015
1996-1998	36.46	1.81	1.217
1999-2002	18.97	1.81	0.417
2003	13.02	0.77	0.084
2004-2006	3.56	0.08	0.084
2007+(0.20 g/bhp-hr N	1.9	0.03	0.011
2016+(d)(0.10 g/bhp-l	0.95	0.03	0.011
2016+(d)(0.05 g/bhp-l	0.47	0.03	0.011
2016+(d)(0.02 g/bhp-l	0.19	0.03	0.011

(a) EMFAC 2014 Zero-Mile Based Emission Factors.
(b) Emission factors incorporate the ultra low-sulfur diesel fuel correction factors listed in Table D-22.
(c) EMFAC provides HC emission factors which are converted into ROG. ROG = HC * 1.26639.
(d) Factors for 2016+ engines are reduced values of 2007 factors by 50 percent, 75 percent, and 90 percent to correspond with 0.10 g/bhp-hr NOx, 0.05 g/bhp-hr NOx, and 0.02 g/bhp-hr NOx optional low NOx standards, respectively.
(e) Factors for 2006 or older engines are for unfiltered trucks.

Table D-4 Alternative Fuel Urban Buses (g/mile)

Engine Model Year	NOx	ROG(b)	PM(d)
Pre-2003	21.6	2.68	0.043
2003-06	15.4	3.87	0.023
2007+(0.20 g/bhp-hr N	0.65	0.04	0.001
2016+(c)(0.10 g/bhp-h	0.33	0.04	0.001
2016+(c)(0.05 g/bhp-h	0.16	0.04	0.001
2016+(c)(0.02 g/bhp-h	0.07	0.04	0.001

(a) EMFAC 2014 Zero-Mile Based Emission Factors.
(b) EMFAC provides HC emission factors which are converted into ROG.
ROG (Pre-2007 engines) = HC * 0.16137. ROG (2007+ engines) = HC * 0.013972.
(c) Factors for 2016+ engines are reduced values of 2007 factors by 50 percent, 75 percent, and 90 percent to correspond with
0.10 g/bhp-hr NOx, 0.05 g/bhp-hr NOx, and 0.02 g/bhp-hr NOx optional low NOx standards, respectively.
(d) Factors for 2006 or older engines are for unfiltered trucks.

Table D-5
Diesel Refuse Trucks
Emission Factors (g/mile)

Engine Model Year	NOx(b)	ROG(b),(c)	PM(b),(g)
pre-1994	34.69	0.01	0.346
1994-97	31.53	0.01	0.137
1998-02	31.25	0.01	0.144
2003-06	21.39	0.01	0.086
2007-09	11.25	0.14	0.008
2007+(d)(0.21-0.50 g/	1.23	0.26	0.008
2010+(e)(0.20 g/bhp-l	1.09	0.04	0.008
2016+(f)(0.10 g/bhp-h	0.54	0.04	0.008
2016+(f)(0.05 g/bhp-h	0.27	0.04	0.008
2016+(f)(0.02 g/bhp-h	0.11	0.04	0.008

Note: These emission factors are not applicable to transfer trucks. Transfer trucks must use the emission factors from Table D-1 or D-2. Per EMFAC 2014, solid waste collection vehicles are considered to be well-maintained and have negligible deterioration which is why only zero-mile emission factors are to be used in calculations for solid waste collection vehicle projects.
(a) EMFAC 2014 Zero-Mile Based Emission Factors.
(b) Emission factors incorporate the ultra low-sulfur diesel fuel correction factors listed in Table D-22.
(c) EMFAC provides HC emission factors which are converted into ROG. ROG = HC * 1.26639.
(d) All model year 2007 and newer engines with Family Emission Limits (FEL) from 0.21 g/bhp-hr to 0.50 g/bhp-hr NOx must use different emission factors from those listed for model years 2010 and newer engines certified to 0.20 g/bhp-hr NOx standards. FEL emission factors are based on EMFAC factors for model year 2010-2012 engines that include weighted averaging of 0.5, 0.35, and 0.20 g/bhp-hr NOx standards based on sales.
(e) These 2010+ emission factors are based only on engines certified to the 0.20 g/bhp-hr NOx standard.
(f) Factors for 2016+ engines are reduced values of 2013 factors by 50 percent, 75 percent, and 90 percent to correspond with 0.10 g/bhp-hr NOx, 0.05 g/bhp-hr NOx, and 0.02 g/bhp-hr NOx optional low NOx standards, respectively.
(g) Factors for 2006 or older engines are for unfiltered trucks.

Table D-6 Alternative Fuel Refuse Trucks Emission Factors (g/mile)

Engine Model Year	NOx	ROG(b)	PM(d)
Pre-2007	53.2	9.86	0.091
2007-09	18.8	3.68	0.004
2010+(0.20 g/bhp-hr N	0.88	0.14	0.004
2016+(c)(0.10 g/bhp-h	0.44	0.14	0.004
2016+(c)(0.05 g/bhp-h	0.22	0.14	0.004
2016+(c)(0.02 g/bhp-h	0.09	0.14	0.004

Note: These emission factors are not applicable to transfer trucks. Transfer trucks must use the emission factors from Table D-1 or D-2. Per EMFAC 2014, solid waste collection vehicles are considered to be well-maintained and have negligible deterioration which is why only zero-mile emission factors are to be used in calculations for solid waste collection vehicle projects.
(a) EMFAC 2014 Zero-Mile Based Emission Factors.

(b) EMFAC provides HC emission factors which are converted into ROG.
ROG (Pre-2007 engines) = HC * 0.16137. ROG (2007+ engines) = HC * 0.013972.
(c) Factors for 2016+ engines are reduced values of 2010 factors by 50 percent, 75 percent, and 90 percent to correspond with 0.10 g/bhp-hr NOx, 0.05 g/bhp-hr NOx, and 0.02 g/bhp-hr NOx optional low NOx standards, respectively.
(d) Factors for 2006 or older engines are for unfiltered trucks.

Table D-7
OFF-ROAD PROJECTS AND
NON-MOBILE AGRICULTURAL PROJECTS
Off-Road Diesel Engines Default Load Factors

Category	Equipment Type	Load Factor
	Aircraft Tug	0.54
	Air Conditioner	0.75
	Air Start Unit	0.9
	Baggage Tug	0.37
	Belt Loader	0.34
	Bobtail	0.37
	Cargo Loader	0.34
Airport Ground Suppor	Cargo Tractor	0.36
	Forklift	0.2
	Ground Power Unit	0.75
	Lift	0.34
	Passenger Stand	0.4
	Service Truck	0.2
	Other Ground Support Equipment	0.34
	Agricultural Mowers	0.43
	Agricultural Tractors	0.7
	Balers	0.58
	Combines/Choppers	0.7
	Chippers/Stump Grinders	0.73
Agricultural (Mobile, Portable or Stationary)	Generator Sets	0.74
	Hydro Power Units	0.48
	Irrigation Pump	0.65
	Shredders	0.4
	Sprayers	0.5
	Swathers	0.55
	Tillers	0.78
	Other Agricultural	0.51
	Air Compressors	0.48
	Bore/Drill Rigs	0.5
	Cement & Mortar Mixers	0.56
	Concrete/Industrial Saws	0.73
	Concrete/Trash Pump	0.74
Construction	Cranes	0.29
	Crawler Tractors	0.43
	Equipment	0.78
	Excavators	0.38
	Graders	0.41
	Off-Highway Tractors	0.44
	Off-Highway Trucks	0.38
	Pavers	0.42
	Other Paving	0.36
	Pressure Washer	0.3
	Rollers	0.38
	Rough Terrain Forklifts	0.4
	Rubber Tired Dozers	0.4
Construction	Rubber Tired Loaders	0.36
	Scrapers	0.48
	Signal Boards	0.78
	Skid Steer Loaders	0.37
	Surfacing Equipment	0.3
	Tractors/Loaders/Backhoe	0.37
	Trenchers	0.5
	Welders	0.45
	Equipment	0.42
	Aerial Lifts	0.31
	Forklifts	0.2
Industrial	Sweepers/Scrubbers	0.46
	Other General Industrial	0.34
	Other Material Handling	0.4
Logging	Fellers/Bunchers	0.71
	Skidders	0.74
	Drill Rig	0.5
	Lift (Drilling)	0.6
Oil Drilling	Swivel	0.6
	Workover Rig (Mobile)	0.5
	Other Workover Equipment	0.6
	Container Handling Equipment	0.59
	Cranes	0.2
	Excavators	0.55
	Forklifts	0.3
Cargo Handling	Other Cargo Handling Equipment	0.51
	Sweeper/Scrubber	0.68
	Tractors/Loaders/Backhoes	0.55
	Yard Trucks	0.39
Other	All	0.43

Table D-8
Uncontrolled Off-Road Diesel Engines
Emission Factors (g/bhp-hr) (EF) and Deterioration Rates (g/bhp-hr-hr) (DR)

Horsepower	Model Year	NOx		ROG		PM10		
		EF	DR	EF	DR	EF	DR	
	Pre- 1988	6.51	0.000098	1.68	0.00021	0.547	0.0000424	
25-49	1988+	6.42	0.000097	1.64	0.00021	0.547	0.0000424	
	Pre- 1988	12.09	0.00028	1.31	0.000061	0.605	0.000044	
20-119	1988+	8.14	0.00019	0.9	0.000042	0.497	0.0000361	
	Pre- 1970	13.02	0.0003	1.2	0.000056	0.554	0.0000403	
	1970-1979	11.16	0.00026	0.91	0.000042	0.396	0.0000288	
	1980-1987	10.23	0.00024	0.8	0.000037	0.396	0.0000288	
120+	1988+	7.6	0.00018	0.62	0.000029	0.274	0.0000199	
	1	5.26	0.000098	1.32	0.00017	0.48	0.0000372	
	2	4.63	0.000093	0.22	0.00005	0.28	0.0000218	
	4 (Interim)	4.55	0.000095	0.09	0.000036	0.128	0.0000096	
25-49	4 (Final)	2.75	0.000057	0.09	0.000036	0.009	0.000001	
	1	6.54	0.00015	0.9	0.000042	0.552	0.0000402	
	2	4.75	0.000071	0.17	0.000025	0.192	0.0000141	
	3(b)	2.74	0.000036	0.09	0.000023	0.192	0.0000141	
	4 (Interim)	2.74	0.000036	0.09	0.000023	0.112	0.000008	
50-74	4 (Final)	2.74	0.000036	0.09	0.000023	0.009	0.0000009	
	1	6.54	0.00015	0.9	0.000042	0.552	0.0000402	
	2	4.75	0.000071	0.17	0.000025	0.192	0.0000141	
	3	2.74	0.000036	0.09	0.000023	0.112	0.000008	
	4 (Phase-Out)	2.74	0.000036	0.09	0.00003	0.009	0.0000009	
	4 (Phase-In or Alt. NOx)	2.15	0.000027	0.08	0.000021	0.009	0.0000009	
75-99	4 (Final)	0.26	0.0000035	0.05	0.000015	0.009	0.0000009	
	1	6.54	0.00015	0.62	0.000029	0.304	0.0000221	
	2	4.15	0.00006	0.15	0.000023	0.128	0.0000094	
	3	2.32	0.00003	0.09	0.00003	0.112	0.000008	
	4 (Phase-Out)	2.32	0.00003	0.09	0.00003	0.009	0.0000004	
	4 (Phase-In or Alt. NOx)	2.15	0.000027	0.08	0.00002	0.009	0.0000004	
100-174	4 (Final)	0.26	0.000004	0.05	0.000011	0.009	0.0000004	
		1	5.93	0.00014	0.29	0.000013	0.12	0.0000064
		2	4.15	0.00006	0.11	0.000022	0.088	0.0000046
		3	2.32	0.00003	0.09	0.000023	0.088	0.0000046
		4 (Phase-Ou	2.32	0.00003	0.09	0.000023	0.009	0.0000003
		4 (Phase-In c	1.29	0.000017	0.06	0.000017	0.009	0.0000003
175-299		4 (Final)	0.26	0.0000036	0.05	0.000011	0.009	0.0000003
		1	5.93	0.000099	0.29	0.00001	0.12	0.0000064
		2	3.79	0.00005	0.09	0.000023	0.088	0.0000044
		3	2.32	0.00003	0.09	0.000023	0.088	0.0000044
		4 (Phase-Ou	2.32	0.00003	0.09	0.000023	0.009	0.0000003
		4 (Phase-In c	1.29	0.000017	0.06	0.000017	0.009	0.0000003
300-750		4 (Final)	0.26	0.0000036	0.05	0.000011	0.009	0.0000003
		1	5.93	0.000099	0.29	0.00001	0.12	0.0000064
		2	3.79	0.00005	0.09	0.000023	0.088	0.0000044
		4 (Interim)	2.24	0.000028	0.06	0.000017	0.051	0.0000021
751+		4 (Final)	2.24	0.000028	0.05	0.000011	0.017	0.0000009

Note: Engines participating in the "Tier 4 Early Introduction Incentive for Engine Manufacturers" program per California Code of Regulations, Title 13, section 2423(b)(6) are eligible for funding provided the engines are certified to the final Tier 4 emission standards. The Air Resources Board (ARB) Executive Order indicates engines certified under this provision. The emission rates for these engines shall be equivalent to the emission factors associated with Tier 3 engines.
Note: For equipment with baseline engines certified under the flexibility provisions per California Code of Regulations, Titles 13, section 2423(d), baseline emission rates shall be determined by using the previous applicable emission standard or Tier for that engine model year and horsepower rating. The ARB Executive Order indicates engines certified under this provision.
(a) Emission factors were converted using the ultra low-sulfur diesel fuel correction factors listed in Table D-23.
(b) Alternate compliance option.

Table 12
LARGE SPARK IGNITION ENGINES
Table D-10
Off-Road LSI Equipment Default Load Factors

Category	Equipment Type	Load Factor
Agriculture (Mobile, Portable or Stationary)	Agricultural Tractors	0.62
	Balers	0.55
	Combines/Choppers	0.74
	Chipper/Stump Grinder	0.78
	Generator Sets	0.68
	Sprayers	0.5
	Swathers	0.52
	Pumps	0.65
	Other Agricultural Equipme	0.55
Airport Ground Support	A/C Tug	0.8
	Baggage Tug	0.55
	Belt Loader	0.5
	Bobtail	0.55
	Cargo Loader	0.5
	Forklift	0.3
	Ground Power Unit	0.75
	Lift	0.5
	Passenger Stand	0.59
	Other Ground Support Equ	0.5
Construction	Air Compressors	0.56
	Asphalt Pavers	0.66
	Bore/Drill Rigs	0.79
	Concrete/Industrial Saws	0.78
	Concrete/Trash Pump	0.69
	Cranes	0.47
	Gas Compressor	0.85
	Paving Equipment	0.59
	Pressure Washer	0.85
	Rollers	0.62
	Rough Terrain Forklifts	0.63
	Rubber Tired Loaders	0.54
	Skid Steer Loaders	0.58
	Tractors/Loaders/Backhoes	0.48
	Trenchers	0.66
	Welders	0.51
Construction	Other Construction	0.48
	Aerial Lifts	0.46
	Forklifts	0.3
	Sweepers/Scrubbers	0.71
Industrial	Other Industrial	0.54

Table D-11a Off-Road and LSI Engines (g/bhp-hr) and deteorioration rates (g/bhp-hr-hr)
Gasoline

Horsepower	Model Year	NOx		ROG		PM10	
		EF	DR	EF	DR	EF	DR
25-50	Uncontrolled pre-2004	8.01	0.0000406	3.76	0.000412	0.06	0
	Controlled 2001 - 2006	1.33	0.000471	0.71	0.000169	0.06	0
	Controlled 2007 - 2009	0.89	0.0001192	0.473	0.000064	0.06	0
	Controlled 2010+	0.27	0.000025	0.142	0.000013	0.06	0
51-120	Uncontrolled Pre-2004	11.84	0.0000601	2.63	0.000287	0.06	0
	Controlled 2001 - 2006	1.78	0.000207	0.26	0.000081	0.06	0
	Controlled 2007 - 2009	1.17	0.000066	0.13	0.000074	0.06	0
	Controlled 2010+	0.35	0.00003	0.03	0.000014	0.06	0
121+	Uncontrolled pre-2004	12.94	0.000127	1.61	0.000042	0.06	0
	Controlled 2001 - 2006	1.94	0.000278	0.16	0.000102	0.06	0
	Controlled 2007 - 2009	1.17	0.000066	0.13	0.000074	0.06	0
	Controlled 2010+	0.35	0.00003	0.03	0.000014	0.06	0

Table D-11b Off-Road LSI Engines Emission Factors (g/bhp/-hr) and Deteorioration Rates (g/bhp-hr-hr)
Alternative Fuels

Horsepower	Model Year	NOx		ROG		PM10	
		EF	DR	EF	DR	EF	DR
	Uncontrolled pre-2004	13	0.0000662	1.38	0.000151	0.06	0
	Controlled 2001 - 2006	1.95	0.000276	0.14	0.000106	0.06	0
	Controlled 2007 - 2009	1.3	0.0000011	0.093	0.000172	0.06	0
25-50	Controlled 2010+	0.39	0.0000002	0.028	0.000036	0.06	0
	Uncontrolled pre-2004	10.53	0.0000533	1.55	0.000169	0.06	0
	Controlled 2001 - 2006	1.58	0.00035	0.16	0.000103	0.06	0
	Controlled 2007 - 2009	1.04	0.0000125	0.1	0.000047	0.06	0
51-120	Controlled 2010+	0.31	0.000038	0.03	0.000014	0.06	0
	Uncontrolled pre-2004	10.51	0.000104	1.38	0.000035	0.06	0
	Controlled 2001 - 2006	1.58	0.000264	0.14	0.000106	0.06	0
	Controlled 2007 - 2009	1.04	0.0000125	0.1	0.000047	0.06	0
121+	Controlled 2010+	0.31	0.000038	0.03	0.000014	0.06	0

Table D-12
Emission Factors for Off-Road LSI Engine Retrofits (g/bhp-hr)

Fuel	Verified Value	NOx	ROG	PM10
Gasoline	3	1.78	0.26	0.06
	2.5	1.48	0.22	0.06
	2	1.19	0.17	0.06
	1.5	0.89	0.13	0.06
	1	0.59	0.09	0.06
	0.6	0.35	0.03	0.06
	0.5	0.29	0.03	0.06
Alt Fuel	3	1.58	0.16	0.06
	2.5	1.32	0.13	0.06
	2	1.05	0.11	0.06
	1.5	0.79	0.08	0.06
	1	0.53	0.05	0.06
	0.6	0.31	0.03	0.06
	0.5	0.26	0.03	0.06

Table D-13a Off-Road LSI Engines Crtified to Optional Standards (g/hbp-hr) and Deteorioration Rates (g/bhp-hr-hr)
Gasoline

Horsepower	Optional Standard	NOx		ROG		PM10	
		EF	DR	EF	DR	EF	DR
25-50	0.4	0.18	0.000017	0.09	8.7E-06	0.06	0
	0.2	0.09	0.000008	0.05	4.3E-06	0.06	0
	0.1	0.04	0.000005	0.02	2.7E-06	0.06	0
51-120	0.4	0.24	0.000021	0.04	3.4E-06	0.06	0
	0.2	0.12	0.00001	0.02	1.7E-06	0.06	0
	0.1	0.06	0.000005	0.01	9E-07	0.06	0
121+	0.4	0.26	0.000022	0.02	1.7E-06	0.06	0
	0.2	0.13	0.000011	0.01	9E-07	0.06	0
	0.1	0.06	0.000005	0.01	9E-07	0.06	0
25-50	0.4	0.26	0.000022	0.02	1.7E-06	0.06	0
	0.2	0.13	0.000011	0.01	9E-07	0.06	0
	0.1	0.07	0.000006	0	0	0.06	0
51-120	0.4	0.21	0.000031	0.02	0.000003	0.06	0
	0.2	0.11	0.000015	0.01	1.3E-06	0.06	0
	0.1	0.05	0.000007	0.01	1.3E-06	0.06	0
121+	0.4	0.21	0.000034	0.01	1.6E-06	0.06	0
	0.2	0.11	0.000015	0.01	1.3E-06	0.06	0
	0.1	0.05	0.00001	0	0	0.06	0

ALL ENGINES
Table D-21
Fuel Consumption Rate Factors (bhp-hr/gal)

Category	Horsepower/Application	Fuel Consumption Rate
Non-Mobile Agricultur	ALL	17.5
Locomotive	Line Haul and Passenger (	20.8
	Line Haul and Passenger (	18.2
	Switcher	15.2
Other	< 750 hp	18.5
	> 750 hp	20.8

REFERENCES
The information in these tables has already been incorporated into the preceding emission factor tables. These tables are included for informational purposes.

Table D-22
Fuel Correction Factors On-Road Diesel Engines

Model Year	NOx	PM10	HC
Pre- 2007	0.93	0.72	0.72
2007+	0.93	0.8	0.72