TSE and Other Freight Efforts – How Do We Quantify Benefits

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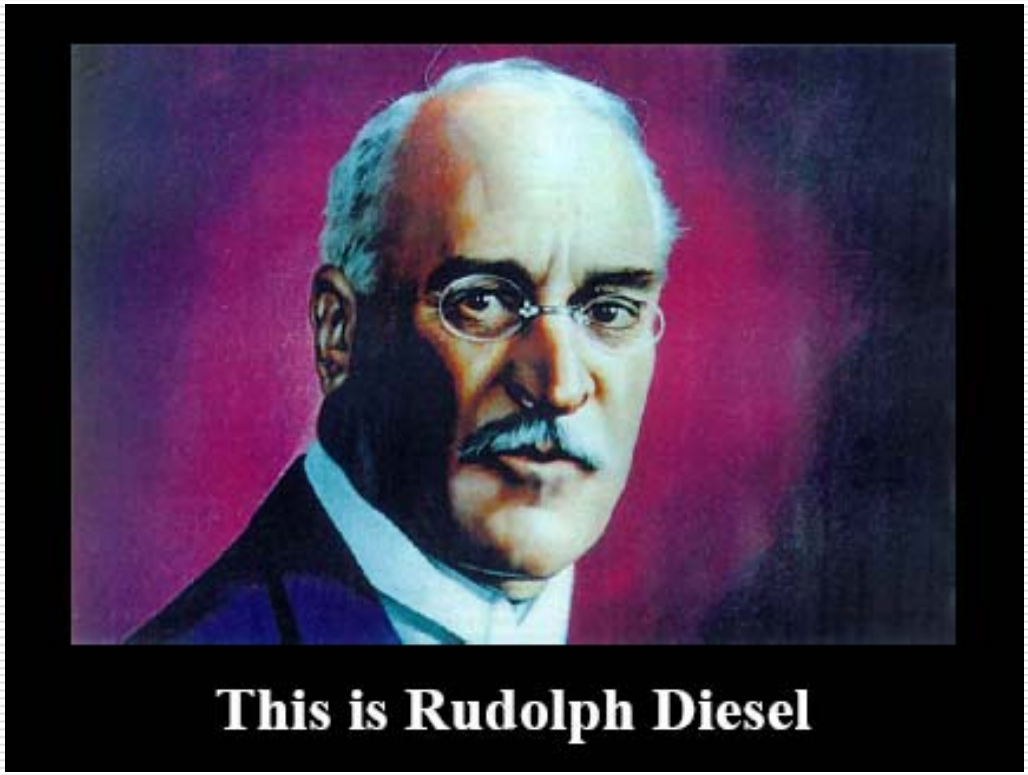
Outline of Quantifying Impacts and Benefits Presentation

- Background information about fleets, pollutants, and regional air quality status
- Consideration of programs available to support air quality improvement goals
- Air Quality improvement alternatives
- Air Quality inventory analysis
- Other Air Quality concerns

Background

Background

Background



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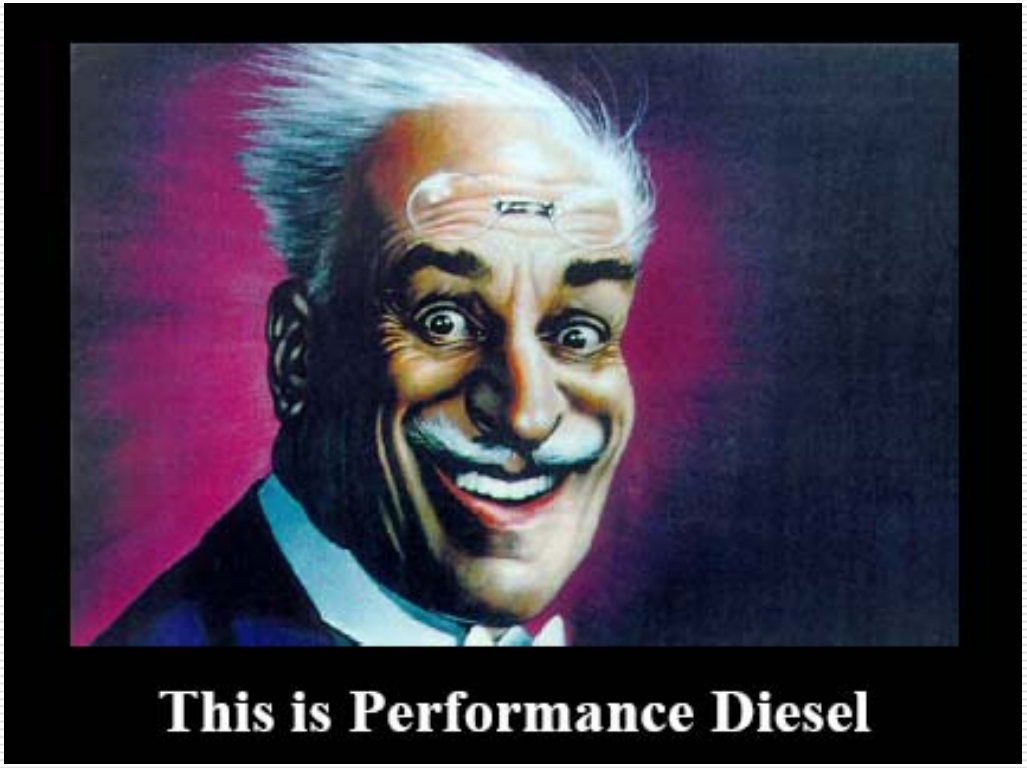


Background - Types of Diesel Vehicle Fleets

- Freight
  - Long haul
  - Short haul
- Public
  - Transit Buses
  - School Buses
  - Service vehicles (trash, highway maintenance, fire)
- Construction
  - Trucks (on-road)
  - Equipment (off-road)

Background - Types of Diesel Emissions

- NOx
  - Start emissions
  - Idle emissions
  - Modal emissions
- PM10 and PM2.5
  - Start emissions
  - Idle emissions
  - Modal emissions
- MSATs and GHGs

Background - Type of Analysis

- Regional (to meet government regulations)
  - Regional contribution (conformity rule)
  - Local contribution CO, PM (hot-spot rule)
- Specific Fleet (to meet operators needs)
  - Freight
  - Public
  - Construction

Background - Regional Air Quality Status

- Is area Nonattainment or Maintenance area for transportation related Criteria Air Pollutants (CAPs)?
  - O3 (ozone)
  - PM10 or PM2.5
- Eligible for CMAQ Funding
  - Transportation Project
  - N/A or Maintenance Area
  - Reduce Emissions

Programs Supporting Air Quality Improvement Alternatives

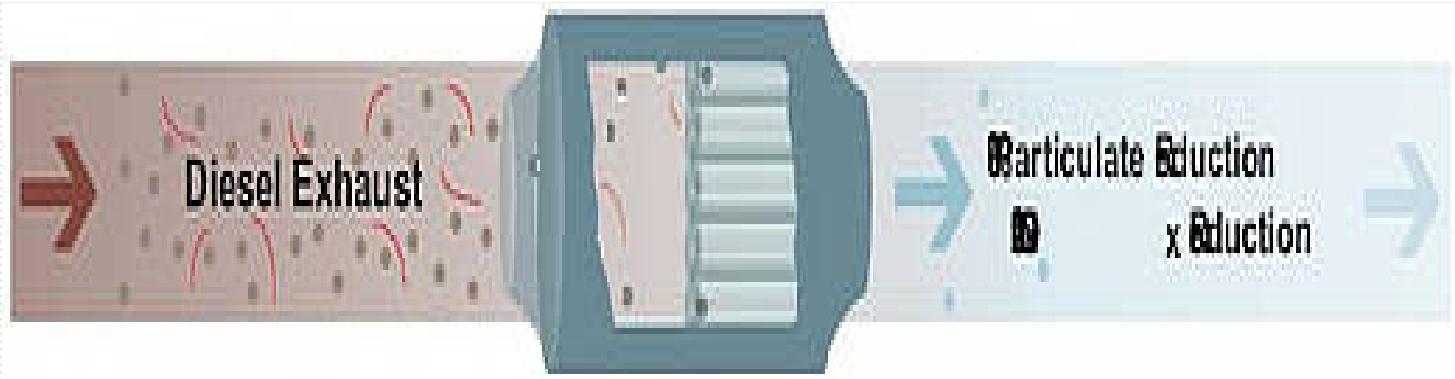
- Programs Available for Assistance
  - CMAQ (National Program)
  - TERP (Texas Program)
  - Carl Moyer Program (California Program)
  - DERA (NSDC, Clean School Bus, Smartway, Specific State programs, [small business, alternative fuel, Harvest Energy])
- More about funding in in Fall Workshop

Options of Emission Reduction Strategies

- Idle Reduction
  - Truck Stop Electrification, TSE
  - Shore Power
  - Auxiliary Power Units
- Diesel Retrofit Technologies
  - Five different technological approached
- Alternative Fuels
  - Fuels and fuel additives

Options of Emission Reduction Strategies - Idle Reduction

Options of Emission Reduction Strategies - Diesel Retrofit Technologies

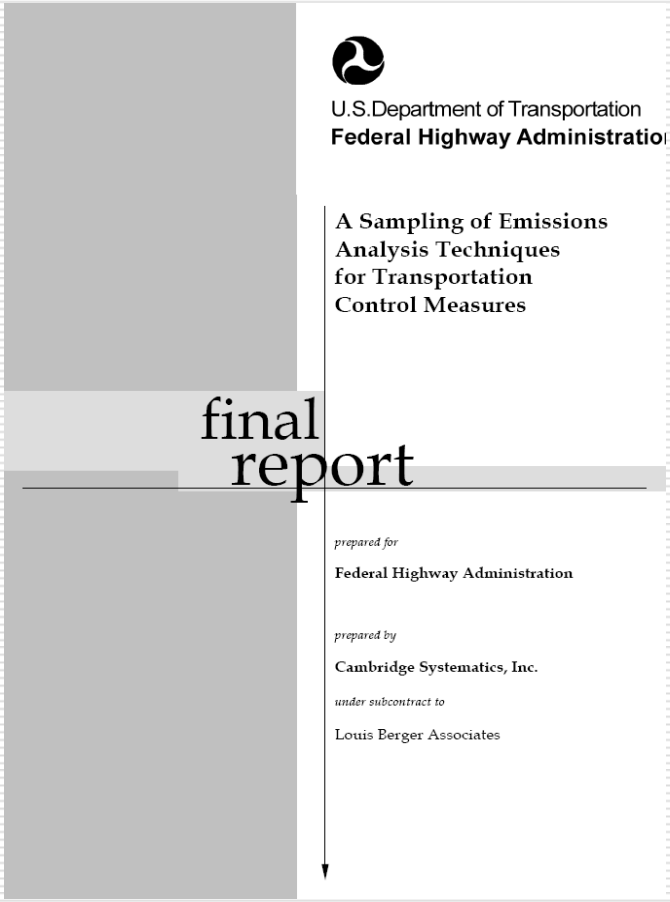


Options of Emission Reduction Strategies - Alternative Fuels

Quantification of Impacts and Benefits

- Two Considerations for Quantification
  - Impacts (emissions)
  - Benefits (emission reductions, savings)
- Quantification of impacts involves calculating the actual emissions generated by the vehicle activity (hours operated, miles driven)
- Quantification of benefits involves calculating the emission reduced by a technology (and/or developing a cost per ton of emission estimate)

Quantification of Impacts and Benefits – Tools Available for Analysis



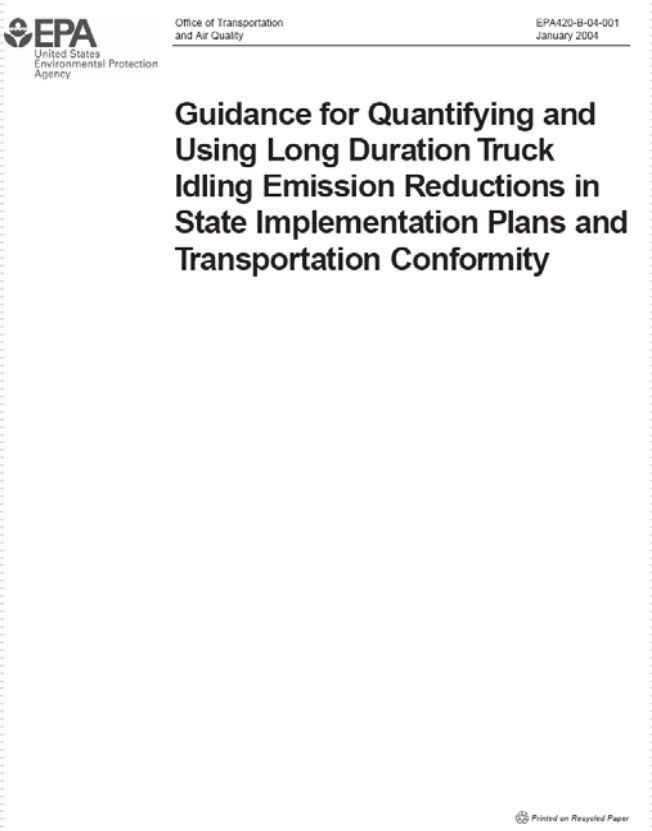
Quantification of Impacts and Benefits – Tools Available for Analysis

Table 3.1 Summary of Methods Included*

Method	Description
Off-the-Shelf TDM/TCM Analysis Software	
TDM Evaluation Model	Software to predict trip and VMT impacts of employer-based TDM strategies.
TCM/Commuter Choice Model	Spreadsheet software based on TDM Evaluation Model; also calculates emissions.
TCM Analyst	Spreadsheet software to estimate travel and emission impacts of TCMs.
CM/AQ Evaluation Model	Software for estimating emission benefits and cost-effectiveness of potential CMAQ projects and for ranking projects.
CUTR_AVR	(Center for Urban Transportation Research Average Vehicle Ridership model) Model to predict AVR impacts of workplace-based TDM programs.
Customized TDM/TCM Analysis Software	
TCM Tools	Spreadsheet model for screening and sensitivity testing of a wide range of TCM strategies at an area-wide level.
Off-Net/PAQONE	Models to predict emissions impacts of various transit, non-motorized travel, and traffic flow strategies.
ECO/Regulation XV Software	Software to help employers predict benefits of and track participation in Employee Commute Options (ECO) programs.
Sketch-Plan Workbook Approaches	
California Standardized Methodology	Calculation steps to estimate emissions reductions and cost-effectiveness of TDM programs, based on survey data on mode shares.
RAQC Workbook	Workbook to estimate potential benefits of various TDM strategies applied at a regional level.
MWCOG Sketch-Planning Methods	Sample calculations by the Metropolitan Washington Council of Governments (MWCOG) for various TCM strategies.
NCTCOG Sketch-Planning Methods	Sample calculations and empirical data from North Central Texas Council of Governments (NCTCOG) for TDM and traffic flow strategies.
Specialized Methods	
Quick HOV	Procedures and software to analyze impacts of HOV facilities.
IDAS	(Intelligent Transportation Systems (ITS) Deployment Analysis System) Software to analyze travel and emissions impacts of over 60 ITS strategies, based on regional travel model data.
SMART	(Simplified Model for the Assessment of Regional Travel) Software to estimate air quality impacts of highway and transit network improvements.
Traffic Simulation Models	Commercial software for analyzing traffic flow and emissions impacts of intersection and roadway operational improvements.
AirCred	Model for estimating emissions benefits of alternative fuel light-duty and transit vehicles.
Bus Replacement Spreadsheet	Spreadsheet for analyzing replacements of older buses with new diesel or alternative fuel buses.
Freight Air Quality Analysis Procedures	Report containing methods and procedures for assessing emissions impacts of freight strategies.

* See Section 7.0 for a list of acronyms.

Quantification of Impacts and Benefits – Tools Available for Analysis



EPA
United States Environmental Protection Agency

Office of Transportation and Air Quality

EPA420-B-04-001
January 2004

Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity

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Quantification of Impacts and Benefits – Tools Available for Analysis

assumptions, and models that were used to calculate emission reductions from long duration truck idling measures, as well any commitments that are necessary to implement the project, as described above. The conformity determination should also document that the total emission reductions from all controls on long duration truck idling for a given pollutant or precursor is not to exceed 3.4 percent of the Class 8 truck emissions in the regional conformity analysis for a given year when using MOBILE6 or MOBILE6.2 (see footnote 9 for California exception).

Section D: Quantifying Long Duration Truck Idling Emission Reductions

The following steps describe how to estimate the emission reductions from a proposed idle reduction project. In addition, these same steps can be used to determine the actual emission reductions achieved from the project. Step 1 establishes the historic idling activity from which you will estimate an emission reduction. Steps 2 and 3 describe how to estimate the truck emissions that are reduced when using an idle control technology. Step 4 describes how to estimate the emissions associated with the idle reduction technology (this step is usually not necessary if using a stationary idle reduction technology). Steps 5 and 6 describe how to estimate the net reduction in emissions for the entire project. Finally, Steps 7 and 8 describe how to determine how much of the net reduction is creditable in a SIP or transportation conformity determination. Appendix D provides a summary of Steps 1-6. Appendices E and F provide quantification examples for mobile and stationary technologies.

11. How do you quantify emission reductions from the use of an idle reduction technology?

Step 1: *Determine the historic idling activity of the trucks involved in the project.*

For each truck using a mobile idle reduction technology, determine the historic idling hours as described in question 7(E)(2). Likewise, for each parking space which will have a stationary idle reduction technology installed, determine the historic idling hours as described in question 7(D)(2).[11]

Step 2: *Select the emission factor for the criteria air pollutant or precursor.*

In Appendix B and C, we provide emission factors for NO_x and PM.[12] These emission factors represent average emissions from a long duration idling truck. For NO_x emissions, the

[11] If dealing with large numbers of vehicles, you can use fleet idling averages to determine the historic idling activity as demonstrated by previously recorded engine control module data on a representative sample of trucks that travel through the nonattainment or maintenance area.

[12] As stated above, where the inventory is based on the latest approved California EMFAC model, we will work with you on a case-by-case basis to determine the appropriate emission factors.

Quantification of Impacts and Benefit – Vehicle Activity Data

- Estimate the number of vehicles in each category (LDDV, HDDV, etc...); fleet, regionally
- Estimate the number of miles or hours of operation of vehicles
- Consider future rate of increase

Quantification of Impacts and Benefits – Vehicle Emission Data

- Determine pollutants of interest
  - NOx
  - PM10, PM2.5
  - HC
  - other

- Estimate the emissions per vehicle type in fleet (consider hours idling and hours driving)
  - MOBILE6.2 Emission Factor Model
  - EMFAC
  - AP-42

Quantification of Impacts and Benefits – Vehicle Emissions

Technology Transfer Network
Clearinghouse for Inventories & Emissions Factors

AP 42, Fifth Edition, Volume 1 Supplements A, B, C, D, E, F, Updates 2001, 2002, 2003, 2004 & 2005

The following is a historical listing of AP 42 Supplements and Updates for the *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources.* Supplements and Updates reflect changes made to sections and become the new "final" section, replacing any previous version of that section. Final sections are available from the AP 42 site and reflect the most recent changes that appear in the supplements and updates. In 2001, EPA discontinued publishing supplements to the 5th edition of AP 42.

For historical AP 42 supplement contents, visit the Older Editions of AP 42 web page..

Changes made in the supplements and updates are explained in the following documents:

- Changes made in Supplements A - F.
- Changes made in Update 2001.
- Changes made in Update 2002.
- Changes made in Update 2003.
- Changes made in Update 2004.

Quantification of Impacts and Benefits – Vehicle Emissions

Emissions Factors & AP 42

An **emissions factor** is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., kilograms of particulate emitted per megagram of coal burned). Such factors facilitate estimation of emissions from various sources of air pollution. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category (i.e., a population average).

The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

where:

- E = emissions;
- A = activity rate;
- EF = emission factor, and
- ER =overall emission reduction efficiency, %

Quantification of Impacts and Benefits – Vehicle Emissions

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************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                           *
* Input file: BAREBONE.IN (file 1, run 1).                             *
************************************************************************

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* Bare Bones MOBILE6 Run
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M 48 Warning:
             there are no sales for vehicle class HDGV8b

                  Calendar Year:  2000
                          Month:  Jan.
                       Altitude:  Low
             Minimum Temperature:  72.0 (F)
             Maximum Temperature:  92.0 (F)
               Absolute Humidity:   75. grains/lb
                Nominal Fuel RVP:   8.7 psi
                   Weathered RVP:   8.3 psi
             Fuel Sulfur Content:  300. ppm

             Exhaust I/M Program:  No
                Evap I/M Program:  No
                     ATP Program:  No
               Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4941    0.2831    0.0967              0.0357    0.0012    0.0016    0.0814    0.0062    1.0000
 -------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :      2.022     2.235     3.484     2.553     3.220     0.793     0.998     0.812      2.54     2.168
    Composite CO  :      18.33     23.14     37.06     26.68     35.63     1.766     1.740     4.251     16.74     20.920
    Composite NOX :      1.319     1.424     1.784     1.516     5.257     1.807     1.766    18.569      1.16     2.940
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Quantification of Impacts and Benefits – Vehicle Emissions

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**************************************************************************
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* Input file: EXAMPLES\EXAMPLE9.IN (file 1, run 1).                      *
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* Example Input File
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2002
                                 Month:  Jan.
              Gasoline Fuel Sulfur Content:  279. ppm
                Diesel Fuel Sulfur Content:  500. ppm
                     Particle Size Cutoff: 10.00 Microns
                        Reformulated Gas:  No
```

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.4638	0.3052	0.1042		0.0357	0.0008	0.0017	0.0827	0.0060	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0044	0.0052	0.0118	0.0068	0.0756	------	------	------	0.0205	0.0077
ECARBON:	------	------	------	------	------	0.1838	0.0813	0.2794	------	0.0234
OCARBON:	------	------	------	------	------	0.0518	0.1169	0.1388	------	0.0117
SO4:	0.0036	0.0051	0.0055	0.0052	0.0084	0.0058	0.0094	0.0314	0.0010	0.0067
Total Exhaust PM:	0.0080	0.0103	0.0173	0.0120	0.0841	0.2414	0.2076	0.4495	0.0215	0.0495
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0088	0.0080	0.0080	0.0260	0.0040	0.0095
Total PM:	0.0286	0.0308	0.0378	0.0326	0.1054	0.2619	0.2281	0.4881	0.0381	0.0715
SO2:	0.0635	0.0807	0.1061	0.0871	0.1617	0.1106	0.1795	0.4485	0.0305	0.1085
NH3:	0.1009	0.0990	0.0939	0.0977	0.0451	0.0068	0.0068	0.0270	0.0113	0.0907

Quantification of Impacts and Benefits – Vehicle Retrofit Technology Efficiencies

Technology	Pollutant Reduced	Percentage of Reduction	Comments
Diesel Particle Filters	Particulate Matter	80% to 90%	Uses catalytic reaction to trap particles
	HC	90%	
	CO	90%	
Catalytic Converters (selective catalytic reduction, SCR; NOx absorbers)	NOx	25% to 50%	Predominately for NOX, may require fuel additive (Lubrizol/PuriNOx)
Diesel Oxidation Catalysts (DOCs)	Particulate Matter	20% to 50%	Uses chemical reaction to oxidize pollutants
	HC	60% to 90%	
	CO	90%	
Exhaust Gas Recirculation (EGR)	NOx	40%	Reduces combustion temperature
NOx Catalysts (“lean NOx catalyst”, “NOx adsorber”	NOx	Up to 70%	Uses chemical reaction

Quantification of Impacts and Benefits – Vehicle Retrofit Technology Efficiencies

Verified Retrofit Technologies						
Manuf.	**Technology**	**Applicability**	**Reductions (%)**			
			PM	**CO**	**NOx**	**HC**
Caterpillar, Inc.	Catalyzed Converter/Muffler (CCM)	Highway, heavy-heavy and medium-heavy duty, 4 cycle, non-EGR, model year 1998 - 2003, turbocharged or naturally aspirated engines	20	20	na	40
Caterpillar, Inc.	Diesel Particulate Filter	Nonroad, 4 cycle, non-EGR equipped, model year 1996-2005, turbocharged engines with power ratings 130 ≤ KiloWatts < 225 (174.2 ≤ Horsepower < 301.5)	89	90	na	93
Clean Diesel Technologies, Inc. ETV	Platinum Plus Purifier System (fuel borne catalyst plus DOC)	Highway, medium heavy- and heavy heavy-duty, 4 cycle, model year 1988 - 2003, turbocharged or naturally aspirated engines	25 to 50	16 to 50		

Quantification of Impacts and Benefits – Vehicle Emission Inventory

- Total Emissions = Vehicle Activity X EF, including efficiency factor as applicable
- Activity information available from fleet owners or from State vehicle registration departments (hours operated, miles driven)
- EFs typically generated by MOBILE6, may be obtained from State DOT, DEQ or MPO

Options of Emission Reduction Strategies

- Truck Stop Electrification (TSE)
- Diesel Retrofit Technologies
- Alternative Fuels

Options of Emission Reduction Strategies - Truck Stop Electrification (TSE)

Options of Emission Reduction Strategies – Truck Stop Electrification (TSE)

- Benefits region by reducing local emissions
- Benefits fleet owners by reducing fuel consumption
- Benefits vehicle drivers by reducing noise, flumes, fuel costs

Quantification of Impacts and Benefits -TSE

- Number of trucks participating
- Number of hours idling is restricted
- Pollutants being reduced
- Inventory of pollutant reductions

Truck Stop Electrification (TSE)

Table of Emission Reductions for TSE Option

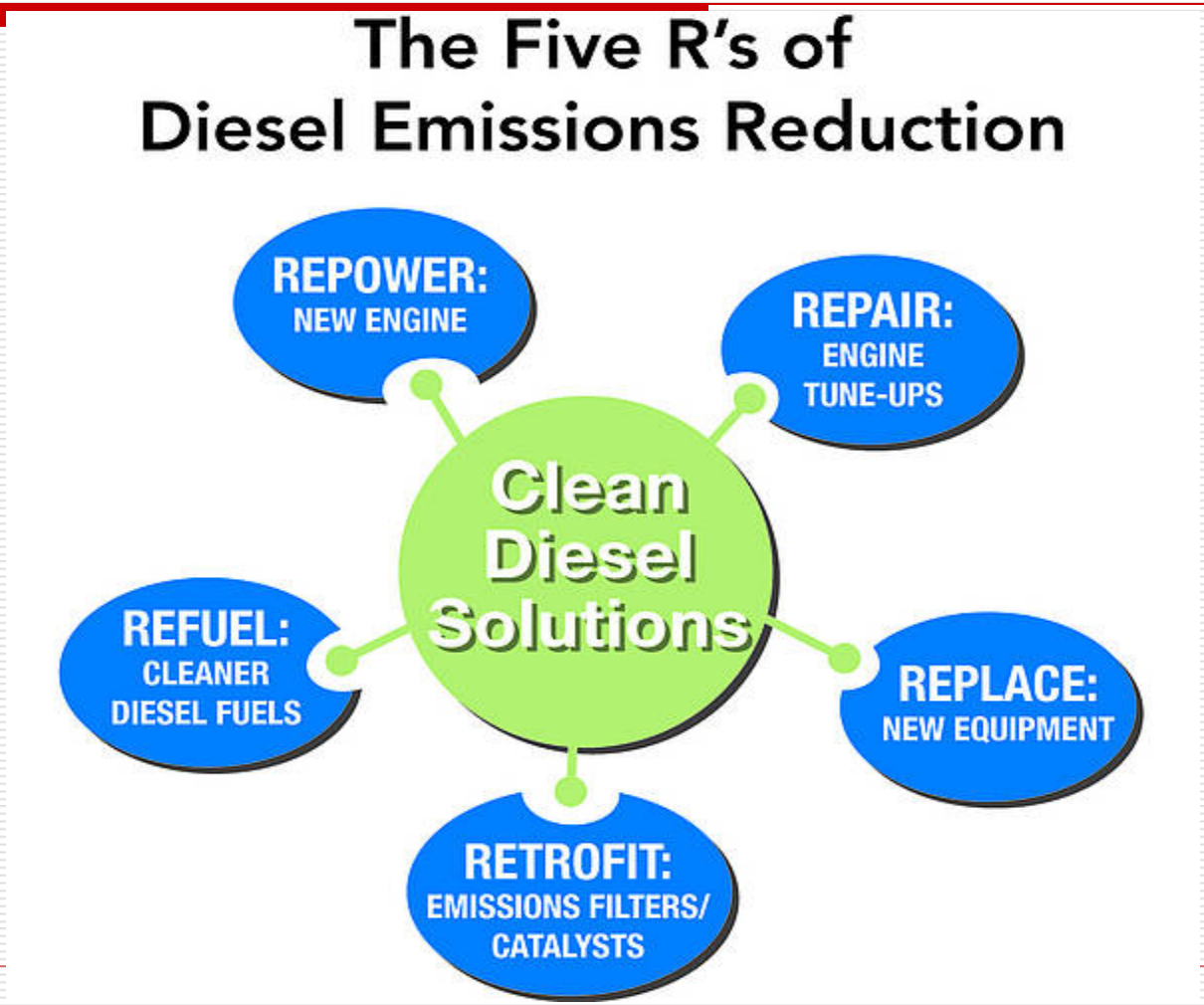
Pollutant	Vehicle Type	Emission Factor (grams/hr)	Number of Vehicles	Number of Idling hours (hours/day)	Number of Idling hours (hours/year)	Total Emissions (tons/year)
NOx	HDDV	2.66	300	12	4380	3.87
DPM	HDDV	0.45	300	12	4380	0.66

NOx: 2.66 * 12 * 365 * 300 * 0.0000011 = 3.87
DPM: 0.45 * 12 * 365 * 300 * 0.0000011 = 0.66

Options of Emission Reduction Strategies – Diesel Retrofit

- Benefits region by reducing local emissions
- Includes five technology types
- Different technologies have different efficiencies and different effects on pollutants

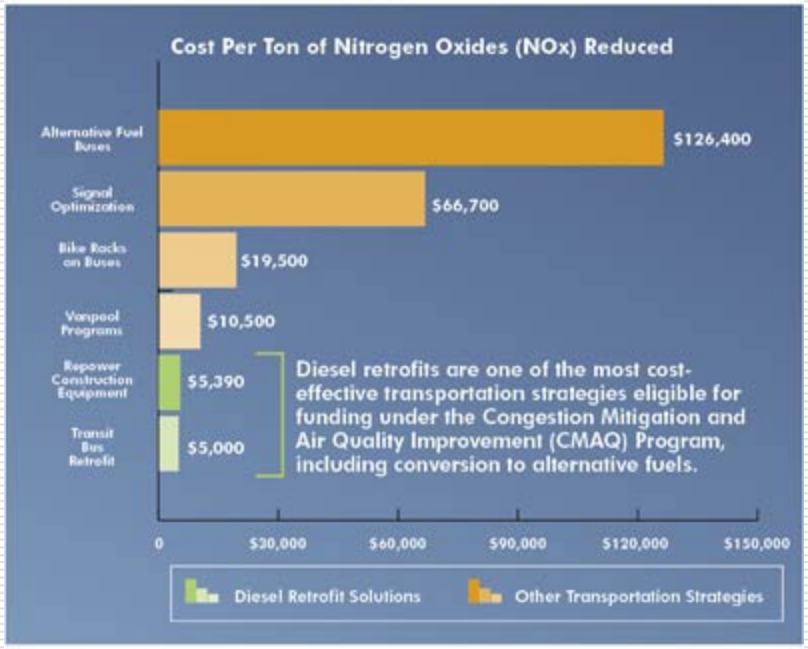
Options of Emission Reduction Strategies – Diesel Retrofit



Options of Emission Reduction Strategies – Diesel Retrofit

- Type of Retrofit category
  - Refuel – use cleaner diesel such as low sulfur diesel, bio-diesel (see Alternative fuels)
  - Retrofit – add exhaust treatment devices such as particle filters, oxidation catalysts
  - Rebuild – rebuild older engines
  - Repower – replace older engines
  - Replace – replace older vehicle

Options of Emission Reduction Strategies – Diesel Retrofit

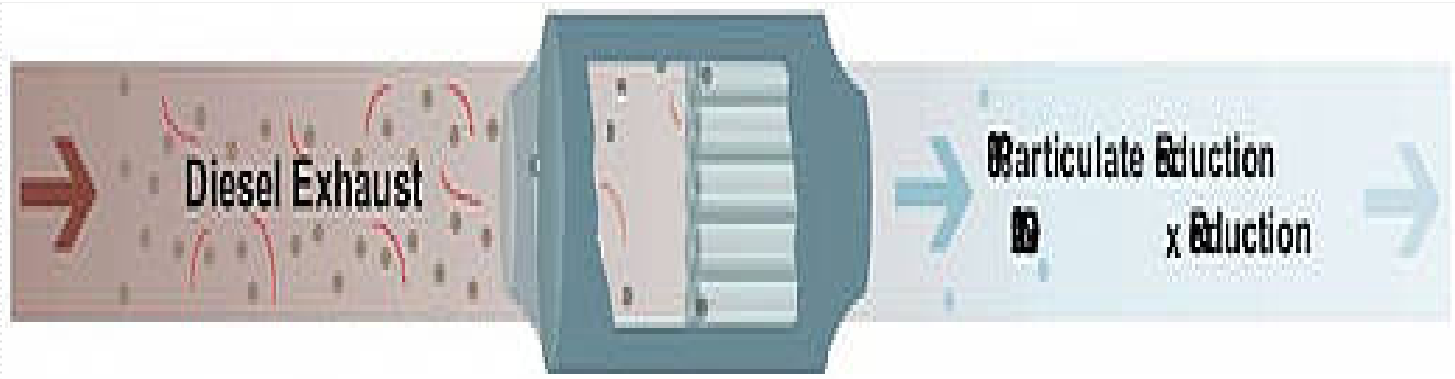


For a more complete list of CMAQ-eligible projects, the cost effectiveness of these strategies and full sourcing information, click on the chart above

Quantification of Impacts and Benefits – Diesel Retrofit

- Number of vehicles impacted
- Strategy for each vehicle (refuel, retrofit, repower, rebuild, replace)
- Number of miles vehicles will be driven
- Pollutants reduced
- Inventory of reduction

Quantification of Impacts and Benefits – Diesel Engine Retrofit



Quantification of Impacts and Benefits – Diesel Engine Retrofit

- Emissions from Retrofit Technologies represent a fraction of emissions without technology

- E = Activity X EF X (1-ER/100)

Quantification of Impacts and Benefits – Diesel Engine Retrofit – Activity Data

Truck Activity Data

Vehicle Class	Number of Vehicles (registered and pass-thru [estimated])	Hours Idling (per year)	Miles driven (per year)
LDDV	10000, ?	2000	10000
MDDV	10000, ?	2000	20000
HDDV	20000, ?	4380	50000

Example data. Actual data, although difficult to come by and in various forms, may be available through State DOTs, State Vehicle Registration departments, MPOs, and fleet operators among other.

Quantification of Impacts and Benefits – Diesel Engine Retrofit – Emission Factor Data

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* MOBILE6.2.03 (24-Sep-2003)                                             *
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**************************************************************************

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* Example Input File
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2002
                                 Month:  Jan.
              Gasoline Fuel Sulfur Content:  279. ppm
                Diesel Fuel Sulfur Content:  500. ppm
                     Particle Size Cutoff: 10.00 Microns
                        Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4638    0.3052    0.1042              0.0357    0.0008    0.0017    0.0827    0.0060    1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
              Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
             GASPM:    0.0044    0.0052    0.0118    0.0068    0.0756    ------    ------    ------    0.0205    0.0077
           ECARBON:    ------    ------    ------    ------    ------    0.1838    0.0813    0.2794    ------    0.0234
           OCARBON:    ------    ------    ------    ------    ------    0.0518    0.1169    0.1388    ------    0.0117
               SO4:    0.0036    0.0051    0.0055    0.0052    0.0084    0.0058    0.0094    0.0314    0.0010    0.0067
  Total Exhaust PM:    0.0080    0.0103    0.0173    0.0120    0.0841    0.2414    0.2076    0.4495    0.0215    0.0495
             Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
              Tire:    0.0080    0.0080    0.0080    0.0080    0.0088    0.0080    0.0080    0.0260    0.0040    0.0095
          Total PM:    0.0286    0.0308    0.0378    0.0326    0.1054    0.2619    0.2281    0.4881    0.0381    0.0715
               SO2:    0.0635    0.0807    0.1061    0.0871    0.1617    0.1106    0.1795    0.4485    0.0305    0.1085
               NH3:    0.1009    0.0990    0.0939    0.0977    0.0451    0.0068    0.0068    0.0270    0.0113    0.0907
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```

Quantification of Impacts and Benefits – Diesel Engine Retrofit – Technology Effectiveness Data

Technology	Pollutant Reduced	Percentage of Reduction	Comments
Diesel Particle Filters	Particulate Matter	80% to 90%	Uses catalytic reaction to trap particles
	HC	90%	
	CO	90%	
Catalytic Converters (selective catalytic reduction, SCR; NOx absorbers)	NOx	25% to 50%	Predominately for NOX, may require fuel additive (Lubrizol/PuriNOx)
Diesel Oxidation Catalysts (DOCs)	Particulate Matter	20% to 50%	Uses chemical reaction to oxidize pollutants
	HC	60% to 90%	
	CO	90%	
Exhaust Gas Recirculation (EGR)	NOx	40%	Reduces combustion temperature
NOx Catalysts (“lean NOx catalyst”, “NOx adsorber”	NOx	Up to 70%	Uses chemical reaction

Diesel Retrofit Inventory

Table of Emission Reductions Associated with Diesel Retrofits - DPF

Pollutant	Vehicle Type	Emission Factor Before Retofit (grams/mi)	Number of Miles/Vehicle (miles/year)	Emission Factor After Retofit (grams/mi)	Number of Miles/Vehicle (miles/year)	Total Emission Saving/Vehicle (tons/year)
HC, CO	HDDV	0.812	50000	0.0812 (0.812 - 0..9 (0.812))	50000	0.041
DPM	HDDV	0.450	50000	0.09 (0.45-0.8(0.45))	50000	0.023

Before Retrofit:
HC: 0.812 * 50000 * 0.00000110 = 0.045
DPM: 0.450 * 50000 * 0.00000110 = 0.025
After Retrofit:
HC Retrofit Efficiency is 90% ---- 0.812 – (0.812 * 0.9) = 0.0812
DPM Retrofit Efficiency is 80% ---- 0.450 – (0.450 * 0.8) = 0.09
HC: (0.0812) * 50000 * 0.00000110 = 0.0036
DPM: (0.09) * 50000 * 0.00000110 = 0.002
Reductions:
HC : 0.0450 – 0.0036 = 0.041
DPM: 0.0250 – 0.0020 = 0.023

Options of Mitigation Strategies – Alternate Fuels

- Benefits region by reducing local emissisons
- Fuels and fuel additives
  - Low sulfur diesel and ULSD
  - Biodiesel
  - Cetane Enhancers
  - Emulsified diesel fuel (E-Diesel)
  - CNG and LNG

Quantification of Impacts and Benefits – Alternative Fuels

- Type of Fuel
  - Low sulfur diesel
  - Bio-diesel
  - Cetane Enhancers

Alternative Fuels Inventory

Table of Emission Reductions Associated with Selected Fuel - Fleet

Pollutant	Fuel Type	Vehicle Type	Emission Factor (g/mi)	Number of Vehicles	Number of Miles (per year)	Total Emissions (tons)
NOx	Diesel	HDDV	2.66	300	50000	44
	Bio-diesel	HDDV	1.90	300	50000	32
	CNG	HDDV	1.70	300	50000	28
PM	Diesel	HDDV	0.45	300	50000	7.5
	Bio-diesel	HDDV	0.30	300	50000	5.0
	CNG	HDDV	0.25	300	50000	4.2

Alternative Fuels Inventory

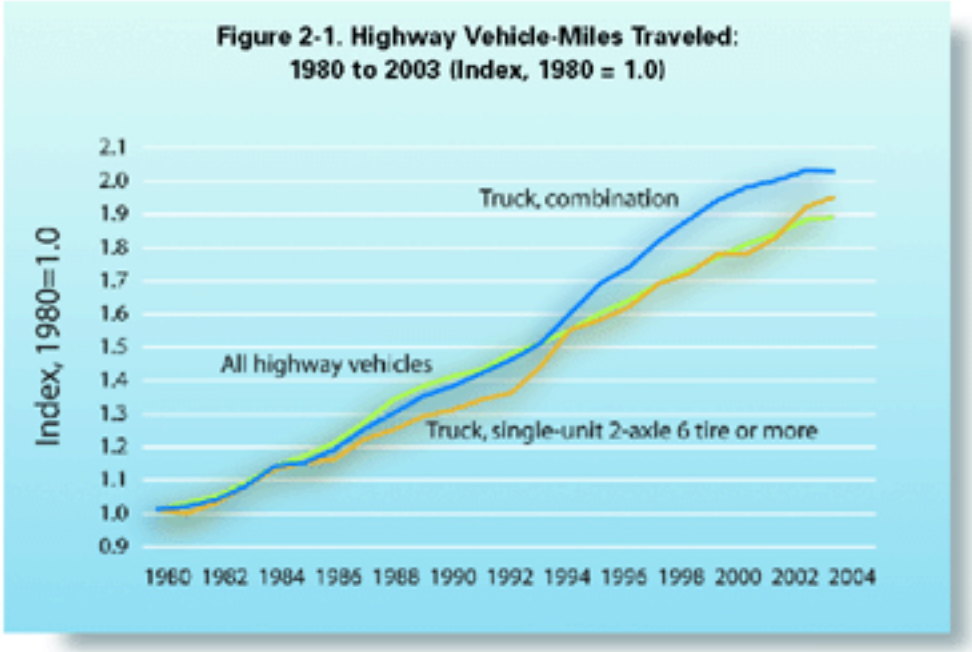
Table of Emission Reductions Associated with Selected Fuel - Region

Pollutant	Fuel Type	Vehicle Type	Emission Factor (g/mi)	Number of Vehicles	Number of Miles (per year)	Total Emissions (tons)
NOx	Diesel	HDDV	2.66	30000	50000	4414
	Bio-diesel	HDDV	1.90	30000	50000	3153
	CNG	HDDV	1.70	30000	50000	2821
PM	Diesel	HDDV	0.45	30000	50000	747
	Bio-diesel	HDDV	0.30	30000	50000	498
	CNG	HDDV	0.25	30000	50000	415

Some Considerations

- Activity Estimates
  - FHWA Evaluating HPMS and travel estimation processes
  - Significant number of trucks are “pass through” trucks
  - FHWA studying truck activity with the Freight Analysis Framework Program
  - http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/state_info/
  - Tianjia.Tang@fhwa.dot.gov

Some Considerations



Some Considerations

- Air Quality Estimates
  - Impacts of New PM and O3 Standards
  - Mobile Source Air Toxics
  - Greenhouse Gas Emissions

Some Considerations

- Energy Concerns
- Future changes to air quality management
- Trans-border issues (Canada, Mexico)

Energy Inventory

Table of Energy Usage for Selected Fuels

Fuel Type	Vehicle Type	Mileage (per year)	Fuel Consumption	Energy Consumption (gallons)
Diesel	HDDV	50000	20 miles/gallon	2500
Bio-diesel	HDDV	50000	18 miles/gallon	2778
CNG	HDDV	50000	16 miles/gallon	3125

Questions ???

Federal Highway Administration
RESOURCE CENTER

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