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AirCRED 4.0 User's Guide

Transportation Technology R&D Center
Argonne National Laboratory

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Acronyms

AFV	alternative fuel vehicle
CNG	compressed natural gas
CO	carbon monoxide
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act
FFV	flexible-fuel vehicle
GUI	graphical user interface
HDV	heavy-duty vehicle
LDV	light-duty vehicle
NLEV	National Low Emission Vehicle
NMHC	non-methane hydrocarbons
NOx	nitrogen oxides
OEM	original equipment manufacturer
SFTP	Supplemental Federal Test Procedure
SIP	State Implementation Plan
VMEP	Voluntary Mobile Source Emission Reduction Program
VMT	vehicle miles traveled

AirCRED Documentation Set

The AirCRED documentation set is divided into three parts, each focusing on different users' needs.

- AirCRED User's Guide: This step-by-step guide describes how to run the AirCRED Web application; specifically, how to use it to generate credit numbers.
- AirCRED Programmers' Manual: This manual details the development of the internal AirCRED calculation models and their deployment as a stand-alone Microsoft VisualStudio.Net Internet-based application. It explains the theory of operation and directions for AirCRED's future development and use.
- AirCRED Project Technical Report: This archived document describes the AirCRED project, the sponsor's requirements, the history of the development, and the groups supporting AirCRED.

Background

To assist the U.S. Department of Energy's (DOE's) Clean Cities coalitions in estimating the ozone precursor and winter season carbon monoxide (CO) emission reduction credits earned by acquiring original equipment manufacturer (OEM) alternative fuel vehicles (AFVs), Argonne National Laboratory has developed a graphical user interface (GUI)-based calculation model called AirCRED. Argonne's goal was to provide an easy-to-use and straightforward procedure to (a) enable the values of those credits to be summed together with Voluntary Mobile Source Emission Reduction Program (VMEP) credits from other local voluntary strategies and programs earned pursuant to EPA's October 1997 guidance and (b) facilitate the calculation of mobile source emission inventories and budgets required for development of State Implementation Plans (SIPs) responding to 2004 ozone and PM2.5 nonattainment designations.

AirCRED is based on the U.S. Environmental Protection Agency (EPA's) MOBILE6.2 model combined with emission test certification data for new OEM vehicles and their gasoline- or diesel-fueled counterparts. Depending on the season selected, it gives the MOBILE6.2-computed emission factor (by vehicle type) appropriate to midsummer, ozone-season, or wintertime (high-CO) conditions in each affected Clean City (about 80 different sets of values are available for ozone and 15 sets for CO). The "clean gap" between AFV and conventional vehicle emissions of non-methane hydrocarbons (NMHC), CO, and nitrogen oxides (NOx) (summer) or CO (winter) determines the magnitude of the net grams per mile credit that can be taken for AFV driving in each Clean City, relative to the MOBILE6.2 emission rates. In the case of light-duty vehicles (LDVs), credit is based on the entire chassis dynamometer-based Supplemental Federal Test Procedure (SFTP). For heavy-duty vehicles (HDVs) (transit and school buses and medium- or heavy-duty trucks operating on natural gas), credit derives from engine dynamometer certification data and thus does not include any computation of the effect of auxiliary load, as in the SFTP.

A Brief Description of AirCRED

After you select the season and Clean City of interest, AirCRED prompts you for the following:

1. Number of AFV cars, trucks, and buses acquired in that Clean City area during a fixed prior period, by fuel type;
2. Average miles per day driven by each of these vehicle categories (if daily mileage accrual differs by vehicle age, credits for each cohort vintage can be estimated separately by selecting only that subset of the fleet for computation, which would also apply to items 3 and 4 below);
3. Number of days driven per week by each of these vehicle categories; and
4. Percentage of miles driven on nonpetroleum fuel by each vehicle type.

The first results screen indicates the daily emission reduction credits (by pollutant) attributable to the fleet in the most recent ozone or CO season as calculated by entries on the input forms. The next several results screens indicate what the net (residual) credits for this fleet will be in subsequent years through 2008, one screen per year. Total mass reduction attributable to each AFV type in the fleet is shown.

The results are reported in tons per day and pounds per day; you can then multiply these values by the number of days the vehicles operated during the season to take the appropriate annual inventory credit (length of each season in days for the Clean City of interest may be obtained from state or local air quality authorities). A multiplier equal to

the TOTAL number of days in the year is inappropriate because the emission factors applied reflect only warm season (ozone) or cold season (CO) conditions, respectively.

Implementation of AirCRED

AirCRED is accessible online at http://www.aircred.anl.gov/. Additional information is available through Argonne's Transportation Technology R&D Center (http://www.transportation.anl.gov/).

How Clean Cities Coalitions Should Use This Model

AirCRED is intended to open the door for coordinators and stakeholders from DOE's Clean Cities program to work more closely with state and regional air quality planners and officials who are laying the groundwork for revising and updating ozone precursor and CO emission reduction strategies under ozone or CO SIP calls. The former will better appreciate how — and to what actual degree — their AFV acquisitions under Energy Policy Act (EPAct) programs contribute to cleaner air, just as the latter can benefit from the numerical estimates that AirCRED provides in summing up the emission benefits of the complete package of their VMEP-qualifying measures for current and future years. As an EPA-accepted and approved tool, the model generates output values that can be submitted directly to air quality agencies and will prevent their having to devote extra time and effort to analyzing AFV credits. There will also be a uniform basis across all EPA regions (excluding California) for considering those credits.

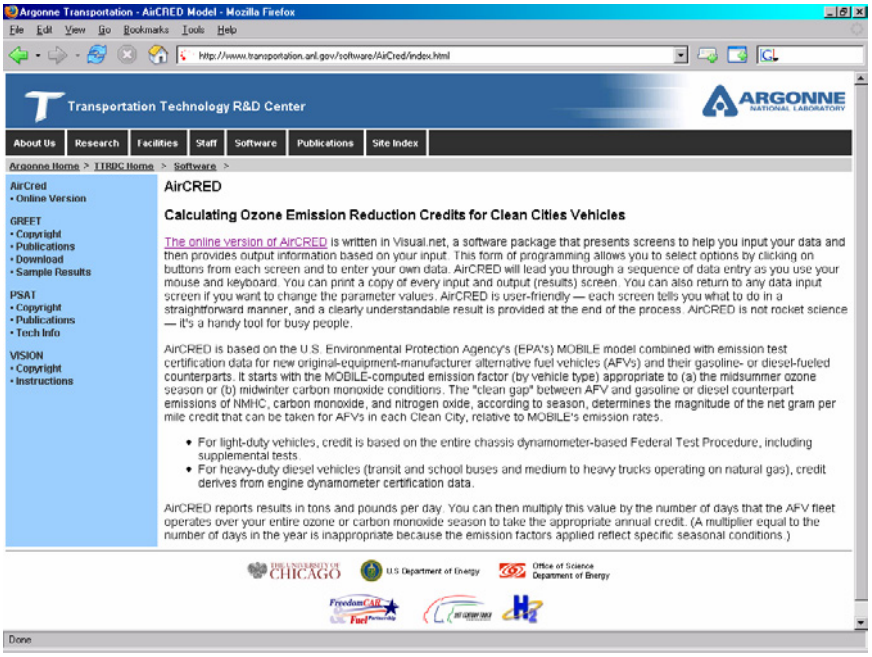
Current and Future Internal Model Implementation

AirCRED currently computes credits for electric and fuel cell vehicles (not hybrids), flexible-fuel cars and light trucks (FFVs) on E85, and dedicated and dual-fueled natural gas and propane LDVs and HDVs (i.e., transit buses and medium- and heavy-duty natural gas vehicles replacing diesel-fueled school buses and Class 5 through 7 trucks) through the year 2008 ozone or CO season. Credits are determined by an emission performance comparison that applies MOBILE6.2 emission rates for new National Low Emission Vehicle (NLEV) and Tier 2-certified gasoline and diesel vehicles. The model is updated regularly (at least annually) as new certification data for AFVs are obtained and new Clean Cities coalitions are inducted.

AirCRED Screen-by-Screen Presentation and Data Entry

AirCRED is written in VisualStudio.Net as a Web-based (Internet) interactive application that is hosted at Argonne National Laboratory. It employs a state-of-the-art object-oriented program and a GUI that presents screens or forms as a way of eliciting data input and providing output information based on that data. You can select multiple options by clicking on radio-button controls from each screen. AirCRED has been designed to lead you through a logical sequence of data entry using a mouse and keyboard; you can return to any data input screen if you discover data entry errors or want to change the values of certain parameters. It seeks to be "user-friendly" in the sense that you are informed in a straightforward manner what to do on each screen, and at the end of the process, you are provided with a clearly understandable result.

AirCRED is launched from the web address *www.aircred.anl.gov*. Additional information is available from the Argonne's Transportation Technology R&D Center software page: *http://www.transportation.anl.gov/software/AirCred/index.html*.



Screen 1: Introduction

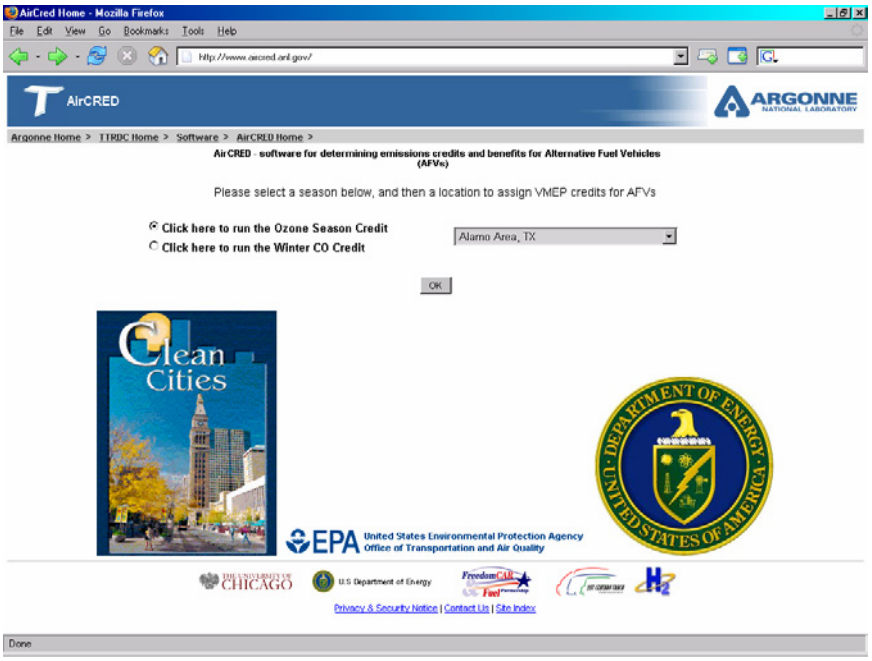
AirCRED's introduction/start-up screen presents the model's sponsors. (AirCRED was developed with funding support from DOE's FreedomCAR and Vehicle Technologies Program and EPA's Office of Transportation and Air Quality.)

On this screen, you will choose whether to follow the path to (a) ozone precursor reduction credits or (b) CO reduction credits. You will then select the desired Clean City from the scroll-down menu to the center right.

If you choose the ozone (warm season) option, all non-corridor Clean Cities coalitions designated as of December 2004 are on the list, but the model works only for states that use the MOBILE model to estimated vehicular emissions (i.e., the 49 states outside California).

If you choose the cold season (CO) option, a subset of Clean Cities plus all current CO nonattainment or maintenance areas is displayed.

If you select a California location, a screen appears with a disclaimer and the model terminates execution.

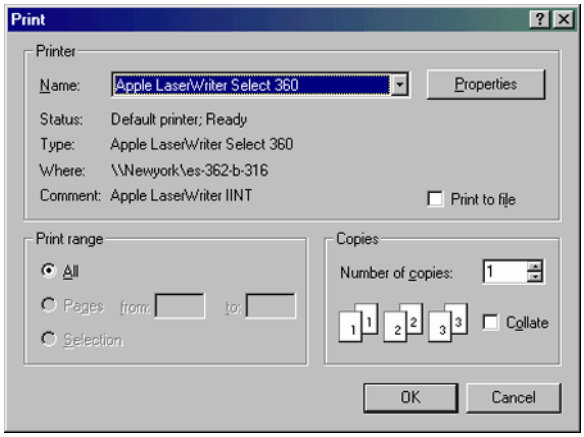


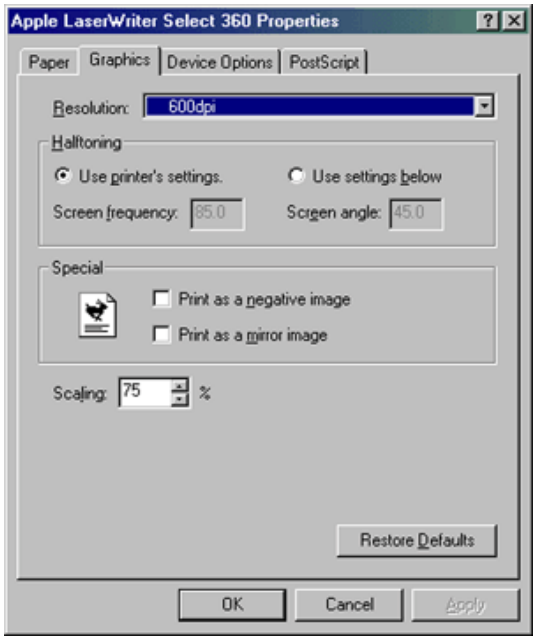
Data Entry Changes and Printing

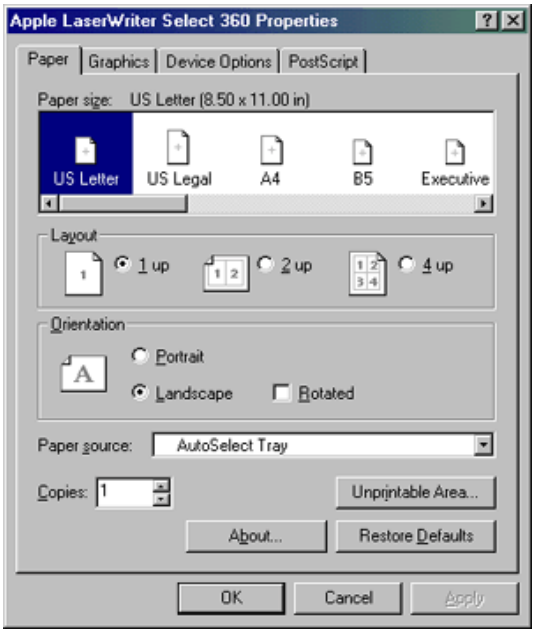
At any time during the operation, you can backtrack and make changes and corrections before proceeding. Each form can be printed to provide the necessary documentation trail.

Clicking the Print button or File/Print command in the top toolbar of most Web browsers will print the full screen image of each input and output page on your local printer.

The dialog boxes at the right illustrate the best settings for a typical printer (in this case, an Apple LaserWriter). Use landscape orientation and a 25% reduction in size (to 75%) to print even the largest data entry screen on a single page. Each printed results screen will contain a date and time stamp so that the date and version of the model used can be verified.



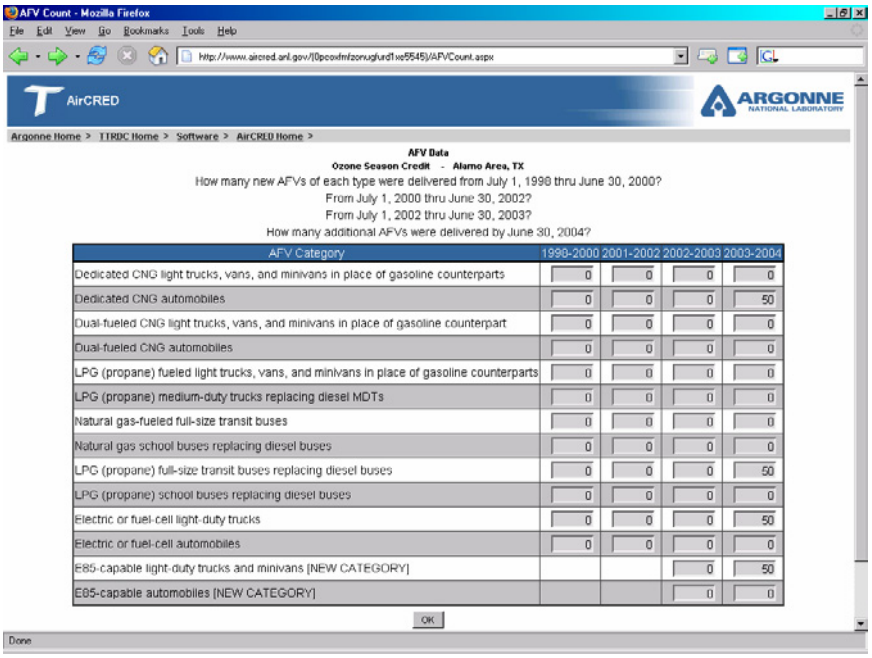




Screen 2: AFV Count Data

Screen 2 prompts you to key into the appropriate entry field the number of new AFVs of a particular type delivered during 1998–2000, 2001–2002, 2003, and 2004. These entries may cover the entire AFV fleet or a subset defined by period of acquisition or fuel type. Fourteen fuel/vehicle combinations — five light trucks, four bus types, a (propane) medium- or heavy-duty vehicle, and four automobiles — are available on the selection menu for ozone (no CO reduction credits for replacement of diesel power in wintertime are available; therefore, HDVs do not appear on the CO screens).

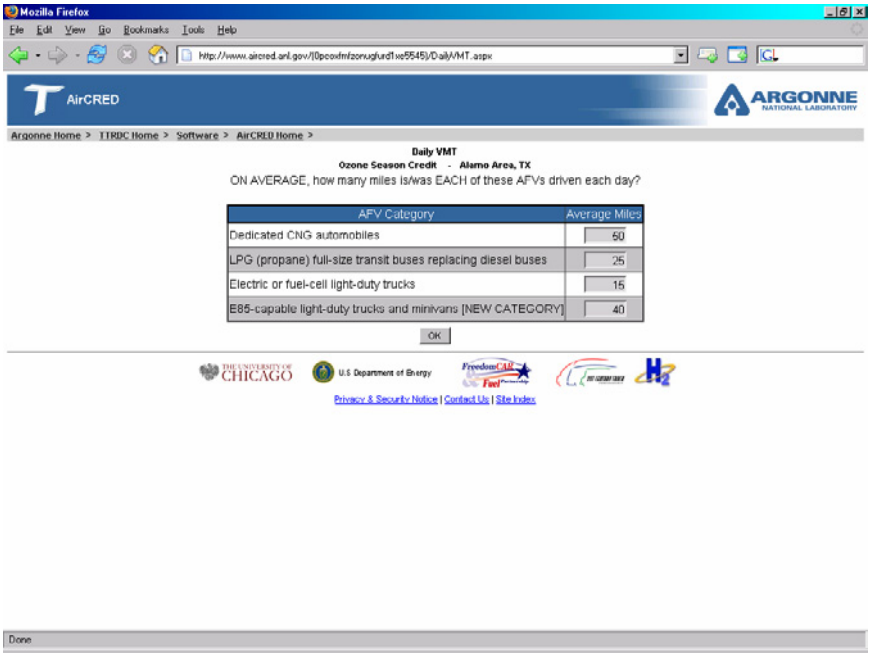
Note: Only AFV types with non-zero entries on Screen 2 will appear on the Screen 3 entry list.



Screen 3: Daily VMT

Screen 3 prompts you to key into the appropriate entry field the average daily miles driven by each AFV type acquired [also called vehicle miles traveled (VMT)].

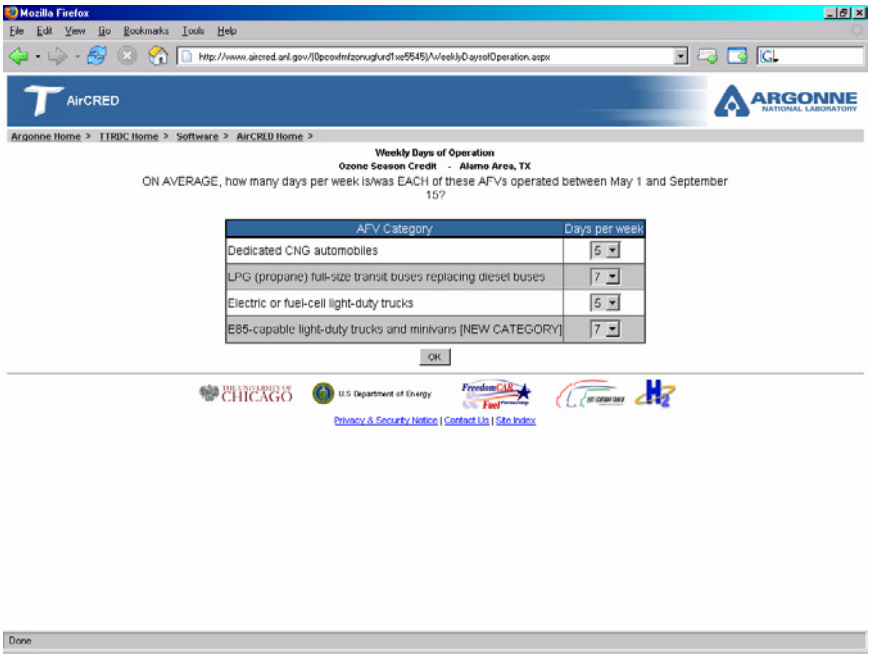
Note: Values left at zero will remove a vehicle type from further credit calculation.



Screen 4: Weekly Days of Operation

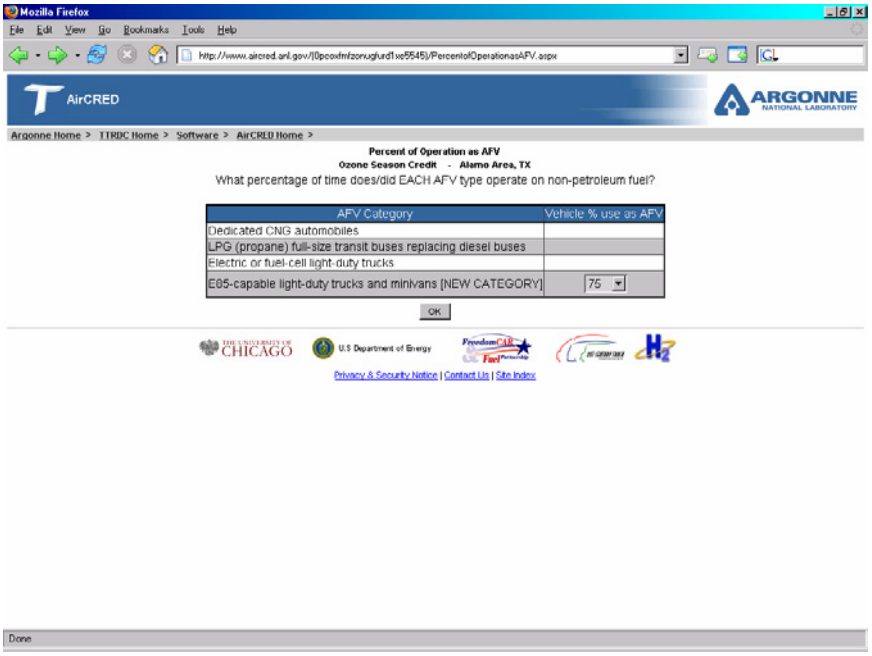
Screen 4 prompts you to select from a scroll-down menu the number of days per week that a vehicle is in service. Vehicles in service more than the five normal weekly workdays for fleets earn extra credit.

Note: Values left at zero remove a vehicle type from further credit calculation.



Screen 5: Percent Operation as AFV

Screen 5 prompts you to select from a scroll-down menu the percent of VMT (0–100, in increments of 5%) that each vehicle drives on a non-petroleum fuel. All dedicated-fuel AFVs are assumed to operate 100% on a nonpetroleum fuel; thus, there is no data entry option for them here, although they will appear on this screen if data for them were entered on prior screens.



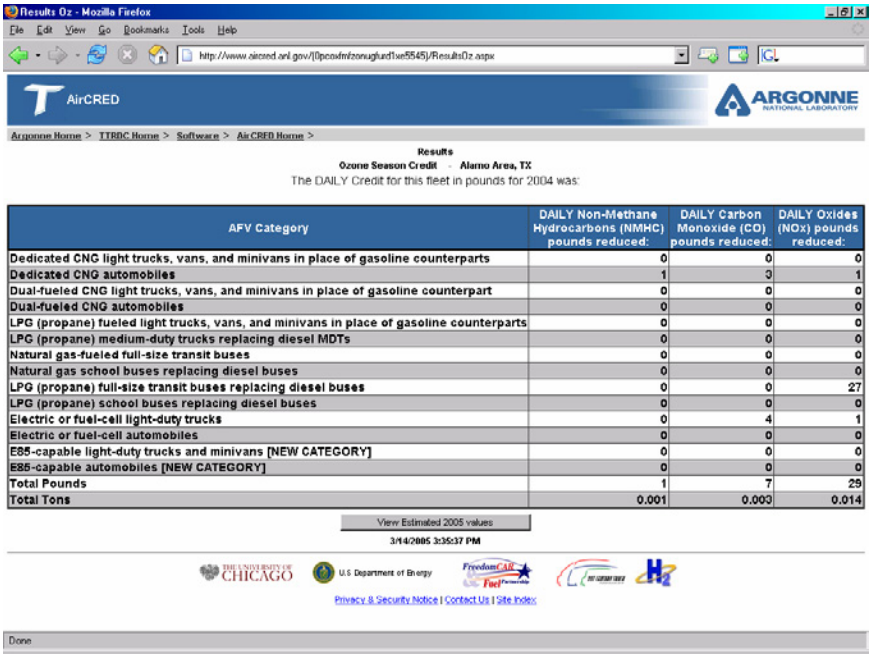
Screen 6: Results — Most Recent Full Year

Screen 6 is the first screen resulting from a "branching" option.

Case 1, Ozone Credits Path: If you select the "OK" button on the Percent Operation as AFV screen, it returns the Clean City and the cumulative total (SFTP-based) daily credits for the preceding summer in (short) tons and pounds of NMHC, CO, and NOx for each group of AFVs entered.

Case 2, CO Credits Path: If you select the "OK" button on the Percent Operation as AFV screen, it returns the location selected and the cumulative total (SFTP-based) daily credits for the preceding winter in (short) tons and pounds of CO for each group of AFVs entered.

Both paths give a credit breakdown (in pounds) by vehicle type. From this screen, you are asked if credits for this fleet in future years should also be displayed. If you choose this option, you will go to Screen 7.

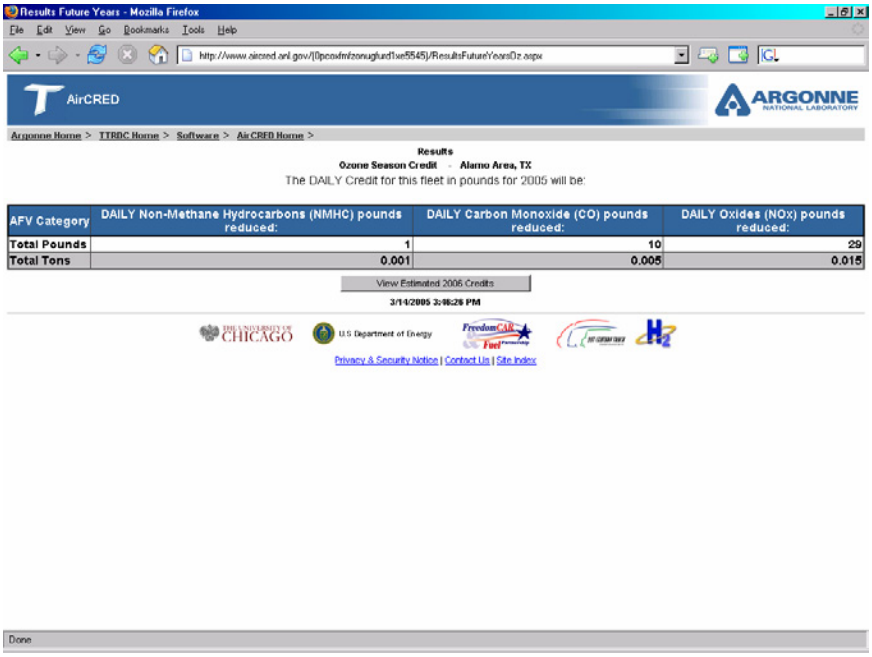


AFV Category	DAILY Non-Methane Hydrocarbons (NMHC) pounds reduced:	DAILY Carbon Monoxide (CO) pounds reduced:	DAILY Oxides (NOx) pounds reduced:
Dedicated CNG light trucks, vans, and minivans in place of gasoline counterparts	0	0	0
Dedicated CNG automobiles	1	3	1
Dual-fueled CNG light trucks, vans, and minivans in place of gasoline counterpart	0	0	0
Dual-fueled CNG automobiles	0	0	0
LPG (propane) fueled light trucks, vans, and minivans in place of gasoline counterparts	0	0	0
LPG (propane) medium-duty trucks replacing diesel MDTs	0	0	0
Natural gas-fueled full-size transit buses	0	0	0
Natural gas school buses replacing diesel buses	0	0	0
LPG (propane) full-size transit buses replacing diesel buses	0	0	27
LPG (propane) school buses replacing diesel buses	0	0	0
Electric or fuel-cell light-duty trucks	0	4	1
Electric or fuel-cell automobiles	0	0	0
E85-capable light-duty trucks and minivans [NEW CATEGORY]	0	0	0
E85-capable automobiles [NEW CATEGORY]	0	0	0
Total Pounds	1	7	29
Total Tons	0.001	0.003	0.014

Screen 7: Year 2005 Results

Screen 7 shows year 2005 total emission reduction credits of the fleet characterized in the preceding screen for each of the three precursor pollutants in pounds and tons. For CO, breakdown of this total by vehicle type is also shown (because of the limited number of vehicles and only one pollutant included). This is determined by comparison of emission deterioration rates for this fleet with a parallel fleet of conventionally fueled vehicles.

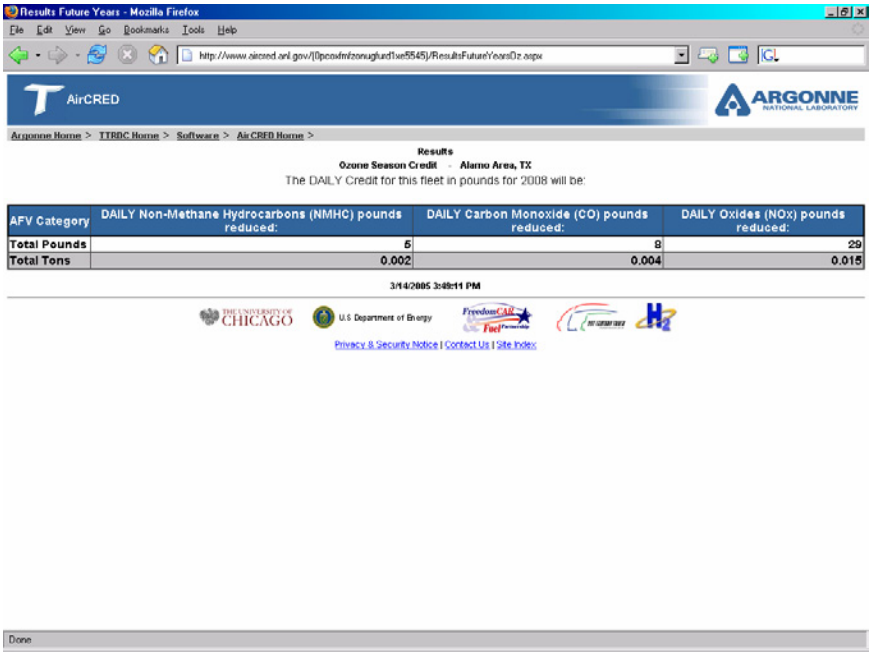
From this screen, you may terminate the program or proceed to a succession of screens showing each future year's total credits through 2008.

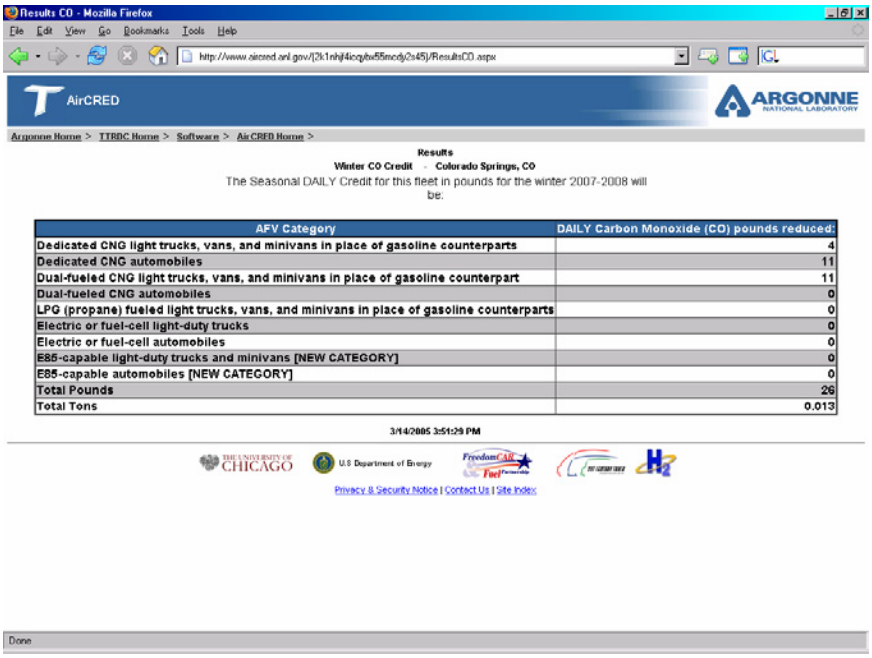


AFV Category	DAILY Non-Methane Hydrocarbons (NMHC) pounds reduced:	DAILY Carbon Monoxide (CO) pounds reduced:	DAILY Oxides (NOx) pounds reduced:
Total Pounds	1	10	29
Total Tons	0.001	0.005	0.015

Screens 8–10: Results for Future Years

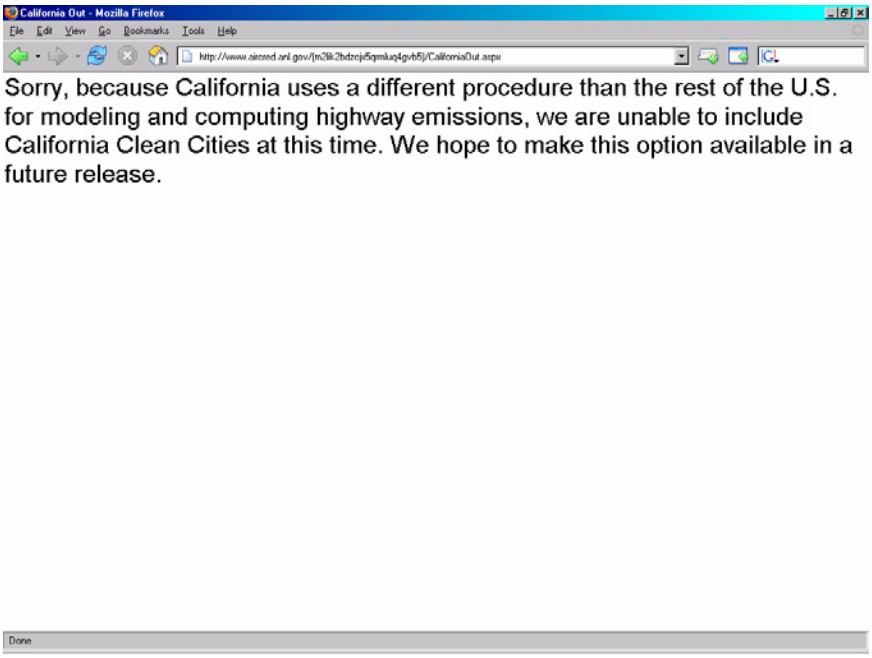
Screens 8, 9, and 10 provide estimated credits for 2006, 2007, and 2008, respectively. The 2008 screen does not provide an "OK" option for credits into the future, as it is believed that most light-duty AFVs acquired before mid-2002 (the only vehicle types for which daily credits will actually vary because of control programs such as I/M and Phase 2 RFG) will be at or near retirement from fleets by the end of 2008.





Screen 11: California Out

Screen 11 informs you that California is not included in this credit calculation because that state uses different emissions calculation procedures.



To complete a session, click the Close button [☒] at the top right of any given data entry screen. To restart the web-based version of AirCRED, click on the AirCRED Home link in the gray banner near the top of the page or hit the browser "Back" button until AirCRED's introduction/start-up screen is displayed.

Acknowledgments

This work was sponsored by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy through the Weatherization & Intergovernmental Program and FreedomCAR & Vehicle Technologies Program. We would like to thank Mr. David Hamilton, Ms. Marcy Rood, and Mr. Dennis Smith, all of the U.S. Department of Energy, and Ms. Betty Waterman of Argonne National Laboratory for their ongoing assistance and contribution to the project; and Mr. Matthew Payne of the U.S. Environmental Protection Agency Office of Transportation and Air Quality for past support. We would also like to express appreciation to the many interested parties both within and outside the Clean Cities program whose review and comment enhanced the look and feel of AirCRED and its utility to stakeholders in the alternative fuel vehicle community.

APPENDIX A

EPA Interest and a List of Clean Cities

Of most interest to the U.S. Environmental Protection Agency (EPA) will be the numerical basis of the initial credits for each Clean City. Table 1 shows the complete list of Clean Cities.

Table A-1. Listing of the Clean Cities Currently Included in AirCRED (California Cities not yet operationalized)			
Clean Cities – Ozone			
Alamo Area, TX	Albuquerque, NM	Ann Arbor, MI	Atlanta, GA
Austin, TX	Baltimore, MD	Baton Rouge, LA	Boston, MA
Capital District, NY	Central Arkansas	Central Indiana	Central New York
Central Ohio	Central Oklahoma	Chicago, IL	Cincinnati, OH
Cleveland, OH	Coachella Valley, CA	Colorado Springs, CO	Connecticut Capital
Corpus Christi, TX	Dallas-Ft. Worth, TX	State of Delaware	Denver, CO
Detroit, MI-Toronto, ON	East Tennessee CFC	East Texas	Florida Gold Coast
Florida Space Coast	Genesee Region, NY	Granite State (NH)	Hampton Roads, VA
Honolulu, HI	Houston, TX	Kansas City, KS-MO	Lancaster, CA
Lansing, MI	Las Vegas, NV	Long Beach, CA	Long Island, NY
Los Angeles, CA	Louisville, KY	Manhattan, KS	Middle Georgia
Middle Tennessee	New Haven, CT	New York City, NY	North Jersey, NJ
Norwich, CT	Omaha, NE	Palmetto State CFC (SC)	Paso Del Norte, TX
Philadelphia, PA	Phoenix, AZ	Pittsburgh, PA	Portland, ME
Portland, OR	Providence, RI	Puget Sound, WA	Red River Valley, ND/MB
Reno, NV	Rogue Valley, OR	Sacramento, CA	St. Louis, MO
Salt Lake City, UT	San Diego, CA	San Francisco Bay, CA	San Joaquin, CA
SCAG, CA	South East TX	South Shore, IN	Southwestern CT
Triangle, NC	Tucson, AZ	Tulsa, OK	Twin Cities, MN
State of Vermont	Washington, DC	Weld-Larimer-RMNP, CO	Western New York
State of West Virginia	Wisconsin SE area		
Clean Cities – CO			
Colorado Springs, CO	Denver, CO	Las Vegas, NV	New York Metro Area
Paso Del Norte, TX	Phoenix, AZ	Portland, OR	Reno, NV
Rogue Valley, OR	Grants Pass, OR	Salt Lake City, UT	Spokane, WA
Tucson, AZ	Twin Cities, MN	Weld-Larimer-RMNP, CO	

Initialization of MOBILE6.2 Credit Base

City-specific values generated by MOBILE6.2 provide the starting point for alternative fuel-specific credits. In the case of vehicles fueled with compressed natural gas (CNG) or E85, a pollutant-specific average of the full SFTP certification data ratios between the AFVs and their gasoline-fueled counterparts is computed on the basis of production shares for the CNG make/model combinations available as OEM offerings for model years 1998–2004 in four groups as model years 1998–2000, 2001–2002, 2003, and 2004. (However, for 2004, no sales data were available, so each vehicle was given equal weighting). Weighted averages by AFV/gasoline counterpart vehicle offering are computed by applying model-year–specific fractions to certification results.

For the most recent model year (2004), these values were:

NG LDV: 0.5 × Chevrolet Cavalier + 0.5 × Honda Civic

NG LDT: 0.2 × Ford F-150 2WD + 0.2 × Ford F-150 4WD + 0.2 × Ford Econoline E-350 + 0.2 × GMC Sierra Model 1 + 0.2 × GMC Sierra Model 2

E85 LDV: 0.33 × Chrysler Sebring Convertible + 0.33 × Ford Taurus Wagon + 0.33 × Mercedes C-Class Wagon

E85 LDT: 0.2 × Chevrolet Silverado + 0.2 × Chevrolet Suburban + 0.2 × Dodge Ram + 0.2 × Ford Sport Trac + 0.2 × Mercury Mountaineer

Each of the 12 values per model-year group (three pollutants × two fuels × two light-duty AFV vehicle types) was subtracted from one to yield the fractional multiplier of the baseline rate that is used to compute the actual credit. Thus, if the weighted mean ratio for a given vehicle/pollutant combination is 0.3, the grams per mile credit = 0.7 times the corresponding MOBILE6.2 composite gasoline emission rate for new vehicles (i.e., acquired during the 12 months immediately preceding) of that combination.

Table 2 shows the natural gas and E85 credit multipliers applied by vehicle type and pollutant for 2003 and 2004 light-duty car and truck credits, respectively. In addition, it is assumed that 50% of refueling for both centralized and noncentralized fleets is provided by natural-gas–powered compressors, with the balance by electrical compressors. Because of the onsite (in-basin) NOx emissions associated with natural-gas–powered compression, AirCRED subtracts one half of the vehicle-type–specific NOx emission rate in grams per mile for natural gas compressors, used by Argonne National Laboratory's GREET model,[1] from the NOx credit assigned to each of the six CNG-fueled vehicle types.

Table A-2. 2003-2004 CNG and E85 Light-Duty Credit Multipliers

Fuel	LDV NMHC	CO	NOx	LDT NMHC	CO	NOx
MY 2003 LDV/LDT						
CNG	0.84	0.40	0.50	0.83	0.60	0.33
EtOH	0.10	0.17	0.25	0.40	0.35	0.40
MY 2004 LDV/LDT						
CNG	0.90	0.24	0.59	0.85	0.34	0.40
EtOH	0.00	0.29	0.19	0.00	0.00	0.00

In the case of electric vehicles, 100% of the MOBILE6.2 factor value is applied because electric vehicles are zero-emission at the tailpipe relative to their gasoline counterparts, and electric power plant emissions attributable to vehicle charging may or may not occur in the specific urban airshed (LDGT1 emission rates are used for electric light truck comparisons). The resulting MOBILE6.2-based values are carried forward in subsequent computations that apply vehicle counts, miles and days driven, and central-refueling proportions.

Estimation of 49-State Heavy Duty Credits

It was Argonne's aim, insofar as possible, to make the procedure for computing credits for heavy-duty (>8,500 lb. GVW) AFV acquisition parallel to that for LDVs. This capability is limited on two fronts:

The use of engine certification (only) for heavy-duty families according to intended application (e.g., medium-duty truck, urban bus) over a load cycle that does not include a cold transient or accessories, in contrast to the chassis dynamometer SFTP with a separate cold transient and AC-load bags for LDVs and light-duty trucks; and

The non-separation of NMHC from total hydrocarbons in reporting of HDV certification test results.

In search of guidance about how best to handle these discrepancies, Argonne turned to the EPA documentation of its intended treatment of natural gas-fueled vehicles in MOBILE6 (Ref. 2). In that report, EPA indicates that MOBILE6 will assign no emission reduction credit for CO or hydrocarbons to natural gas HDVs that replace or are obtained in lieu of diesel-fueled units (Sec. 5.1). Moreover, all modifying factors relating to accessory load, deterioration, and power transient would be applied equally to CNG AFVs and their respective counterparts [thus, in the case of LDVs, these factors for CNG would be equivalent to those for ultra-low-emissions vehicle (ULEV) certified gasoline-fueled units (Sec. 6.2)]. On the basis of these statements, Argonne estimates NOx credits only (where actual and legitimate, based on the complete heavy-duty certification cycle) for replacement of diesel-powered transit and school buses (and medium- and heavy-duty service vehicles) by CNG- or propane-fueled units.

The intended use of the CNG- or propane-fueled HDV engine determines its baseline factor computation. All certification data for OEM CNG- and propane-fueled HDVs were obtained from EPA certification database at http://www.epa.gov/otaq/certdata.htm#largeng. Certification results for heavy-duty CNG and propane were compared within target vehicle type with their diesel-fueled counterparts. That is, all engines were compression-ignition.

In 2004, Cummins Engine Company, Detroit Diesel Corporation, and Mack Trucks Inc. offered both CNG and diesel versions of the same (displacement) engine. Ford Motor Company offered a 5.9-liter CNG engine for buses and medium- and heavy-duty trucks, but no diesel counterpart. Ford's QVM program is currently the only provider of dedicated propane-fueled medium-duty truck engines. Market share information on the qualifying (counterpart) CNG engines was not available for the most recent certifications, so each engine was given equal weighting:

2003-2004

Transit buses: 0.33 × Cummins 8.3L + 0.33 ×x Detroit Diesel 8.5L + Mack 11.9L

School buses/medium- and heavy-duty vehicles: 0.33 × Cummins 5.9L + 0.33 × Cummins 8.3 L + 0.33 Detroit Diesel 8.5L

Certification results for NOx in g/bhp-h were transformed to grams per mile estimates based on EPA-recommended conversions by (target) vehicle type,[3] and adjusted for onsite natural gas compression as described above. While this conversion retained the proportionate relationship between results for diesel and natural gas counterparts, it augmented the gap between the absolute values of the baseline emission rate difference. However, these values are used as the 24-hour NOx credit for natural gas replacement of diesel by the AirCRED procedure:

Transit buses: 4.679 bhp-hr/mi

Diesel-fueled school buses and medium- and heavy-duty vehicles: 2.989 bhp-hr/mi

Both Argonne and the diesel engine manufacturers expect that the NOx gap between CNG vehicles and their diesel-powered counterparts will close almost completely by 2007, thanks to significant improvement in diesel emission control technology.[4] By that time, however, it will be useful to examine discrepancies between corresponding certification test results for fine particle emissions.

Example Results: MOBILE6.2 Output for Ozone Season Clean City

(Format-edited)

Scenario Title Text - ATLANTA METRO
LEV phase-in data read from file ALLULEV.D
Calendar Year: 2004
Month: July
Altitude: Low
Minimum Temperature: 75.0 (F)
Maximum Temperature: 95.0 (F)
Absolute Humidity: 75. grains/lb
Nominal Fuel RVP: 7.0 psi
Weathered RVP: 6.6 psi
Fuel Sulfur Content: 150. ppm
Exhaust I/M Program: Yes
Evap I/M Program: Yes
ATP Program: Yes
Reformulated Gas: No

Vehicle Type:	**LDGV**	**LDGT12**	**LDGT34**	**LDGT**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**All Veh**
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.3918	0.3288	0.1260		0.0363	0.0004	0.0020	0.1098	0.0049	1.0000
Composite Emission Factors (g/mi):										
Composite VOC :	0.151	0.139	0.371	0.203	0.728	0.032	0.098	0.405	1.35	0.229
Composite CO :	2.15	2.17	2.46	2.25	6.79	0.450	0.353	2.099	14.39	2.418
Composite NOX :	0.391	0.437	0.533	0.463	3.463	0.171	0.482	5.172	0.94	1.063
Non-Exhaust Emissions (g/mi):										
Hot Soak Loss:	0.013	0.008	0.008	0.008	0.011	0.000	0.000	0.000	0.117	0.010
Diurnal Loss:	0.005	0.004	0.004	0.004	0.006	0.000	0.000	0.000	0.001	0.004
Resting Loss:	0.010	0.008	0.008	0.008	0.012	0.000	0.000	0.000	0.227	0.009
Running Loss:	0.035	0.033	0.033	0.033	0.034	0.000	0.000	0.000	0.000	0.030
Crankcase Loss:	0.002	0.003	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.002
Refueling Loss:	0.010	0.013	0.209	0.067	0.383	0.000	0.000	0.000	0.000	0.048
Total Non-Exhaust:	0.073	0.068	0.264	0.119	0.449	0.000	0.000	0.000	0.345	0.103
Calendar Year: 2005										
Composite VOC :	0.156	0.153	0.394	0.220	0.734	0.036	0.117	0.419	1.62	0.242
Composite CO :	2.37	2.65	2.97	2.74	6.51	0.476	0.381	2.163	15.30	2.729
Composite NOX :	0.390	0.515	0.643	0.550	3.437	0.179	0.513	5.214	0.95	1.098
Hot Soak Loss:	0.014	0.010	0.009	0.010	0.012	0.000	0.000	0.000	0.123	0.011
Diurnal Loss:	0.005	0.004	0.004	0.004	0.006	0.000	0.000	0.000	0.001	0.004
Resting Loss:	0.011	0.008	0.008	0.008	0.013	0.000	0.000	0.000	0.252	0.010
Running Loss:	0.037	0.035	0.035	0.035	0.036	0.000	0.000	0.000	0.000	0.032
Crankcase Loss:	0.004	0.005	0.005	0.005	0.005	0.000	0.000	0.000	0.000	0.004
Refueling Loss:	0.010	0.013	0.209	0.067	0.382	0.000	0.000	0.000	0.000	0.049
Total Non-Exhaust:	0.080	0.075	0.270	0.125	0.455	0.000	0.000	0.000	0.375	0.109
Calendar Year: 2006										
Composite VOC :	0.177	0.183	0.435	0.252	0.748	0.041	0.136	0.435	1.94	0.269
Composite CO :	3.02	3.47	3.84	3.57	6.31	0.505	0.411	2.230	16.36	3.380
Composite NOX :	0.486	0.667	0.827	0.710	3.525	0.187	0.543	5.268	0.98	1.204
Hot Soak Loss:	0.016	0.011	0.011	0.011	0.014	0.000	0.000	0.000	0.132	0.012
Diurnal Loss:	0.005	0.004	0.004	0.004	0.006	0.000	0.000	0.000	0.001	0.004
Resting Loss:	0.012	0.009	0.009	0.009	0.014	0.000	0.000	0.000	0.285	0.011
Running Loss:	0.039	0.037	0.037	0.037	0.038	0.000	0.000	0.000	0.000	0.034
Crankcase Loss:	0.006	0.007	0.007	0.007	0.007	0.000	0.000	0.000	0.000	0.006
Refueling Loss:	0.011	0.014	0.209	0.067	0.382	0.000	0.000	0.000	0.000	0.050
Total Non-Exhaust:	0.088	0.082	0.277	0.133	0.462	0.000	0.000	0.000	0.417	0.117
Calendar Year: 2007										
Composite VOC :	0.180	0.198	0.451	0.266	0.762	0.045	0.155	0.450	2.25	0.280
Composite CO :	2.40	3.13	3.53	3.24	6.44	0.533	0.441	2.290	17.41	3.013
Composite NOX :	0.387	0.644	0.828	0.694	3.495	0.195	0.572	5.317	1.00	1.150
Hot Soak Loss:	0.018	0.013	0.013	0.013	0.015	0.000	0.000	0.000	0.142	0.014
Diurnal Loss:	0.005	0.004	0.004	0.004	0.007	0.000	0.000	0.000	0.001	0.004
Resting Loss:	0.013	0.010	0.010	0.010	0.015	0.000	0.000	0.000	0.323	0.012
Running Loss:	0.042	0.039	0.039	0.039	0.041	0.000	0.000	0.000	0.000	0.036
Crankcase Loss:	0.008	0.009	0.009	0.009	0.009	0.000	0.000	0.000	0.000	0.007
Refueling Loss:	0.011	0.017	0.210	0.069	0.382	0.000	0.000	0.000	0.000	0.052
Total Non-Exhaust:	0.096	0.092	0.285	0.142	0.469	0.000	0.000	0.000	0.466	0.125
Calendar Year: 2008										
Composite VOC :	0.205	0.231	0.491	0.301	0.793	0.049	0.172	0.463	2.56	0.310
Composite CO :	2.83	3.68	4.12	3.80	6.74	0.561	0.471	2.345	18.46	3.478

Composite NOX :	0.462	0.757	0.967	0.814	3.569	0.202	0.599	5.361	1.03	1.232
Hot Soak Loss:	0.020	0.015	0.015	0.015	0.018	0.000	0.000	0.000	0.154	0.016
Diurnal Loss:	0.006	0.005	0.005	0.005	0.007	0.000	0.000	0.000	0.001	0.005
Resting Loss:	0.014	0.011	0.011	0.011	0.017	0.000	0.000	0.000	0.368	0.013
Running Loss:	0.045	0.043	0.043	0.043	0.045	0.000	0.000	0.000	0.000	0.039
Crankcase Loss:	0.009	0.010	0.011	0.011	0.011	0.000	0.000	0.000	0.000	0.009
Refueling Loss:	0.011	0.020	0.210	0.071	0.382	0.000	0.000	0.000	0.000	0.054
Total Non-Exhaust:	0.105	0.104	0.296	0.154	0.479	0.000	0.000	0.000	0.524	0.136

Example Results: MOBILE6.2 Output for CO Cold Season Clean City

(Format-edited)

Scenario Title Text – DENVER CO WINTER
LEV phase-in data read from file ALLULEV.D
Calendar Year: 2005
Month: Jan.
Altitude: High
Minimum Temperature: 16.1 (F)
Maximum Temperature: 43.2 (F)
Absolute Humidity: 75. grains/lb
Nominal Fuel RVP: 13.0 psi
Weathered RVP: 13.2 psi
Fuel Sulfur Content: 160. ppm
Exhaust I/M Program: Yes
Evap I/M Program: Yes
ATP Program: Yes
Reformulated Gas: No
Ether Blend Market Share: 0.750 Alcohol Blend Market Share: 0.250
Ether Blend Oxygen Content: 0.027 Alcohol Blend Oxygen Content: 0.035
Alcohol Blend RVP Waiver: Yes

Vehicle Type: GVWR:	LDGV	LDGT12 <6000	LDGT34 >6000	LDGT (All)	HDGV	LDDV	LDDT	HDDV	MC	All Veh
VMT Distribution:	0.3846	0.3328	0.1279		0.0365	0.0003	0.0020	0.1110	0.0049	1.0000
Composite Emission Factors (g/mi):										
Composite CO :	11.30	7.79	7.08	7.60	21.57	0.445	0.347	5.144	20.44	9.306
Calendar Year: 2006										
Composite CO :	12.27	8.84	8.36	8.71	31.72	0.462	0.366	5.232	20.95	10.539
Calendar Year: 2007										
Composite CO :	9.95	8.25	8.42	8.30	28.07	0.491	0.396	5.408	22.01	9.362
Calendar Year: 2008										
Composite CO :	8.63	7.98	8.33	8.07	24.65	0.519	0.426	5.566	23.10	8.669
Calendar Year: 2009										
Composite CO :	9.47	8.97	9.27	9.05	24.32	0.547	0.456	5.708	24.25	9.467

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3. L. Browning, *Update Heavy-Duty Engine Emission Conversion Factors for MOBILE6: Analysis of BSFCs and Calculation of Heavy-Duty Engine Emission Conversion Factors*, EPA420-R-02-005, Office of Transportation and Air Quality, U.S. Environmental Protection Agency (January 2002).
4. V. Duggal, Cummins Engine Co., Columbus, IN, personal communication (September 3, 1999).