EMFAC Modeling Change Technical Memo

**SUBJECT:** EVAP TECH FRACTIONS FOR MY 2003+ PC AND LDT1

**LEAD:** BEN HANCOCK

# SUMMARY

In November of 1998, the California Air Resources Board adopted staff’s Low Emission Vehicle II (LEVII) proposal which calls for lower exhaust and evaporative emissions standards for all new passenger cars, light-duty and medium-duty trucks beginning in 2004. Based on these regulations, the emission rates for the affected technology groups and their corresponding implementation schedules were updated in EMFAC2000 for both exhaust and evaporative processes.

After the release of EMFAC2000, the ARB adopted additional programs that required that additional changes be made to the model. These programs included modifications to the ARB’s Zero-Emission Vehicle Program (ZEV) and the adoption of some portions of the federal Tier 2 Program. These changes affected exhaust and evaporative emissions for all Light-duty Autos (LDA), Light-duty Trucks (LDT), and Medium-duty trucks (MDT) less than 8500 pounds.

While the changes resulting from these programs were incorporated into EMFAC2001[[1]](#footnote-1) for the exhaust processes, implementation schedules were not updated for the evaporative technology groups. Therefore, the implementation schedules for the evaporative technology groups are being revised to properly reflect the above mentioned program changes.

Staff of the Mobile Source Control Division (MSCD) who oversee these programs have created implementation schedules that reflect these changes. While these program modifications mainly focused on exhaust emissions, the changes indirectly affect the implementation of the evaporative standards. Specifically, the changes in the ZEV mandate and the incorporation of portions of the federal program into LEVII dictate the percentages of PZEVs and ZEVs sold by the manufacturers. For this reason, the incorporation of the evaporative standards must be made consistent with the exhaust implementation schedule.

Table 1 provides the revised evaporative implementation schedule for all Light-Duty Automobiles and Class 1 Light-Duty Trucks (less than 3750 lbs.). The above-mentioned programs do not affect evaporative emissions for LDT2 and MDT vehicles. The schedules for these vehicle classes, therefore, do not need to be revised.

**Table 1. Revised Evaporative Implementation Schedule**

**Passenger Cars and Light-Duty Truck 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model Yr | EnhancedEvap | Near-ZeroEvap | Partial ZEVs | ZEVs |
| 2003 | 90.3% | 0.0% | 9.3% | 0.4% |
| 2004 | 81.1% | 0.0% | 18.5% | 0.4% |
| 2005 | 7.8% | 64.5% | 27.3% | 0.4% |
| 2006 | 0.0% | 63.5% | 36.0% | 0.5% |
| 2007 | 0.0% | 59.1% | 40.3% | 0.6% |
| 2008 | 0.0% | 54.6% | 44.8% | 0.6% |
| 2009 | 0.0% | 49.0% | 50.1% | 0.9% |
| 2010 | 0.0% | 44.4% | 54.6% | 1.0% |
| 2011 | 0.0% | 39.9% | 59.1% | 1.0% |
| 2012 | 0.0% | 34.2% | 64.4% | 1.4% |
| 2013 | 0.0% | 34.2% | 64.4% | 1.4% |
| 2014 | 0.0% | 34.2% | 64.4% | 1.4% |
| 2015 | 0.0% | 31.1% | 67.0% | 1.9% |
| 2016 | 0.0% | 31.1% | 67.0% | 1.9% |
| 2017 | 0.0% | 31.1% | 67.0% | 1.9% |
| 2018 | 0.0% | 28.0% | 69.6% | 2.4% |
| 2019 | 0.0% | 28.0% | 69.6% | 2.4% |
| 2020 | 0.0% | 28.0% | 69.6% | 2.4% |

The change in evaporative technology fraction to shift more toward zero-evaporative-emission cars will result in a decrease of 0.1 tpd in 2010 (0.02% of the total onroad exhaust and evaporative ROG emissions that year). The effect will increase every year as more and more zero-evaporative vehicles are sold. In 2030 the effect is estimated to be a 10-tpd decrease of evaporative HC emissions out of 140 tpd that year of total evaporative emissions and 73 tpd that year of exhaust HC emissions.

# NEED FOR REVISION

# As part of a review of CARB’s ZEV and LEVII programs, we noted a discrepancy between the exhaust and evaporative technology fractions with respect to PZEVs. After consulting with staff from MSCD, it was determined that the evaporative technology fractions did not reflect their current expectations.

# Therefore, the evaporative technology fractions will be adjusted to be consistent with the exhaust technology fractions. The new desired technology fractions are shown in Table 1. The existing technology fractions are shown in Table 2. It can be seen in Table 2 that the number or fraction of PZEVs (vehicles meeting the zero-evaporative emission standards) will be increased six to eight-fold at the expense of vehicles meeting the near-zero evaporative emission standards.

Table 2.

Existing (7/2001) Evap Technology Fractions

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MY | 86-94 TBI | 86-94 FI | +95 TBI | +95 FI | Enhanced | Near-zero | Partial ZEVs | ZEVs |
| 1994 | 11.4 | 88.6 |  |  | 0.0 | 0.0 | 0.0 | 0.0 |
| 1995 |  |  | 3.78 | 86.22 | 10.0 | 0.0 | 0.0 | 0.0 |
| 1996 |  |  | 2.80 | 67.20 | 30.0 | 0.0 | 0.0 | 0.0 |
| 1997 |  |  | 1.80 | 48.20 | 50.0 | 0.0 | 0.0 | 0.0 |
| 1998 |  |  | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| 1999 |  |  |  |  | 100.0 | 0.0 | 0.0 | 0.0 |
| 2000 |  |  |  |  | 100.0 | 0.0 | 0.0 | 0.0 |
| 2001 |  |  |  |  | 100.0 | 0.0 | 0.0 | 0.0 |
| 2002 |  |  |  |  | 100.0 | 0.0 | 0.0 | 0.0 |
| 2003 |  |  |  |  | 90.0 | 0.0 | 9.6 | 0.4 |
| 2004 |  |  |  |  | 54.0 | 36.0 | 9.6 | 0.4 |
| 2005 |  |  |  |  | 18.0 | 72.0 | 9.6 | 0.4 |
| 2006 |  |  |  |  | 0.0 | 90.0 | 9.5 | 0.5 |
| 2007 |  |  |  |  | 0.0 | 90.0 | 9.4 | 0.6 |
| 2008 |  |  |  |  | 0.0 | 90.0 | 9.4 | 0.6 |
| 2009 |  |  |  |  | 0.0 | 90.0 | 9.1 | 0.9 |
| 2010 |  |  |  |  | 0.0 | 90.0 | 9.0 | 1.0 |
| 2011 |  |  |  |  | 0.0 | 90.0 | 9.0 | 1.0 |
| 2012 |  |  |  |  | 0.0 | 90.0 | 8.6 | 1.4 |
| 2013 |  |  |  |  | 0.0 | 90.0 | 8.6 | 1.4 |
| 2014 |  |  |  |  | 0.0 | 90.0 | 8.6 | 1.4 |
| 2015 |  |  |  |  | 0.0 | 90.0 | 8.1 | 1.9 |
| 2016 |  |  |  |  | 0.0 | 90.0 | 8.1 | 1.9 |
| 2017 |  |  |  |  | 0.0 | 90.0 | 8.1 | 1.9 |
| 2018 |  |  |  |  | 0.0 | 90.0 | 7.6 | 2.4 |
| 2019 |  |  |  |  | 0.0 | 90.0 | 7.6 | 2.4 |
| 2020 |  |  |  |  | 0.0 | 90.0 | 7.6 | 2.4 |

# AFFECTED SOURCE CODE/VERSION

TFEVASSIGN.for Version 2.08 (7/17/01)

## METHODOLOGY FOR REVISION

The revised new sales fractions were inserted in the data assignment statements for 2003 to 2040 model-year passenger cars and light-duty trucks (<3750-lb curb weight).

# INVENTORY EFFECTS

The following table shows the estimated change in emissions for the South Coast Air Basin that results from this revision to the implementation schedule.

### Table 2. Estimated Change in ROG Evaporative Emissions

### South Coast Air Basin, Tons per Day

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Using current** **default sched** | **With updated** **evap sched** | **Emissions****difference** |
| **Cal Yr** | LDA | LDT1 | LDA | LDT1 | LDA | LDT1 |
| 2010 | 54.04 | 12.14 | 54.00 | 12.16 | **-0.04** | **0.02** |
| 2020 | 32.58 | 8.58 | 31.23 | 8.34 | **-1.35** | **-0.24** |

 \* Note: A negative value indicates a decrease in emissions.

Table 3 shows the change in emission estimates obtained from running EMFAC 2001 with and without the evaporative tech fraction change. This is on an average-summer-day basis for the years 1980 through 2030, broken down by evaporative emissions type. Virtually no effect is seen before 2004, the first year for the LEV II evaporative requirements[[2]](#footnote-2)\*\*. This shift from near-zero evaporative emissions to zero evaporative emissions results in a decrease in evaporative emissions of about 11 tpd in 2030, about half of which is attributable to decreased running losses.

Table 3. ROG Emission Effects due to Evap Tech Changes

Statewide Summer day

|  |  |  |
| --- | --- | --- |
| Calendar Year | On-road Evaporative Emissions Change(tons per day) | Change To Total On-road ROG Inventory |
|  | Diurnal | Hot Soak | Running | Resting | Total Evap ROG |  |
| 1980 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00% |
| 1990 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00% |
| 2000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00% |
| 2010 | -0.04 | -0.03 | 0.02 | -0.06 | -0.10 | -0.02% |
| 2020 | -0.65 | -0.76 | -1.80 | -0.92 | -4.13 | -1.23% |
| 2030 | -1.70 | -2.00 | -5.34 | -2.40 | -11.44 | -5.11% |

In the three following tables, tables 4,5, and 6, the inventory results with and without the change to the evaporative tech fraction populations are shown for the years 2004, 2020, and 2030 for several individual areas. These tables show data from annual-average day runs. EMFAC 2001 version 2.08 and those before it contained the erroneous PZEV sales projections shown in Table 2 (referred to as “Old Evap Tech Fractions”). EMFAC 2001 version 2.092 contains the revised PZEV sales fractions shown in Table 1, referred to below as “New Evap Tech Fractions.” The results shown below do not include the possibly confounding effects of revising the gasoline sales volatility. That effect is separately modeled elsewhere.

Table 4. Effects of Increased PZEV sales estimates 2004

|  |  |
| --- | --- |
|  | Evaporative ROG from LDAs and LDT1s tpd |
|  | New Evap Tech Fractions | Old Evap Tech Fractions | Change |
| SCAB | 97.87 | 97.90 | -0.03 |
| Santa Barbara County | 3.47 | 3.47 |  |
| San Francisco Bay AB | 53.46 | 53.44 | -0.02 |
| Sacramento County | 9.90 | 9.90 |  |

Table 5. Effects of Increased PZEV sales estimates 2020

|  |  |
| --- | --- |
|  | Evaporative ROG from LDAs and LDT1s tpd |
|  | New Evap Tech Fractions | Old Evap Tech Fractions | Change |
| SCAB | 37.23 | 38.70 | -1.47 |
| Santa Barbara County | 1.14 | 1.17 | -0.03 |
| San Francisco Bay AB | 19.23 | 19.92 | -0.69 |
| Sacramento County | 3.69 | 3.83 | -0.14 |

Table 6. Effects of Increased PZEV sales estimates 2030

|  |  |
| --- | --- |
|  | Evaporative ROG from LDAs and LDT1s tpd |
|  | New Evap Tech Fractions | Old Evap Tech Fractions | Change |
| SCAB | 23.6 | 27.5 | -3.9 |
| Santa Barbara County | 0.7 | 0.8 | -0.1 |
| San Francisco Bay AB | 11.8 | 13.6 | -1.8 |
| Sacramento County | 2.4 | 2.7 | -0.3 |

1. For details of program changes incorporated into EMFAC2001, refer to memo, “Adoption of New Standards Affecting all Vehicles up to the Medium-duty Truck Category” in EMFAC2001 documentation. [↑](#footnote-ref-1)
2. \*\* 2004 is the first model-year for which the LEV II emission rates are required. However, we also changed the voluntary PZEV sales rate projection for 2003 from 9.6 to 9.3%. In spite of the fact that the terms “SULEV” and “PZEV” technically do not exist before the 2004 model year, as of the 2000 model year, manufacturers have made vehicles which qualify for those labels. The model estimated this pre-program penetration of zero-evaporative-emissions PZEVs at 9.6% of new-car sales in 2003 previously. We changed this figure to 9.3% to match the assumed engine emissions technology sales breakdown. The emissions effect from this small change is negligible. [↑](#footnote-ref-2)