

**The Valley Clean Air Now (CAN) Tune In & Tune Up 2007
Program**

Arvin, California

Sponsored by Valley CAN

**With Assistance from
The Advanced Transportation Technology and Energy Initiative
Arvin High School
The Kenneth L. Maddy Institute at California State University, Fresno
and
The California Bureau of Automotive Repair**

**Douglas R. Lawson
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INTRODUCTION

The Valley CAN Tune In & Tune Up (TI&TU) Program was conducted in Arvin, California on Saturday, July 14, 2007. The objectives of the Program were to use a portable analyzer to quickly identify high-emitting vehicles in need of repairs and based on the cost of the repairs, to determine the cost-effectiveness of a voluntary emissions repair program. Relationships established between Valley CAN, the Advanced Transportation Technology and Energy Initiative (ATTEi), Arvin High School and the State Bureau of Automotive Repair (BAR) contributed to the program's success. Through additional funding from a grant awarded to The Maddy Institute by the California Partnership for the San Joaquin Valley, Valley CAN was able to outreach to smaller rural communities including the City of Arvin.

With the assistance of media buys on English and Spanish radio stations and a comprehensive grassroots outreach campaign, 341 vehicle owners volunteered to have their vehicles tested. The vehicles were given a tailpipe emissions test that was conducted in minutes with an emission testing device, performed by staff from BAR. Candidate vehicles were tested for exhaust hydrocarbons (HC) and carbon monoxide (CO), performing the two-speed idle test using the AutoLogic Model 310-0121 gas analyzer. Because the vehicles were tested under idle conditions, no measurements of nitrogen oxides (NO_x) were made during the TI&TU event on July 14, 2007. If the vehicle failed any of the BAR criteria for HC or CO exhaust emissions, or the visual/functional test as performed in the state's Smog Check inspection, the vehicle was judged to be eligible to enter the Valley CAN vehicle repair program.

TI&TU Program staff provided repair vouchers worth up to \$500 in emission-related repair costs to the owners of 280 vehicles that failed the tailpipe emissions test. 230 vehicle owners actually participated in the repair portion of the program. Vehicle repairs were performed at one of three One Stop Smog facilities in Bakersfield.

In addition to the tailpipe emissions test, motorists were directed to an on-site diagnostic testing station where automotive students from Arvin High School provided written information regarding possible causes of their vehicles' emission problems. At that station, an under-the-hood inspection was conducted to provide vehicle owners with more information regarding the condition of their vehicle.

The following sections describe data collected during the 2007 Arvin TI&TU Program and emission reductions resulting from repairs to the high-emitting vehicles.

VEHICLE AND REPAIR DATA

230 vehicles began the repair program, where vehicles were first given a California Smog Check test and inspection at the One Stop Smog facility in Bakersfield. The model year distribution of all vehicles participating in the program is shown in Figure 1.

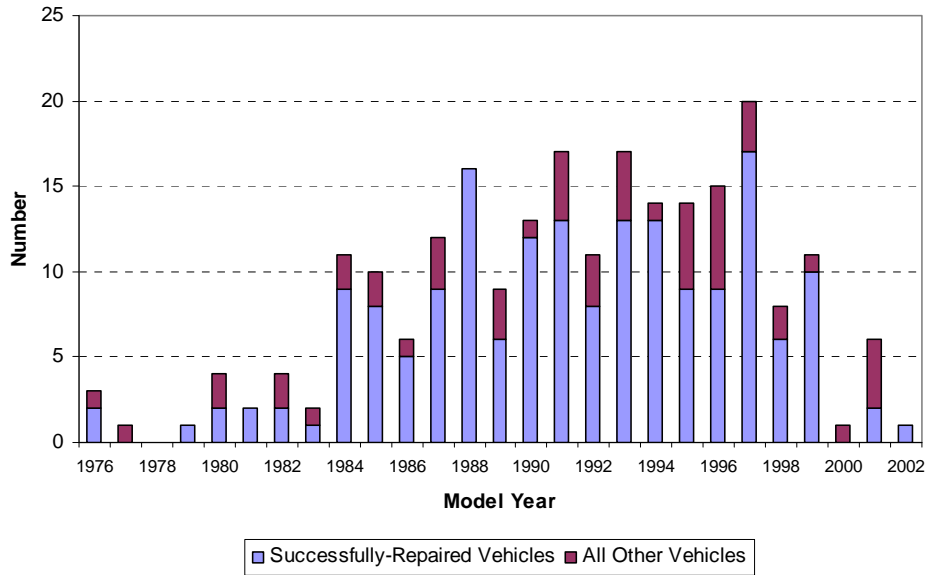


Figure 1. Model year distribution of the vehicles entering the 2007 Arvin Tune In & Tune Up Program.

Vehicles were given both emissions tests in the Smog Check program, the ASM5015 and the ASM2525, which are steady-state loaded mode tests conducted on a dynamometer. Table 1 provides the status of the vehicles that entered the repair program and their average costs of repair.

Table 1. Status of vehicles that entered the 2007 Arvin TI&TU Repair Program.

Vehicle Class	Average Repair/Diagnosis Cost/Vehicle
Successfully repaired, n = 177	\$497
Partial repairs/Left program, n = 18	\$298
No NOx requirements, n = 11	\$345
Not testable, n = 3	Incomplete data
Incomplete Data, n = 15	\$371
Vehicle passed Smog Check = 6	\$79

One hundred seventy-seven vehicles that initially failed the Smog Check test were successfully repaired according to Smog Check criteria. The average repair cost was \$497; the minimum cost was \$40, and the maximum repair cost was \$1,881. Seventy-four vehicles' repair expenses exceeded the \$500 voucher amount. An additional 18 vehicles were partially repaired, but for a number of reasons, their repairs were not completed according to Smog Check criteria. The average cost of partial repairs for this group was \$298. Eleven vehicles were repaired according to Smog Check criteria, but because they were registered outside the Arvin area, there were no Smog Check emission standards for nitrogen oxides (NOx); the data for this group of vehicles are incomplete and/or questionable in some cases. Three vehicles were in such bad state of maintenance that they were judged as not testable. Eight vehicles that failed the BAR emissions test on the July 14th event passed the initial Smog Check at the repair station, but several of them required repairs as judged by the repair technicians.

SMOG CHECK EMISSION REDUCTIONS

Table 2 summarizes the pre- and post-ASM emissions data for the 177 vehicles that were successfully repaired according to Smog Check criteria for those individual vehicles. The values shown in the table are the average of the ASM5015 and ASM2525 emission tests. Emission reductions of 87%, 59%, and 59% were achieved for CO, HC, and NOx, respectively, for the successfully-repaired group of vehicles.

Table 2. Pre- and post-repair emissions data for the 2007 Arvin TI&TU vehicles.

Vehicle Class	Ave. Before-Repair ASM Emissions			Ave. After-Repair ASM Emissions		
	CO, %	HC, ppm	NOx, ppm	CO, %	HC, ppm	NOx, ppm
Successfully repaired, n = 177	1.53	140	602	0.20	57	249
Partial repairs/Left program, n = 18	1.44	197	753	--	--	--
No NOx requirements, n = 11*	0.52	73	--	--	--	--
Not testable, n = 3	--	--	--	--	--	--

*Data incomplete and/or questionable for these vehicles.

Also shown above are pre-repair average ASM readings for the vehicles in each subgroup, where emissions data were available. Notable are the higher average pre-repair HC and NOx emissions for the 18 vehicles for which the motorists chose not to participate fully in the 2007 Arvin TI&TU repair program. Had these vehicles been repaired according to Smog Check criteria, the total emission reductions obtained in the Arvin program would have been significantly larger.

Figure 2 illustrates the average pre- and post-repair ASM emissions for the 177 vehicles that were successfully repaired according to Smog Check criteria, resulting in average ASM emission reductions of 87, 59, and 59% for CO, HC, and NOx, respectively.

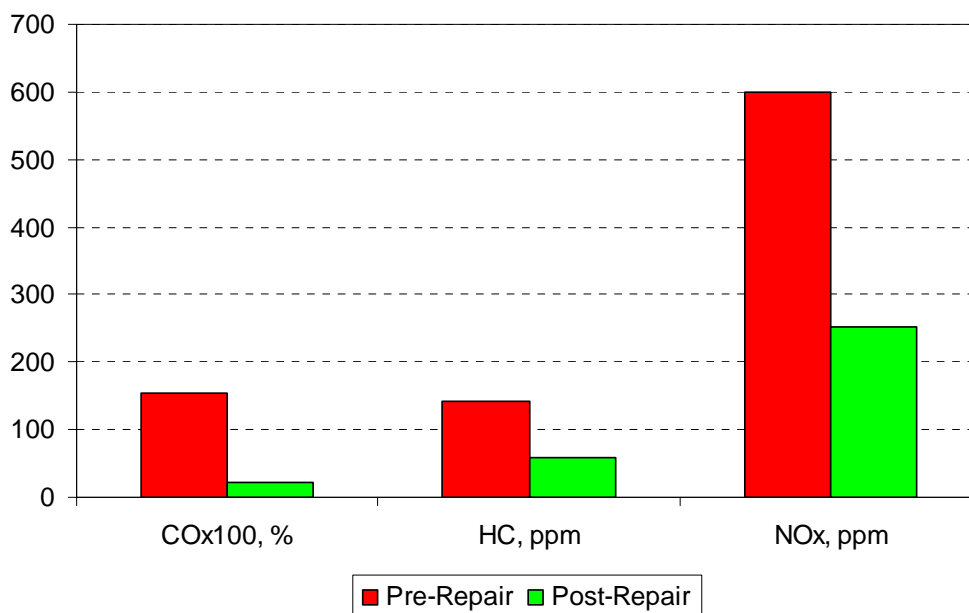


Figure 2. Pre- and post-repair average ASM emissions for the successfully-repaired 177 vehicles.

COMPARISON WITH THE 1995 CALIFORNIA I/M PILOT PROGRAM

In 1995, the California Air Resources Board tested a set of more than 600 vehicles using the Federal Test Procedure (FTP), IM240, ASM 5015, ASM2525, and two-speed idle tests using the BAR90 analyzer. In that unique study, the vehicles that failed the IM240 or the ASM test were repaired according to emissions criteria using the test that they failed. BAR-employed technicians repaired the failing vehicles, and their pre- and post-repair emissions data were collected at State of California-operated facilities. The California I/M Pilot Study provided the maximum possible repair benefit obtainable in an inspection and maintenance (I/M) program, as the mechanics were employed by the State, and their performance was monitored in a centralized I/M program format with no motorist intervention. The emissions reductions obtained in the Valley CAN Fresno 2005, Bakersfield 2006, Stockton 2006, and Arvin 2007 TI&TU programs are compared with those from the California Pilot Program in Table 3.

Table 3. Pre- and post-repair emissions data from the 2005 Fresno, 2006 Bakersfield, 2006 Stockton, 2007 Arvin TI&TU Programs and the 1995 California I/M Pilot Program.

Program	Pre-/Post-Repair Ave. ASM Emissions			Percent Reduction		
	CO, %	HC, ppm	NOx, ppm	CO	HC	NOx
Fresno TI&TU 2005	1.39/0.09	131/46	710/335	94	65	53
Bakersfield TI&TU 2006	1.68/0.27	210/67	923/333	84	69	64
Stockton TI&TU 2006	0.98/0.18	127/51	666/221	82	60	67
Arvin TI&TU 2007	1.53/0.20	140/57	602/249	87	59	59
CA I/M Pilot Program 1995	1.36/0.22	160/50	884/419	84	69	52

Although there is a 10-12 year difference and vehicle model years/technologies are different between the Valley CAN and California I/M Pilot programs, the similarities between pre- and post-repair emissions levels, along with percent emission reductions, are quite similar. The emission reductions obtained in all of the TI&TU programs are comparable to or higher than those obtained in the government-run California I/M Pilot Program.

COSTS OF EMISSION REDUCTIONS

Using statistical relationships derived from the California I/M Pilot Study, where regression relationships were calculated between ASM emission reductions and corresponding FTP data, it is possible to derive rough approximations of tons/year of emission reductions from this Program. Although there is scatter among the different emission test types regarding emission reduction relationships, we used these statistical relationships to estimate total emission reductions for the 177-vehicle fleet, assuming that the repairs are effective for 10,000 miles. Estimated reductions would be different if the duration of repairs differs from the 10,000-mile assumption for repair effectiveness. These estimates are provided in Table 4.

Table 4. Emission reductions from the 177 successfully-repaired vehicles, assuming repair effectiveness for 10,000 miles.

Emission Reductions	CO	HC	NOx
Pounds per vehicle	575	50	27
Pounds from 177 vehicles	101,844	8,852	4,739
Tons from 177 vehicles	50.9	4.43	2.37

The 177 vehicles were repaired according to Smog Check criteria at a total cost of \$87,987, or an average cost of \$497 per vehicle. Because it is not possible to apportion the repair types to specific emission reductions, we can provide two calculations in terms of dollars/ton for Arvin TI&TU 2007 Program effectiveness. If we sum the pollutants CO + HC + NO_x, the cost-effectiveness of the program is \$1524/ton for exhaust emission reductions. The cost-effectiveness for HC + NO_x emissions combined is \$12,948/ton. Because Smog Check repairs also include those that reduce evaporative or nontailpipe HC, these costs are upper limit costs for the three pollutants. If evaporative or nontailpipe HC emission reductions could have been measured in this program, the true cost-effectiveness values would be lower than the ones shown here. At the time of the 2007 Arvin TI&TU Program, California's Smog Check program did not test for particulate matter (PM) exhaust emissions, so it is not possible to calculate PM emission reductions that might have been obtained in this program.

ARVIN TUNE IN & TUNE UP PARTICIPANTS

Those who participated in the Arvin Tune In & Tune Up event were asked to provide information regarding their household income and location of residence, as a way of providing additional data for the Valley CAN program. Figure 3 is a map of the Arvin area, and it contains three sets of information provided by TI&TU participants. The dots show the residence of participants; the color shadings give the average household income by census tract, and the legend provides the household income of participants. Although advertising for the program focused on the event to occur in Arvin, many participants were from Bakersfield. Participants came from as far as Wasco, which is 50 miles from Arvin. In addition, the majority of participants were from census tracts that averaged less than \$50,000 annual income in the 2000 census, with 93% of those participating having household incomes less than \$50,000 per year.

SUMMARY

The Valley CAN Tune In & Tune Up Program event was conducted on July 14, 2007 in Arvin, California, where high-emitting vehicles identified according to BAR idle test results were repaired using the ASM Smog Check emission tests. Emission cutpoints as established by BAR using the two-speed idle test for CO and HC were used to determine whether a vehicle was identified as a high emitter and therefore qualified for repairs at the One Stop Smog repair shop. 280 vehicle owners of high-polluting vehicles that failed the two-speed idle test were given a voucher worth up to \$500 to assist in repairing their high-emitting vehicles. 230 vehicles entered the repair program; 177 that initially failed the emissions portion of the Smog Check inspection were successfully repaired to Smog Check criteria at an average cost of \$497 per vehicle. Owners of 18 vehicles decided not to complete the repair program. The pre-repair HC and NO_x emissions of those vehicles were higher than those that were successfully repaired.

Large emission reductions were obtained from the effectively-repaired 177 vehicles having complete data in this program; their emission reductions were comparable to those obtained from repaired vehicles in the 1995 California I/M Pilot Program. The 2007 Arvin Tune In & Tune Up Program achieved average ASM emission reductions of 87, 59, and 59% for CO, HC, and NO_x, respectively, for the successfully repaired vehicles. If each of these vehicles was driven 10,000 miles per year and the repairs lasted for 10,000 miles, each vehicle's emissions would be reduced by a total of 575, 50, and 27 pounds per year of CO, HC, and NO_x, respectively. In one year, the 177 successfully-repaired vehicles' emissions would be reduced by 51, 4.4, and 2.4 tons for CO, HC, and NO_x, respectively.

The cost-effectiveness of the 2007 Arvin Tune In & Tune Up Program for the 177 successfully-repaired vehicles was \$1524/ton for the sum of carbon monoxide, exhaust hydrocarbons, and nitrogen oxide emissions. For exhaust hydrocarbons and nitrogen oxides combined, the cost of emission reductions was \$12,948/ton. These are upper-limit values, because reductions of evaporative or nontailpipe hydrocarbons emissions obtained by performing Smog Check repairs were not measured in this program. Additional program benefit would have been obtained if all participating vehicles had been completely repaired.

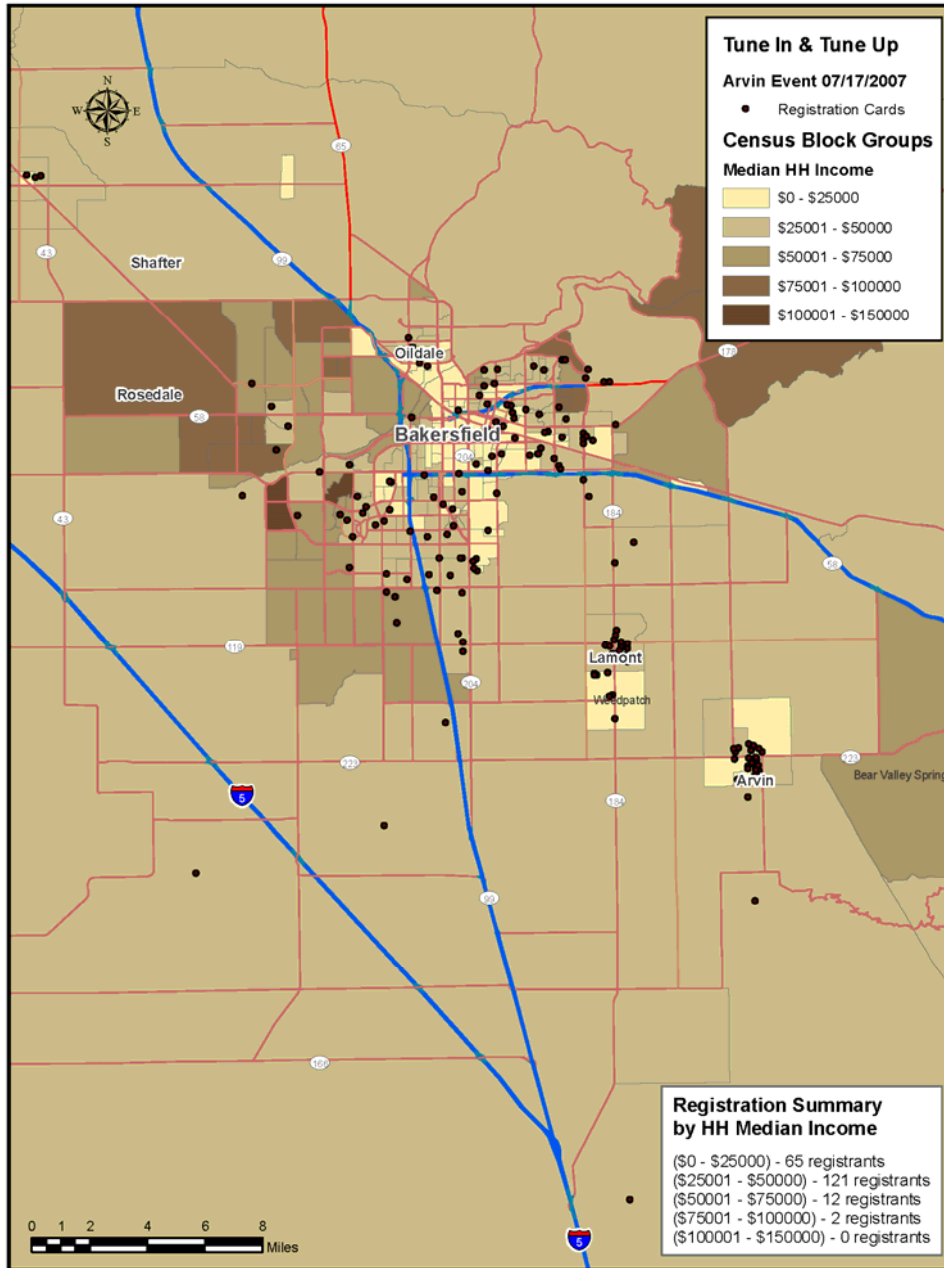


Figure 3. Location, census tract average household incomes, and incomes of participants in the Arvin Tune In & Tune Up Program.

ACKNOWLEDGMENTS

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