REPAIR YOUR AIR CAMPAIGN I
FINAL REPORT

Regional Air Quality Council
September 2006

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Executive Summary

Introduction

The Repair Your Air Campaign (RYAC) was funded by the Federal Highway Authority (FHWA) and the Colorado Department of Transportation (CDOT) through the Congestion Mitigation and Air Quality (CMAQ) Grant program. This program was a partnership between the Regional Air Quality Council (RAQC), the Colorado Department of Public Health and Environment (CDPHE) and Colorado Department of Revenue (DOR). Other private partners included Air Care Colorado, Denver University, Valero Energy Corporation, NAPA auto parts and private repair facilities.

The RYAC's primary goal was to reduce hydrocarbon emissions (HC) to help the Denver metro area avoid violating federal ozone standards during the 2003 summertime ozone season. It also focused on reducing other pollutants such as carbon monoxide (CO), particulate matter (PM) and oxides of nitrogen (NOx). These reductions would be realized through three efforts:

- Educating motorists about the importance of car maintenance through seven Car Care Fairs;
- Implementing a High Emitter Program (HEP) utilizing remote sensing based emissions testing to identify both high HC and high CO emitting vehicles while providing subsidized repair for high HC emitting vehicles; and
- Educating area local governments about the importance of implementing and enforcing smoking vehicle laws through a Smoking Vehicle Enforcement Program (SVEP).

Through these efforts, approximately 13 TPY HC, 76 TPY CO and 1.4 TPY of NOx were reduced. The overall program cost was $225,000 in federal funding and $222,000 in local cost-share for a total program cost of $447,000.

This final report assesses the program costs and benefits and details issues identified throughout the duration of this effort. It also provides recommendations for improving this project if similar efforts continue in the future.

Car Care Fairs

The RAQC, in conjunction with the NAPA Colorado Select Group, hosted seven Car Care Fairs across the Denver metro area and one in Fort Collins. These fairs helped motorists maintain optimum gas mileage and performance as well as reduce emissions and safety risks. This was accomplished by NAPA-certified technicians performing 30 point inspections on participant vehicles.

NAPA technicians and volunteers inspected a total of 164 vehicles. Emissions reductions were realized primarily through gas cap testing and replacement. Overall, 7 gas caps were replaced resulting in nearly a 245 pound reduction in VOC emissions.

This event also provided an opportunity to educate motorists through the distribution of more than 150 information brochures about the Repair Your Air Campaign and fact sheets with ozone reduction tips. The event was a success and RAQC and NAPA will continue to operate these events into the future.

High Emitter Program

This innovative program used remote sensing based emissions testing efforts from CDPHE, University of Denver and the State's RapidScreen Program to identify high-emitting vehicles in the Denver metro area. The program located remote sensing vans at high traffic volume sites around the Denver metro area to identify high-emitting vehicles. Once that data passed quality assurance, it was provided to CDPHE to perform registration matches and qualify vehicles into the program. CDPHE then sent the data to the RAQC to mail solicitations to potential program participants.

The goal of this effort was twofold; the first was to identify high-emitting vehicles of HC and offer free pre and post repair emissions testing, $500 in emissions related repairs and a free rental car while the vehicle was in the repair facility. As described above, the primary goal was to reduce HC during the 2003 summertime season.

The second goal was to reduce emissions from high-emitting vehicles of CO. These vehicles would be offered free emissions testing and a 10 percent discount on repairs at participating repair facilities. Unfortunately, there was no participation from the public in this portion of the program and it was discontinued. This portion of the program is not detailed in the report below.

Of the 668 respondents that signed up to participate in the program, 502 vehicles were given an IM240 emissions test. Of these vehicles tested, 194 failed the IM240 testing and were confirmed to be high-emitters. This equates to a 61 percent mis-identification rate. While this rate seems high, a high mis-identification rate was expected and occurred for a number of reasons. These reasons included:

- Requiring only one valid remote sensing reading;
- Cold start identifications: when a vehicle is identified by the remote sensor as a high-emitter prior to the engine reaching proper operating temperature;
- A vehicle owner repairing the vehicle after it is identified as a high-emitter but prior to its confirmatory IM240 test;
- The variability of vehicle emissions and test results; and
- RSD technology software issues related to high-emitter identification.

The mis-identification rate experienced during this project was not unexpected since the goal was to bring in as many vehicles as possible to reduce ozone for the 2003 season. Addressing the high mis-identification rate will be more critical for Phase II since it will be a test bed for a full-scale high-emitter program. The second phase of RYAC will implement measures to enhance the accuracy of high-emitting vehicle identification. These measures include increasing the number of valid readings required to qualify for the program, site analyses, potentially using an index to screen those vehicles and attempting to reduce cold start identifications.

By measuring the emissions reductions of the 194 vehicles in the data set, an estimate can be made of the annual emissions reductions. On an annual basis, the program resulted in a reduction of approximately 13 TPY of HC, 76 TPY of CO, and 1.4 TPY of NOx. Benefits for the program are estimated to last two years. This equates to 27 TPY of HC, 153 TPY of CO and 3 TPY of NOx.

Smoking Vehicle Enforcement Program

The SVEP was designed to be an outreach/education and training program for local government law and code enforcement staff to implement and enforce smoking vehicle ordinances. The goal of SVEP was to influence local governments to implement a smoking vehicle program requiring smoking vehicle owners to repair their vehicle.

RAQC staff planned and administered a "Smoking Vehicle Training" on August 17, 2005. The City and County of Denver, which currently has a smoking vehicle enforcement program in place, outlined the program costs, benefits and effectiveness of their program. The RAQC presented information on how to leverage grant funds for program start up and implementation. The RAQC discussed the program benefits including air quality benefits, enhanced driver safety and the additional revenue growth that would be derived from such a program. CDPHE provided a "smoke training" and all attendees were trained to identify different levels of tailpipe smoke density. Informational packets including fact sheets, grant funding opportunities, other existing program information and contact information were distributed.

One week after the "Smoking Vehicle Training," each attending local government received a follow up call to determine if the RAQC could assist in leveraging grant funds or provide program development assistance. Through these calls, the RAQC determined that local governments were not interested in implementing a smoking vehicle enforcement program due to limited budgets and staff resources.

Conclusion

Overall, the Car Care Fairs and HEP were successful efforts with quantifiable emissions reductions. These program elements achieved the goals of reducing emissions while educating vehicle owners about the importance of routine vehicle maintenance. By implementing the recommendations listed in this report, these efforts can be more effective in the future.

The SVEP met the goal of educating local governments about the importance of identifying and repairing smoking vehicles in the Denver metro area. Unfortunately, budget restrictions limited the ability of local governments to implement a full-scale effort to address this problem. The RAQC will continue to pursue opportunities to implement these types of programs in the future.

Repair Your Air Campaign Final Report

Introduction

The Repair Your Air Campaign (RYAC) was a partnership between the Regional Air Quality Council (RAQC), the Colorado Department of Public Health and Environment (CDPHE) and Colorado Department of Revenue (DOR). Other private partners included Air Care Colorado, Denver University, Valero Energy Corporation, NAPA auto parts and private repair facilities.

The RYAC's primary goal was to reduce hydrocarbon emissions (HC) to help the Denver metro area avoid violating federal ozone standards during the 2003 summertime ozone season. It also focused on reducing other pollutants such as carbon monoxide (CO), particulate matter (PM) and oxides of nitrogen (NOx). These reductions would be realized through three efforts:

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This program was funded through a Federal Highway Administration (FHWA), Congestion Mitigation Air Quality grant (CMAQ) grant. This final report assesses the program costs and benefits and details issues identified throughout the duration of this effort. It also provides recommendations for improving this project if similar efforts continue in the future.

Car Care Fairs

The RAQC, in conjunction with the NAPA Colorado Select Group, hosted seven Car Care Fairs across the Denver metro area and one in Fort Collins. These fairs helped motorists maintain optimum gas mileage and performance as well as reduce emissions and safety risks. This was accomplished by NAPA-certified technicians performing 30 point inspections on participant vehicles. Overall, RAQC, NAPA and volunteers hosted Car Care Fairs on Saturday, June 21st in the following cities:

- Boulder
- Denver
- Federal Heights
- Fort Collins
- Lakewood
- Longmont
- Wheat Ridge

NAPA technicians and volunteers inspected a total of 164 vehicles. Emissions reductions were realized primarily through gas cap testing and replacement. Overall, 7 gas caps were replaced

resulting in nearly a 245 pound reduction in VOC emissions. Additional emissions reductions were realized through motorist's voluntarily repairing any other emissions related items noted by NAPA technicians. These repairs were not investigated.

This event also provided an opportunity to educate motorists through the distribution of more than 150 information brochures about the Repair Your Air Campaign and fact sheets with ozone reduction tips. The event was a success and RAQC and NAPA will continue to operate these events into the future.

High-Emitter Program (HEP)

Background

This innovative program used remote sensing based emissions testing efforts from CDPHE, University of Denver and the State's RapidScreen Program to identify high-emitting vehicles in the Denver metro area. The program located remote sensing vans at high traffic volume sites around the Denver metro area to identify high-emitting vehicles. Once the high-emitter data passed quality assurance, it was provided to CDPHE to perform registration matches and qualify vehicles into the program. CDPHE then sent the data to the RAQC to mail solicitations to potential program participants.

The goal of this effort was twofold; the first was to identify high-emitting vehicles of HC and provide free pre- and post-repair emissions testing, $500 in emissions related repairs and a free rental car while the program vehicle was in the repair facility. As described above, the primary goal was to reduce HC during the 2003 summertime season. The second goal was to reduce emissions from high-emitting vehicles of CO. These vehicles would be offered free emissions testing and a 10 percent discount on repairs at participating repair facilities. Unfortunately, there was no participation from the public in this portion of the program and it was discontinued. This portion of the program is not detailed in the report below.

The RYAC program was kicked off with a large press event in May 2003. This event was well attended and covered by all media outlets in the Denver area. This provided good exposure at program start-up and helped legitimize the program to potential participants.

After the program kickoff, the RAQC and CDPHE began notifying area motorists that they had been identified as a potential high-emitter and began repairing vehicles. The effort operated through June of 2005.

RSD Analysis

An important factor that influenced the program's efficiency and effectiveness was the total number of high-emitting vehicles identified through remote sensing. Three primary factors impacted the total number of vehicles identified. These included the number of remote sensing vans in operation, the number of days those vans were on the road collecting data and the number of sites used to collect data.

The start-up of the HEP was timed to coincide with the launch of the State's RapidScreen Program. This program utilized remote sensing to identify clean vehicles and opt them out of having to go to an Envirotest station to get an emissions test. The HEP planned on using this network of remote sensing vans to also identify high-emitters. However, the implementation of the RapidScreen Program was delayed. At the start of the HEP in May 2003, only one CDPHE

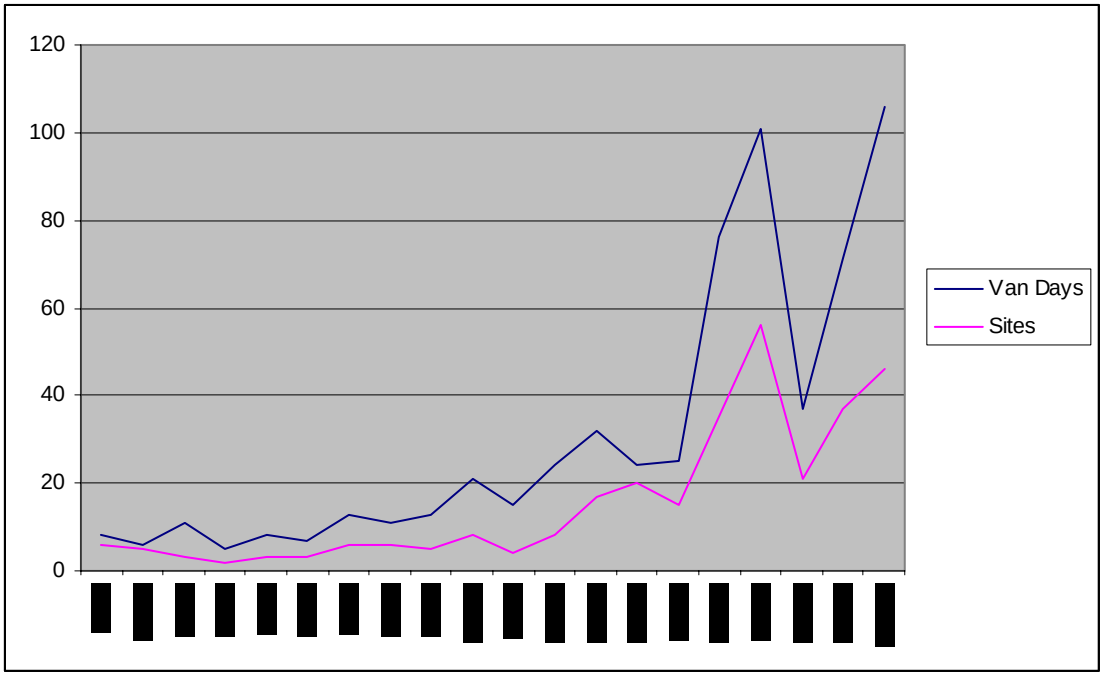
staffed remote sensing van was deployed to identify high-emitters. When the RapidScreen Program officially began in September 2003, only 1 – 3 vans were on the road at any time. This initial slow implementation limited the number of high-emitters identified and reduced program efficiency. As the RapidScreen Program matured and more vans were added and van days on the road increased, the number of high-emitters identified increased.

Additionally, as the program was phased in, the vans were not deployed every day. Over time, the equipment was deployed more often which also led to more high-emitter identifications.

Another factor was the number of sites visited by the vans. As the program added more permitted remote sensing sites, remote sensing coverage increased across the Denver metro area. By visiting as many sites as possible, the RapidScreen vans identified more discrete vehicles across a wider geographic area.

By the end of the HEP, there was an average of 5 active vans collecting data across the region. Figure 2.1 show the increase in van days and permitted sites over the course of the program.

Figure 2.1 – Van Days and Sites Utilized



The increased number of vans on the road and the additional permitted sites led to a significant increase in the number of records collected on a per wave basis (each program mailing is a wave and accounts for approximately one month's worth of remote sensing data). Figure 2.2 shows that the number of raw records correlates with the increased van days and permitted sites throughout the program's 20 waves.

Figure 2.2 – Raw Records by Wave

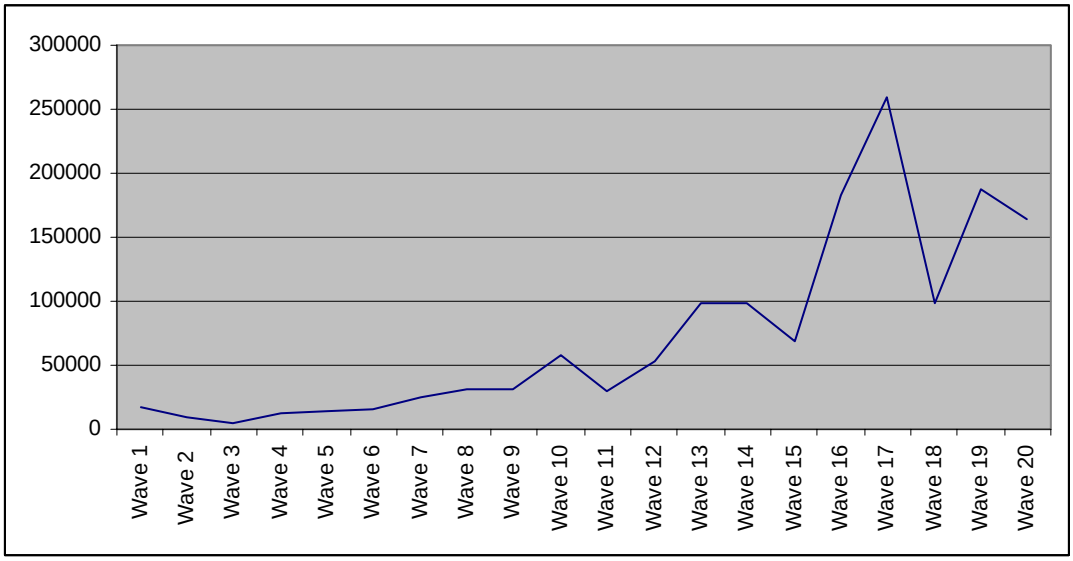


Table 2.3 below shows the number of raw records collected by the RSD4000 through the RapidScreen Program and provides a measure of the equipment's effectiveness for waves 4 – 20. Waves 1 – 3 were removed from the data set since vehicles were identified using different types of remote sensing equipment and methodology.

Table 2.3 – RSD4000 Performance (Waves 4 - 20)

	Number of Records	**Percentage**
Van Days	589	
Raw records	1,425,523	
Usable records	537,585	37%
HC records meeting criteria	3,995	0.74%

The data in this section indicates that more vans on the road for more days increases the number of high-emitters identified. However, one issue detailed in Table 2.3 that could also increase the number of high-emitters for the program is addressing the 37 percent usable records rate. This indicates that a high percentage of records are discarded for a variety of reasons that can include invalid remote sensing readings, inability to match the license plate to a registration record, out-of-state license plates or obscured license plates.

Recommendations:

Investigate the RSD4000's usable records rate to determine if the usable records rate can be improved.

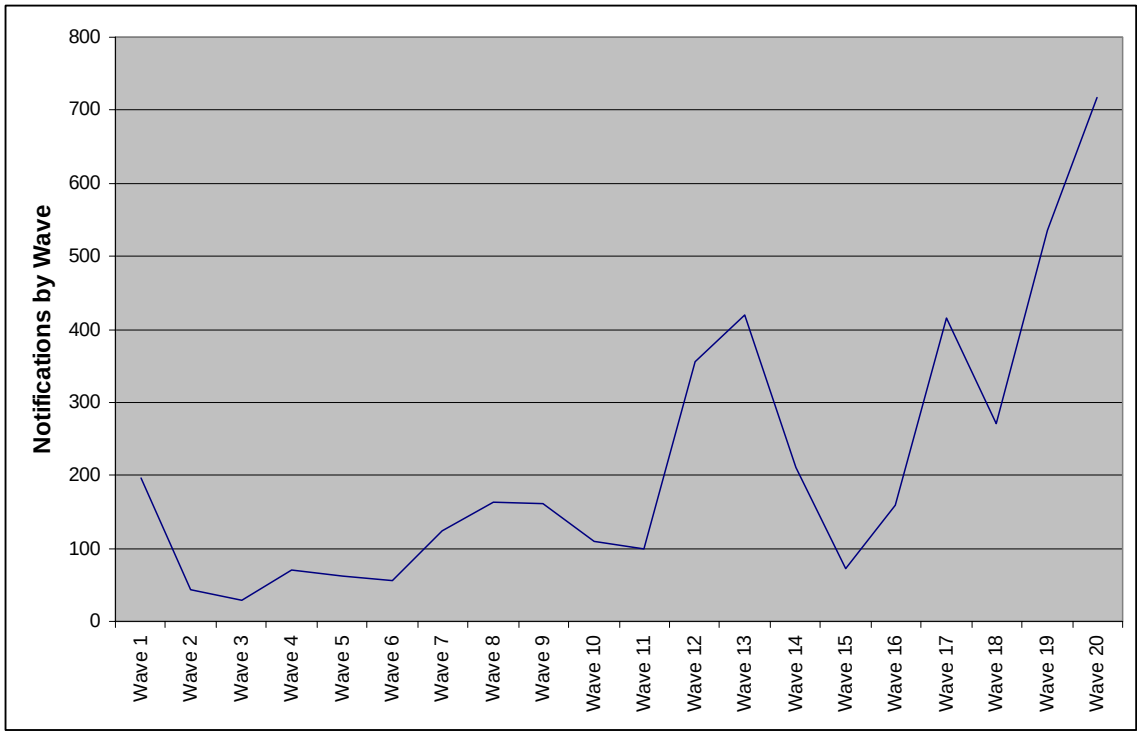
Notification & Participation

The HEP utilized a number of data sources at the beginning of the program but transitioned to only using the RapidScreen Program once that program was implemented. The data gathered from the various sources was provided to CDPHE to perform registration matches and qualify vehicles into the program. CDPHE then provided the data to the RAQC to mail solicitations to

potential program participants. Waves 1 through 20 are detailed below in Figure 3.1. Wave 1 had an accumulation of data from a number of months and different sources due to the delayed implementation of the RapidScreen Program. Each wave is approximately one month's worth of data.

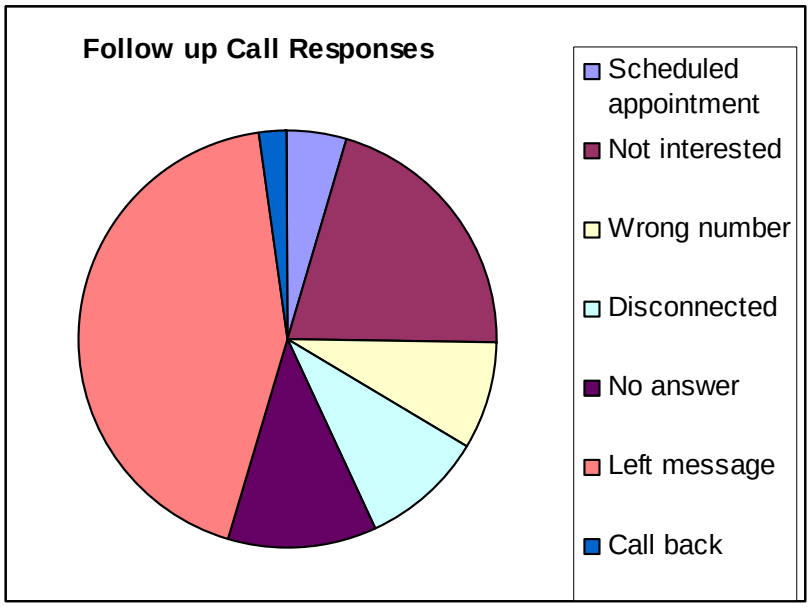
Overall, CDPHE provided 4,267 qualified participants to the RAQC for notification that they were eligible as high-emitters of HC. Figure 3.1 below shows the total number of notifications by wave. Of this total, 385 mailers (9 percent) were returned due to incorrect addresses. Therefore, only 3,882 mailers reached the intended motorist.

Figure 3.1 – Notifications by Wave



Once the initial contact letter was sent to potential program participants, interested motorists were directed to call the RAQC for scheduling into CDPHE Emissions Technical Centers (ETC) for a confirmatory IM240 emissions test. One week after the initial letter was sent to potential participants, a second follow-up letter was sent as a reminder to all non-respondents. A week after the follow-up letter was sent; RAQC staff called all non-respondents as a final reminder to participate in the program. Figure 3.2 shows the outcomes of those calls

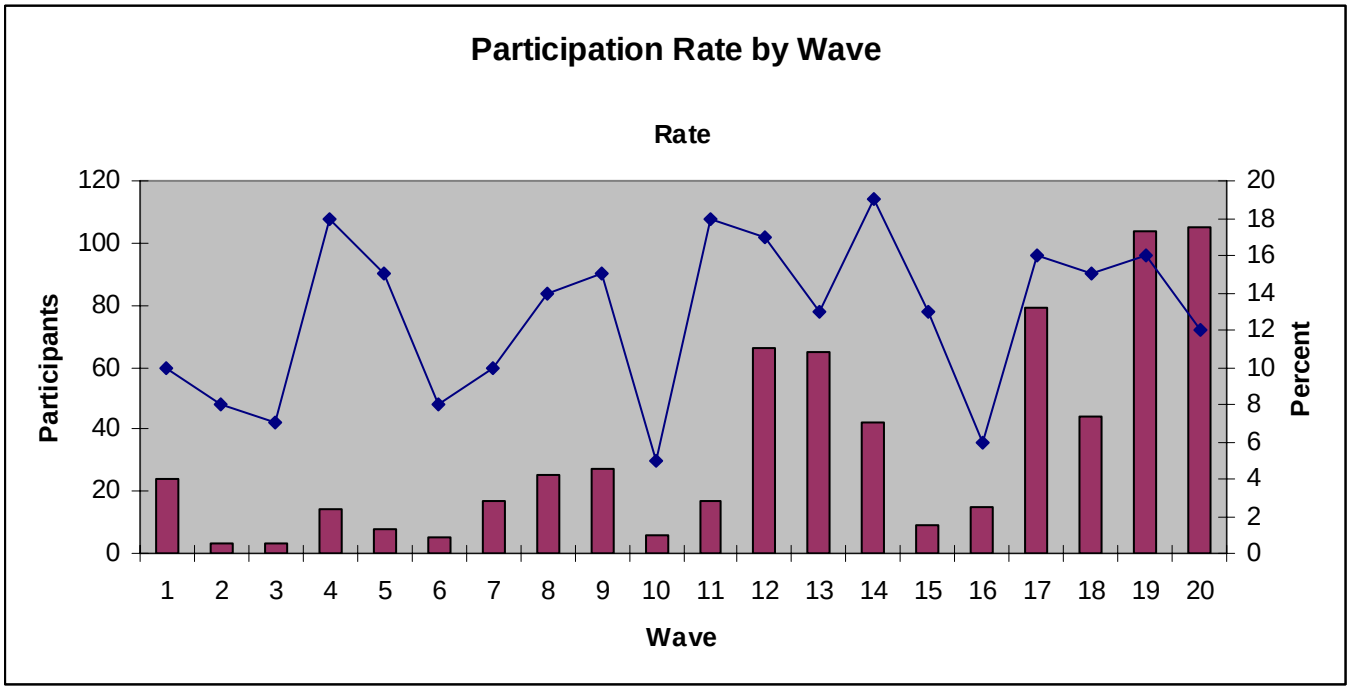
Figure 3.2 – Follow-up Call Responses



Overall, the call effort was effective in adding participants to the program. Through Wave 20, 643 calls were attempted. Thirty of these calls, or 5 percent, resulted in appointments being made.

Overall, all three points of contact were critical for increasing program participation. Throughout the program, contact efforts resulted in 668 motorists responding to program solicitations. Of the 668 respondents, 132 did not show up for their appointment, sold their vehicle, or had their vehicle break down permanently. Figure 3.3 shows the 536 participants per wave and the overall participation rate.

Table 3.3 – Participation by Wave (n = 536)



As the table shows, the participation rate was between 5 – 19 percent for all waves with an overall average of 14 percent. Several options were identified to help increase program participation.

During the beginning waves of the program the initial letter was sent out on RYAC letterhead. This led to many questions from the public regarding the program's legitimacy. Starting with Wave 9, the program packet included the initial contact letter on State letterhead and program articles from the Rocky Mountain News. This led to a small increase in participation.

Another option explored to increase participation was to change from a completely voluntary program to a more compulsory program with registration-based enforcement and fines. However, program partners believed that strengthening the letter to include language indicating high-emitting vehicle owners were violating State Statute and may fail their next required emissions test was the most appropriate choice for future mailings.

A final area that should be addressed in the future is how to contact non-English speaking potential participants. If a non-English speaker called to participate in the program, staff did not have the ability to effectively communicate with them. Future efforts should involve translated materials and potentially a contracted translator to handle non-English speaking participants.

Recommendations:

A number of improvements can be made to increase the effectiveness of notification efforts. These include:

- Strengthening the letter sent to potential program participants;
- Potentially requiring program participation through a compulsory program that includes fines and registration based enforcement; and

- Improving the ability to contact non-English speakers.

Outreach Effort

Outreach initiatives were ongoing throughout the program but limited due to funding. A widely covered media kickoff event was held at the beginning of the program to increase public awareness. However, media coverage decreased as the program continued and was a contributing factor to the low participation rate.

Program efforts to increase public awareness included advertising on the Internet, RTD bus stop advertisements and through state and local government employee and citizen newsletters. This was a small scale effort and ultimately had little impact on the program.

In future efforts, an effective public relations campaign should be implemented to increase program participation. Further initiatives such as new program materials, development of a new website, Spanish translation of all materials and community events teamed with other RAQC programs will be implemented in effort to improve program effectiveness. Additionally, the RAQC and CDPHE will continue their efforts to partner with local governments to notify employees and citizens about the program.

Recommendations:

A number of improvements can be made to increase public awareness of our efforts. These include:

- A sustained, large scale media outreach effort to educate citizens in the Denver metro area to continuously educate and remind citizens about the Repair Your Air Campaign, and;
- A coordinated effort to partner with local governments to notify employees and citizens about the program through local government outreach efforts.

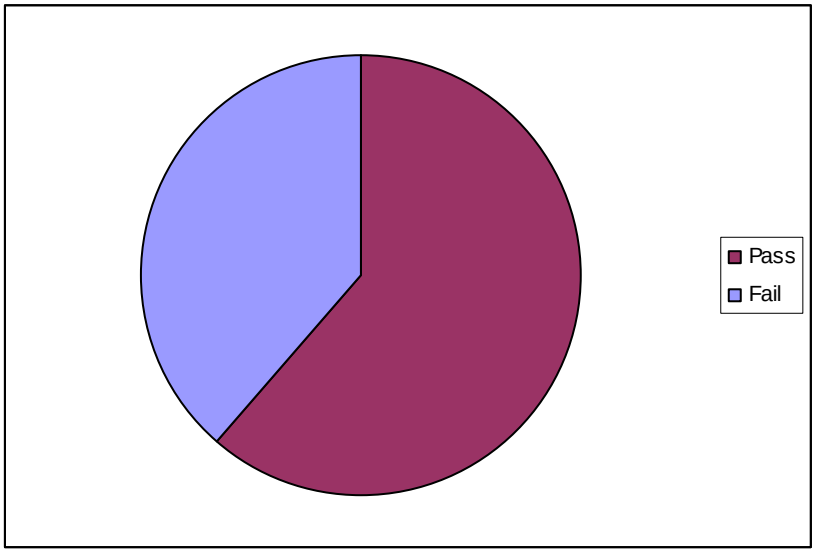
Testing Effort

After a vehicle was identified as a high-emitter and the owner called to participate, the vehicle was given a series of IM240 emissions tests at a CDPHE ETC. All vehicles received a confirmatory, pre-repair IM240 emissions test. If the vehicle passed, the vehicle did not qualify for the program and the owner was given a $10 gas coupon from Valero. If the vehicle failed, it officially qualified to be repaired under the program. After the vehicle was repaired, it was given a post-repair IM240 test to ensure that the repairs were effective in reducing emissions.

Of the 668 respondents that signed up to participate in the program, 536 showed up for testing. Of these vehicles, 18 were rejected due to safety reasons or inability to test the vehicle on the dynamometer. Another 16 vehicles did not complete the required program process and were dropped from the data set due to incomplete data on the vehicle. Overall, 502 vehicles completed the required program emissions testing and procedures to be included in this analysis.

Figure 5.2 shows the results of the IM240 testing efforts. Of the 502 vehicles tested, 194 failed the IM240 testing and were confirmed to be high-emitters. This equates to a 61 percent mis-identification rate.

Figure 5.2 – IM240 Testing Results



While this rate seems high, mis-identification occurred for a number of reasons. These reasons included:

- Requiring only one valid remote sensing reading;
- Cold start identifications where a vehicle is identified by the remote sensor as a high-emitter prior to the engine reaching proper operating temperature;
- A vehicle owner repairing the vehicle after it is identified as a high-emitter but prior to its confirmatory IM240 test;
- The variability of vehicle emissions and test results; and
- RSD technology software issues related to high-emitter identification.

The mis-identification rate experienced during this project was not unexpected since the goal was to bring in as many vehicles as possible to reduce ozone for the 2003 season. Addressing the high mis-identification rate will be more critical for the second phase of this effort since it will be a test bed for a full-scale high-emitter program. The second phase should implement measures to enhance the accuracy of high-emitting vehicle identification. These measures include increasing the number of valid readings required to qualify for the program, site analyses, potentially using an index to screen those vehicles and attempting to reduce cold start identifications.

Data indicated that utilizing an identification protocol of two valid remote sensing readings would lower the mis-identification rate. By combining two remote sensing readings with an index, a matrix that opts out vehicles by make and model year that are shown to be historically clean in the Envirotest lanes, the mis-identification rate could be further reduced. As an example, the index would show that newer model year vehicles consistently pass the IM240 test. Since these newer vehicles are historically clean, these vehicles would not be solicited to participate in the program.

To reduce the number of cold start identifications, a site-by-site analysis should be performed to determine which sites are marginal and mis-identifying the most vehicles. Experts theorized that sitting RapidScreen vans near neighborhoods resulted in more cold start identifications

because vehicle owners did not properly warm up their vehicles prior to driving past a remote sensing unit. Those sites that have high mis-identification rates could be eliminated from providing high-emitter data.

Recommendations:

A number of improvements can be made to minimize mis-identification rates in future efforts. These improvements include:

- Changing the current identification strategy from one valid remote sensing reading to two or more valid readings;
- Potentially utilizing an emissions index;
- Using an in-depth site-by-site analysis to determine where false failures are occurring in the metro area and elimination of those sites as sources of high-emitter data;
- Questioning of participants to determine if they have performed repairs on their vehicle prior to confirmatory testing; and
- Continuing the improvement of the RSD technology through high-emitter identification.

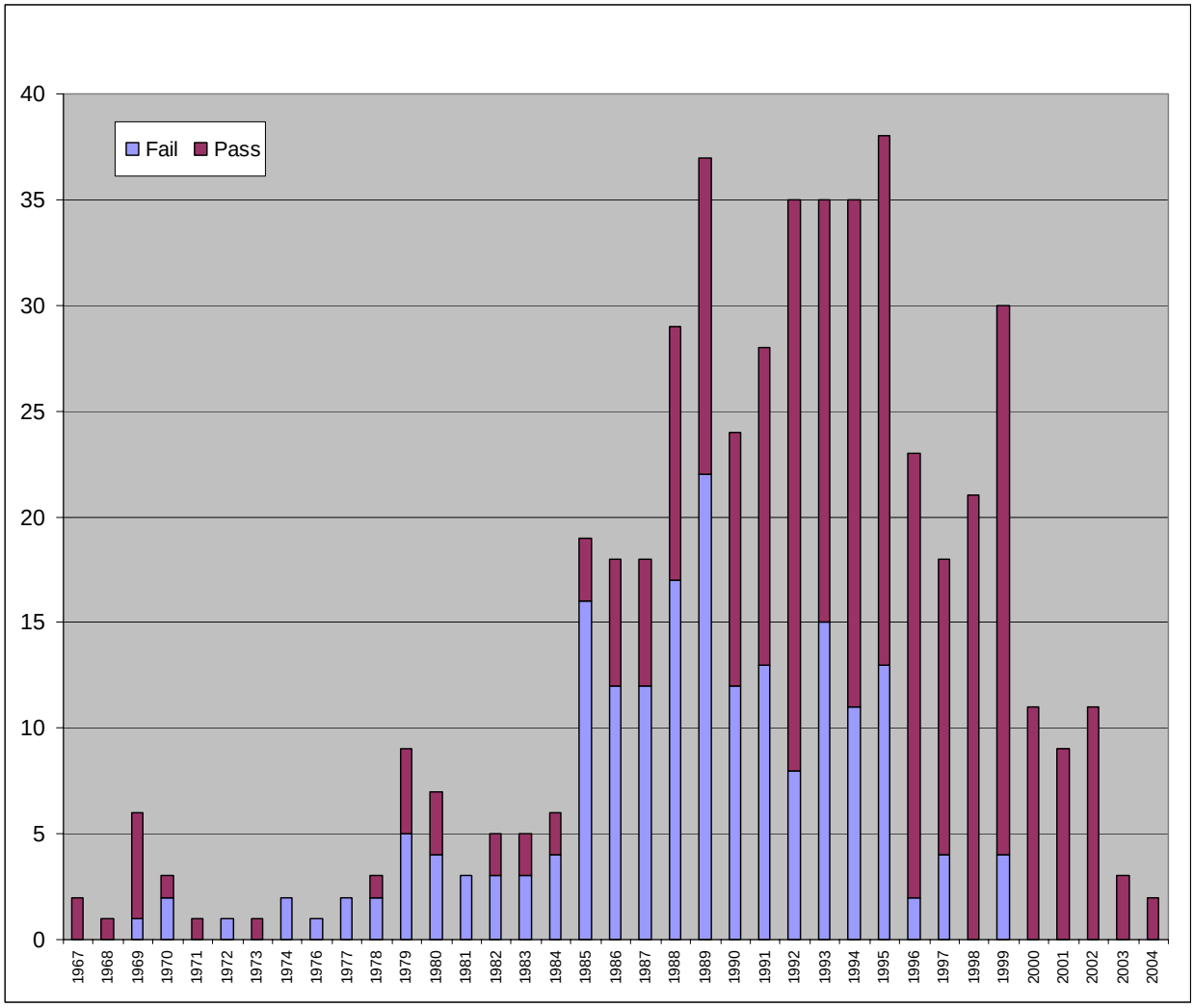
Repair Statistics

An analysis was performed to determine the demographics and repair details of all vehicles repaired through the program. On average, repaired vehicles in the program were:

- 1988 average model year; and
- Averaging 130,000 miles.

Table 6.1 shows the range of vehicle model years that came through the program and their fail and pass rates. The majority of failures occurred between 1985 – 1995 and no vehicles between 2000 – 2004 failed the initial confirmatory IM240 test in this program.

Table 6.1 – IM240 Testing Results by Model Year



Overall, the types of repairs performed on program vehicles fell into two categories; tune-ups and emissions equipment repairs. Many tune-ups required changing engine oil, replacing distributor caps and spark plugs and cleaning engine components. The top repair in the program was replacing spark plugs. Over 100 vehicles received this tune-up.

The other repair category, emissions equipment repairs, included replacement of catalytic converters and oxygen sensors. The second highest repair category was the replacement of 79 catalysts. Some vehicles fell into both categories. Appendix A contains tables detailing all of the emissions related repairs performed during the program and information regarding the "Top 10" highest emitters and their repairs.

Table 6.2 shows the mean and median of pre-repair emissions by HC, CO and NOx. The pre-repair emissions tests for HC show a mean of 6.46 grams per mile and a median of 2.69 grams per mile.

Table 6.2 – Pre-repair Emissions Statistics (n=194)

	Mean	Median
Hydrocarbons	6.46	2.69
Carbon Monoxide	40.64	19.78
Nitrogen Oxide	2.19	2.01

Table 6.3 details the mean and median of post-repair emissions by criteria pollutant. The post-repair emissions tests for HC show a mean of 1.35 grams per mile and a median of 0.69 grams per mile.

Table 6.3 – Post-repair Emissions Statistics (n=194)

	Mean	Median
Hydrocarbons	1.35	0.69
Carbon Monoxide	12.08	5.08
Nitrogen Oxide	1.63	1.18

The table below provides the overall emissions reductions for the program and indicates program repairs reduced HC an average of 5.1 grams per mile. By measuring the emissions reductions of the 194 vehicles in the data set, an estimate can be made of the annual emissions reductions. On an annual basis, the program resulted in a reduction of approximately 13 TPY of HC, 76 TPY of CO, and 1.4 TPY of NOx. Benefits for the program are estimated to last two years and equate to a program lifetime emissions benefit of 27 TPY of HC, 153 TPY of CO and 3 TPY of NOx.

Table 6.4 – Reduction by Pollutant (n=194)

	Pre-Repair (gr/mi)	Post-Repair (gr/mi)	Reduction (gr/mi)	TPY*
Hydrocarbons	6.46	1.35	5.11	13.64
Carbon Monoxide	40.64	12.08	28.56	76.28
Nitrogen Oxide	2.16	1.63	0.53	1.42

*The methodology used to calculate TPY utilizes the gram per mile emissions reduction multiplied by an annual average vehicle miles traveled of 12,500.

Of the 194 vehicles in the data set, the repair costs totaled approximately $64,000. This total included parts costs and private repair shop technician time. Overall, the average repair cost equated to $330 per vehicle. This is lower than the $500 average estimated at the time of program implementation.

One issue that hampered the HEP repair process was the slow data reporting process developed for the program. Paperwork moved slowly through the system and overwhelmed the staff inputting the data for analysis. In addition, the data provided for vehicle repairs made it difficult to track repair sequences and overall time spent repairing vehicles. This must be rectified in future efforts.

Recommendations:

Improve the repair process to include a more efficient data reporting process that captures repairs by type and tracks time spent on each vehicle.

HEP Conclusions

Overall, the program performed within its design parameters and resulted in demonstrable emissions reductions at a reasonable cost. The average reduction for HC was approximately 5.1 grams per mile. Repairs cost an average of $330 per vehicle, which was below the $500 average repair cost estimated at the time of program implementation.

Several critical areas will be assessed in the future. Increasing participation by strengthening the contact letters and more extensive outreach should be implemented in the future. It is also important to reduce the mis-identification rate. This will be done through site analysis and a more rigorous identification protocol. These initiatives will help further the analysis required to successfully implement a full-scale high emitter identification program.

Smoking Vehicle Enforcement Program

Background

The SVEP was designed to be an outreach/education and training program for local government law and code enforcement staff to implement and enforce smoking vehicle ordinances. The goal of SVEP was to influence local governments to implement a smoking vehicle program requiring smoking vehicle owners to repair their vehicle.

The goal was to use local law enforcement, or code enforcement staff, to identify and ticket smoking vehicles. The vehicle owner would then be required to repair the vehicle to eliminate visible smoke. The RAQC developed program elements to meet the goals of SVEP that included:

- Local Government Outreach Program - The RAQC educated local governments about the detrimental effects of smoking vehicles in an effort to encourage implementation of a smoking vehicle program. These presentations were directed to elected officials, law enforcement and other stakeholders.

- Promotional Materials - Fact sheets, brochures, press releases and RAQC web site updates were provided to stakeholders.

- Inspector Training - The RAQC provided training for local governments interested in a SVEP. This training focused on program development, smoke identification and vehicle inspection before and/or after repair. Handouts were created for the trainers to use in educating their organizations' law or code enforcement staff.

- Model Ordinance Development - During our stakeholder process, many local governments indicated they did not have a smoking vehicle ordinance in place. As part of our efforts to encourage local governments to implement a smoking vehicle program, RAQC staff developed model ordinances to assist with program implementation.

- Local Government Recognition Program - A special recognition program would be planned and administered to highlight local government efforts to address smoking vehicles.

Results

In 2003, RAQC staff began meeting with various stakeholder groups and local governments to discuss the feasibility of implementing a smoking vehicle enforcement program. RAQC staff gave numerous presentations and received feedback from local governments on their interest in initiating this type of program. Throughout 2003 – 2004, local government feedback indicated that the majority of local governments had limited budgets and resources to utilize toward a smoking vehicle enforcement program.

In 2005, RAQC staff administered a comprehensive phone survey to local governments throughout the Denver metro area. Local governments were surveyed on their interest in attending a "Smoking Vehicle Training" and/or implementing an enforcement program. Of the local governments surveyed, six were interested in attending training and receiving more information.

RAQC staff planned and administered a "Smoking Vehicle Training" in August 2005. The City and County of Denver, which currently has a smoking vehicle enforcement program in place, outlined the program costs, benefits and effectiveness of their program. The RAQC presented information on how to leverage grant funds for program start up and implementation. The RAQC discussed the program benefits including air quality benefits, enhanced driver safety and the additional revenue growth that would be derived from such a program. CDPHE provided a "smoke training" and all attendees were trained to identify different levels of tailpipe smoke density. Informational packets including fact sheets, grant funding opportunities, other existing program information and contact information were distributed.

One week after the "Smoking Vehicle Training," each attending local government received a follow up call to determine if the RAQC could assist in leveraging grant funds or provide program development assistance. Through these calls, the RAQC determined that local governments were not interested in implementing a smoking vehicle enforcement program due to limited budgets and staff resources.

Due to the limited success of the SVEP, a local government recognition program was eliminated from the final work plan. There were not any local governments that adopted the model ordinance into their regulations or that could fund an enforcement program. The RAQC continues to provide information to inquiring local governments via stakeholder groups, presentations and the RAQC's website. The RAQC will continue to address smoking vehicles as an air quality issue with the goal that some local governments will eventually implement an identification and enforcement program.

Recommendations:

Continue to provide SVEP information to local governments.

Program Budget

Table 7.1 details the overall program budget. The program administration line-item covers costs associated with both the HEP and SVEP. The Car Care Fair cost is included under local cost-share since these RAQC costs were part of the match to get the CMAQ Grant. The total project cost was $225,000 in federal funding with $222,000 in local cost-share for a total project cost of $447,000.

Table 7.1 – RYAC Program Budget

	Totals
CMAQ Grant	
Program Administration	$113,186
Repairs	$63,747
Rentals	$24,913
Materials	$23,154
Subtotal	**$225,000**
Local Cost-Share	
Program Administration	$212,000
Car Care Fairs	$10,000
Subtotal	**$222,000**
Total	**$447,000**

Conclusion

Overall, the Car Care Fairs and HEP were successful efforts with quantifiable emissions reductions. These program elements achieved the goals of reducing emissions while educating vehicle owners about vehicle maintenance. By implementing the recommendations listed in this report, these efforts can be more effective in the future.

The SVEP met the goal of educating local governments about the importance of identifying and repairing smoking vehicles in the Denver metro area. Unfortunately, budget restrictions limited the ability of local governments to implement a full-scale effort to address this problem. The RAQC will continue to pursue opportunities to implement these types of programs in the future.

Appendix A

There are two tables included in the Appendix. The first table is a categorization of repairs administered on participant vehicles throughout the duration of Repair Your Air I listed in order of frequency.

The second table shows the "Top 10" highest emissions-reductions vehicles. This table indicates vehicle year, make and model. The following pollutant reductions: hydrocarbon, carbon monoxide and nitrogen dioxide, are listed and show before and after repair emissions reductions.

Repair Specific	Count
Ign Sparkplugs	100
Emis CAT	79
Ign Wires	46
Comp O2 Sens	44
Eng Decarbon	39
Ign Cap Rotor	34
Emis EGR	26
Fluids Oil	23
Ign Timing	22
Fuel Air Filter	21
Emis EVAP	20
Fuel Vacuum Leaks	19
Emis PCV	16
Emis AIR	15
Carb Over Haul	14
Ign Coil	13
Carb Adjustment	9
Eng Valve Adj	9
Inj Replacment	8
Carb Other	8
Comp ECM	6
Comp MAF Sens	6
Cool Therm	6
Inj Cleaning	6
Fuel Filter	5
Fuel Fuel Pump	5
Emis Gas Cap	4
Inj Pressure Adj	4
Carb Alt Comp Valve	3
Comp M/C Syl	3
Fuel Reroute Vacuum lines	3
Ign Dist	3
Fuel Leaks	3
Ing Points and Condensor	3
Eng Internal	3
Carb Decel Valve	2

Comp Coolant Temp Sens	2
Ign Other	2
Ign Vacuum Advance	2
Comp Intake Air Temp sens	1
Comp TP Sens	1
Radiator	1
Fluids OPS	1
Fuel Pressure Regulator	1

YEAR	MAKE	MODEL	Pre HC	Post HC	HC Redux	Pre CO	Post CO	CO Redux	Pre NOX	Post NOX	NOX Redux	Repairs
1982	Ford	F150	67.9741	6.3993	**6.4**	469.766	53.312	**416.45**	0.1293	4.2181	**4.09**	Carb overhaul, PCV, Spark Plugs, Oil change
1989	Geo	Spectrum	52.5207	0.5097	**52.01**	92.4333	13.6622	**78.77**	0.3494	0.7899	**0.44**	Spark plugs, oxygen sensor, reroute vacuum lines
1982	Chevrolet	Nova	38.2294	3.7245	**34.5**	89.2683	68.1964	**21.07**	5.5157	2.5968	**2.92**	Carb overhaul, Spark plugs, oil change, air filter
1994	Mazda	626	34.7911	0.9566	**33.83**	33.2499	3.1882	**30.06**	3.0743	0.895	**2.18**	Catalytic converter, wires, cap/rotor replacement, air filter
1985	Cherokee	American	33.5988	2.1738	**31.43**	250.1284	9.4885	**240.64**	0.2377	4.1881	**3.95**	Carb overhaul, spark plugs, oxygen sensor
1999	Ford	F150	26.7184	0.1732	**26.55**	30.1	0.2431	**29.86**	2.5577	0.4478	**2.11**	Spark plugs, coil replacement, oxygen sensor, catalytic converter
1988	Dodge	Aries	26.3106	1.0591	**25.25**	187.5298	2.6887	**184.84**	0.1896	0.8899	**0.7**	ECM, Timing, catalytic converter, decarbon treatment
1990	DATS	720	24.2942	0.4423	**23.85**	66.1747	7.5088	**58.67**	1.4796	0.1215	**1.36**	Wires, cap/rotor replacement
1982	MERZ	280	23.7922	0.5534	**23.24**	35.3138	2.4775	**32.84**	3.3525	2.5374	**0.82**	Spark plugs, cap/rotor replacement, evaporative system repaired
1989	Toyota	Corolla	25.0941	2.4933	**22.6**	31.6145	22.6773	**8.94**	1.6693	2.1725	**0.5**	Spark plugs, wires, cap/rotor replacement