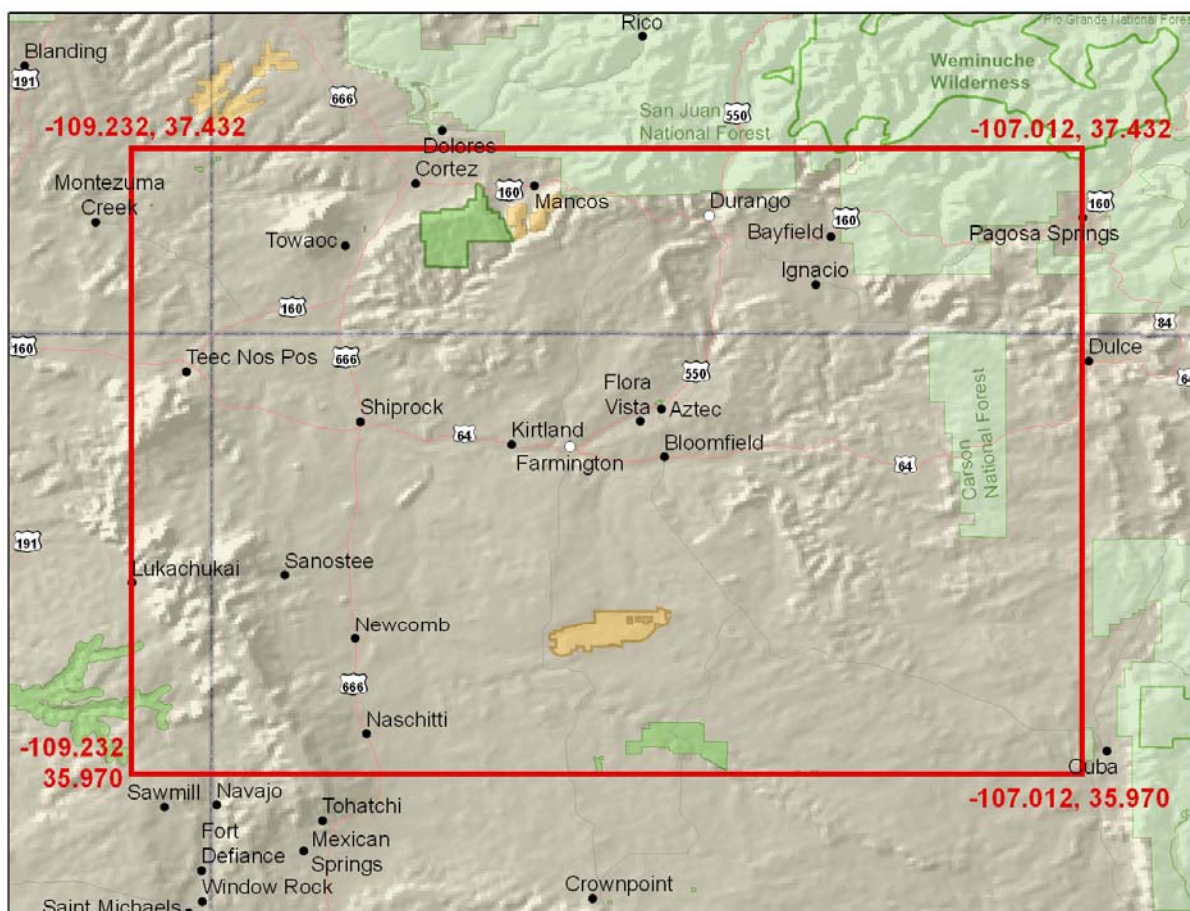


OTHER SOURCES SECTION

Four Corners Air Quality Task Force Report of Mitigation Options



November 1, 2007

The report is a compilation of mitigation options drafted by members of the Four Corners Air Quality Task Force. This is not a document to be endorsed by the agencies involved, but rather, a compendium of options for consideration following completion of the Task Force's work in November 2007.

**Other Sources
Table of Contents**

Preface 1
 Phased Construction Projects 2
 Public Buy-in through Local Organizations to push for transportation alternatives and ordinances. 4
 Regional Planning Organization for the Four Corners..... 5
 Develop Public Education and Outreach Campaign for Open Burning..... 6
 Automobile Emissions Inspection Program..... 7
 Low Reid Vapor Pressure 12
 Use of Reformulated Gasoline 15
 Idle Ordinances 18
 School Bus Retrofit..... 22
 Subsidy for Cleaner Residential Fuels 24
 Stage One Vapor Recovery 27
 Stage Two Vapor Recovery and Vehicle On-board Refueling Vapor Recovery Systems..... 30
PUBLIC COMMENTS 35

Other Sources: Preface

Overview

The Other Sources Work Group was charged with analyzing emissions mitigation strategies from all industrial, residential and transportation sectors that have emissions that significantly impact air quality in the Four Corners region. Although the work group was small, participation in the group involved state, local and tribal air quality agencies, industry representatives, public citizens, and representatives of environmental organizations.

Organization

The members of the Other Sources Work Group decided to focus on four main topic areas:

1. Transportation, including mobile sources
2. Land use, development, and planning
3. Burning
4. Alternative energy and fuels

Mitigation options for transportation issues included the following: including multi-modal transportation options in the 2035 transportation plan, including the Four Corners region into the Clean Cities designation for the Western Slope, encouraging local organizations to push for new projects and ordinances for transportation issues, developing requirements for anti-idling, school bus retrofits, increasing taxes for dirtier vehicles, developing a regional inspection and maintenance program, retrofitting or replacing oil and gas fleet vehicles, and looking at the Reid vapor pressure of fuels.

For land use, development and planning, the group discussed the consistency of regulations between jurisdictions for construction and sand and gravel operations, developing a regional planning organization for the region, phasing of projects to minimize blowing dust from bladed tracts of land, and developing a fugitive road dust plan.

Burning is handled very differently among the different jurisdictions in the Four Corners region. Mitigation options discussed for burning included public education and outreach, regulating agricultural burning in the Colorado portion of the region, providing a subsidy for cleaner fuels for residential heating, and using filter traps on wood stoves.

The alternative energy and fuels options were developed in conjunction with the Power Plants work group, and are included in the Energy Efficiency, Renewable Energy and Conservation section of this document.

Mitigation Option: Phased Construction Projects

I. Description of the mitigation option

Construction projects remove large quantities of vegetation leaving bare earth open to wind erosion, as well as to other environmental and biological degradation. Phasing these projects, large and even single residential development could lessen this environmental problem. Phasing re-vegetation would also result in decreased wind erosion.

Since phasing includes both small and large projects, this is something that individuals can have a part in as well as participating in for the larger community.

Benefits:

- Air quality – Particulate matter would decrease, protection of scenic views and economic benefits for tourism
- Environmental – Globally desertification is a big concern. The decrease in wind-blown particulates could delay man-made local desertification.
- Economic—construction would be phased according to building. Therefore, upfront costs would be also coordinated with sales, rather than all at the project beginning. Construction loans would also be phased.

Burdens:

- Developers may see change in methods as a threat to free enterprise.
- Construction managers would have to keep grading machinery on site locations throughout the project.

II. Description of how to implement

A. Mandatory or voluntary

Both. Mandatory for new construction. Incentives for individual homeowners to plant vegetation on disturbed sites.

B. Indicate the most appropriate agency(ies) to implement

Counties and towns in land use regulations, building permits. Local and state agencies may also implement programs for free compost or vegetation (e.g., native trees or shrubs for lot sizes over 1 acre).

III. Feasibility of the option

A. Technical – High

B. Environmental – High

C. Economic – High – may result in higher costs for construction projects in some areas.

IV. Background data and assumptions used

Help from monitoring work group to collect data downwind of

V. Any uncertainty associated with the option (Low, Medium, High) – Low

VI. Level of agreement within the work group for this mitigation option.

VII. Cross-over issues to the other source groups

Oil and gas and power plant work groups may look at phased development and revegetation for new projects.

Mitigation Option: Public Buy-in through Local Organizations to push for transportation alternatives and ordinances

I. Description of the mitigation option, including benefits and burdens.

Involve existing local organizations in supporting alternative transportation options. Go to meetings of existing organizations and discuss how they can help to promote clean air. Examples of the type of projects local organizations might support include bike paths, bike racks on buses, carpool lanes, and ride-share.

Benefits of applying this option might include reduced traffic congestion, reduction of fuel use, and boosts to local neighborhood economies. Burdens would be minimal though there may some tax increases may be necessary to fund the projects.

II. Description of how to implement

This would be a voluntary option. Agencies and task force members would implement by participation in local meetings. Publicity to encourage participation in organizations and support for alternatives might also be used. States could use these partnerships as early action compacts for State Implementation Plans.

III. Feasibility of the option

This option would be easy to implement because it is voluntary. While there may be some minimal cost for agencies to participate in local meetings it would be within their mission and a positive use of tax dollars.

IV. Background data and assumptions

The simplicity of this option requires no background analysis. It is assumed that individuals would make the effort to partner with local organizations.

V. Any uncertainty associated with the option

There is little uncertainty that this would be a viable and effective option.

VI. Level of agreement within the Work Group for this option

All work group members agree that this is a worthwhile option.

VII. Crossover issues to other workgroups

Involvement in planning for employee ridesharing may crossover to the Power Plant and Oil and Gas groups.

Mitigation Option: Regional Planning Organization for the Four Corners Region

I. Description of the mitigation option

The Four Corners region has a number of different jurisdictions and requirements. The air quality issues in the region are more widespread than local jurisdictions or agencies can address without working together as a regional planning organization (RPO). What occurs in one jurisdiction affects other jurisdictions, especially with respect to air quality. Although any one jurisdiction may have a very good program, that would be unlikely to have a widespread effect throughout the Four Corners region. The synergies of a region are much greater. In not duplicating efforts, costs will be lessened. States and local jurisdictions must be committed to the work of the RPO. RPO membership should be limited to those who have regulatory authority (e.g., towns, cities, counties, tribal governments, states).

II: Description of how to implement

Members could be appointed by local and/or state governments. Officers could be voted in by the members. Member entities would include the cities/towns of Durango, Farmington, Aztec, Cortez, Bloomfield, and Pagosa Springs; the tribes of Navajo Nation, Southern Ute, Ute Mountain Ute, Jicarilla Apache; and the counties of San Juan and Rio Arriba in New Mexico and Montezuma, La Plata and Archuleta in Colorado.

Meetings of the regional planning organization would be held on a regular schedule (perhaps quarterly) and open to the public. It is important that the governors of the Four Corners states support the organization. Local agencies would brief the governors and the state agencies on the need for a work of the organization. It is possible that this organization could be set up similarly to a Council of Governments organization. One way to begin the conversation to establish the RPO would be to ask the League of Women Voters or other task force members to present this idea to the Northwest New Mexico Council of Governments. Funding could be joint from states, tribes, local governments, and potentially EPA grants.

Another option would be to house this RPO within the Western Governors Association, perhaps similarly to the Western Regional Air Partnership with a scope limited to the Four Corners region.

III. Feasibility of option

If there are 2 or 3 local champions that are willing to dedicate time and energy, this could work. Also, support of the state agencies and governors would be critical.

IV. Background data and assumptions used Assume local governments will be willing to work together on these issues.

V. Any uncertainty associated with the option (Low, Medium, High) Medium, depending on local support.

VI. Level of agreement within the workgroup for this mitigation option Strong.

VII. Cross-over issues to other source groups

No, although it is similar in focus to the Overarching mitigation option on Reorganization of EPA Regions.

Mitigation Option: Develop Public Education and Outreach Campaign for Open Burning

I. Description of the mitigation option

This option involves the development of a public education and outreach campaign that would target the practice of open burning. The goals of this mitigation option are to 1) educate the public on the health dangers associated with open burning, 2) educate the public on the environmental/air quality damages of open burning, and 3) decrease the usage of open burning in the targeted communities.

Open burning is a more serious threat to public health and the environment than what was previously believed. Burning household waste produces many toxic chemicals and is one of the largest known sources of dioxins in the nation. Dioxins are highly toxic, long-lasting organic compounds that are extremely dangerous, even at low levels. Dioxins have been linked to serious health problems, including cancers and developmental and reproductive disorders. Other air pollutants such as particulate matter, sulfur dioxide, lead, mercury and hexachlorobenzene also affect adults and children with asthma or other lung diseases. Diseases related to the nervous system, kidneys and liver have also been linked to these pollutants.

II. Description of how to implement

A. Mandatory or Voluntary: This program would be a voluntary program hosted by local agencies or environmental groups.

B. Indicate the most appropriate agency(ies) to implement: Public Health, Environmental

III. Feasibility of the option

A. Technical: There are many similar open burning education campaigns present in Colorado, therefore it would not be difficult to receive technical support for the option.

B. Environmental: Since we are aware of the environmental dangers associated with open burning, there is much research available to use in educating the public.

C. Economic: Depending on the budget of the agencies, this program should not be prohibitive or expensive.

IV. Background data and assumptions used

1. Data on emissions from open burning was pulled from the EPA's Municipal Solid Waste Web site (www.epa.gov/msw)

V. Any uncertainty associated with the option (Low, Medium, High)

Medium

Mitigation Option: Automobile Emissions Inspection Program

I. Description of the mitigation option

Automobile emissions inspection/maintenance (IM) programs are a traditional mobile source strategy to control automotive emissions. They improve air quality through the identification and repair of high emitting vehicles. Vehicles that are repaired pollute less, improving air quality. They also get better fuel economy that contributes to reducing green house gas emissions.

Inspection/maintenance programs have been used to control automobile emissions since the early 1970s. They were originally used in New Jersey, Arizona and other states as early as 1974. They have been predominantly implemented in areas that are, or have been, out of attainment for ozone or carbon monoxide.

It is estimated that in urban areas, such as Denver or Albuquerque, motor vehicles contribute one-quarter to one-half of all the anthropogenic hydrocarbon and nitrogen oxide emissions, and three-fourths of the carbon monoxide emissions. Even in rural areas, automobiles can be a source for these emissions. Control of these emissions will reduce ozone concentrations, dependent on factors such as the NO_x/HC ratio, amount of solar radiation, and meteorology/air mass movement and vertical mixing. Of importance is the fact that mobile source hydrocarbon emissions generally are higher in ozone reactivity (ability to make ozone) than other sources, such as natural gas production, thus may be important to control.

	Mobile Inventory	Total Inventory
VOC	117.5	479.4
NO_x	119.3	336.5

Source: CDPHE, Early Action Compact (EAC)

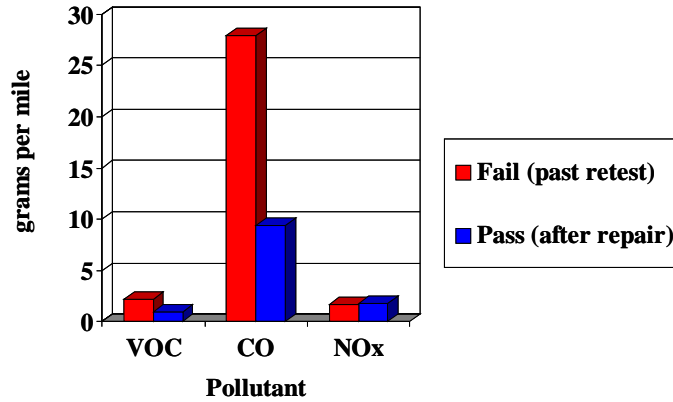
Repair Effectiveness

High emitting vehicles disproportionately contribute to mobile source emissions. Their repair is important in maintaining low overall mobile source inventories. Colorado inspection station data indicate that repairs to failing vehicles significantly reduce hydrocarbon emissions. Vehicles that failed their initial IM 240, and are later repaired, emit an average of 2.2 grams of hydrocarbons per mile. Upon passing a retest, these same vehicles emit an average of 1.0 gram of hydrocarbons per mile. This is a 57% reduction in the amount of hydrocarbons emitted by these vehicles.

Other emissions such as carbon monoxide, a weak ozone precursor, are similarly reduced. Motor vehicles that failed their initial IM 240 test, and are repaired, emit an average of 27.9 grams of carbon monoxide per mile. On a passing retest, these same vehicles emit an average of 9.4 grams of carbon monoxide per mile. This is a 66% reduction in the amount of carbon monoxide emitted by these vehicles. NO_x emissions are not emphasized in Colorado's program and are basically unchanged. Adoption of tighter NO_x emission cutpoints would result in greater NO_x benefit.

The repair effectiveness results of Colorado's IM240 program are given in Figure 1.

Figure 1
2005 COLORADO IM240 TEST RESULTS
INITIAL FAILS VS FINAL PASSING TEST
ALL VEHICLES



On-Board Diagnostics

There are many different types of IM programs and IM tests. However, a simple cost-effective IM program is an on-board diagnostics (OBD) program, either as a stand-alone program for 1996 and newer model year vehicles, or one matched with an idle or other emissions test for 1995 and older vehicles. An OBD program can also be paired with an emissions test that measure a vehicle’s emissions as well as examining their diagnostic codes. Examples of other emissions tests that may be paired with an OBD test are given in the attached appendix.

All 1996 and newer light duty vehicles are equipped with on-board diagnostics (OBD) technology. The intent of the OBD system is to monitor the vehicle’s emissions control systems while the vehicle is in operation and detect potential problems as soon as they occur. Once a problem is detected, the system notifies the motorist by turning on a malfunction indicator light along with storing malfunction specific diagnostic information in the computer. The sensitivity of the system is programmed to detect a malfunction that may cause the vehicle’s emissions to exceed 1.5 times its certification levels.

An OBD IM Program would require 1996 and newer model-year vehicles to undergo a periodic diagnostic check of all their stored trouble codes. If no malfunctions were identified the vehicle would pass. If malfunctions were identified, the vehicle would be required to be repaired. The following table identifies the IM benefit of an OBD-only program and an OBD program linked to an exhaust emissions test, in this case an IM240 test, for the Denver area fleet in 2007.

Table 2 OBD & OBD/IM240 Benefit 2007 Denver-Metro Fleet						
	No I/M (gpm)	OBD only (gpm)	% Benefit		OBD w/IM240 (gpm)	% Benefit
HC	1.364	1.313	3.7		1.25	8.4
CO	13.627	12.832	5.8		11.959	12.2
NOx	1.392	1.334	4.2		1.315	5.5

Source: CDPHE, MOBILE 6 / 2007 Denver-metro fleet

II: Description of how to implement

An on-board diagnostics (OBD) program can be implemented as a contractor operated centralized IM program, or a decentralized inspection program, or decentralized inspection and repair program. State/local/or contractor staff would undertake program design, after authority for such a program is established through the state legislature and/or regulatory boards. Enforcement would be through state or local program enforcement staff. Registration denial would be the most effective way of maintaining program compliance.

III. Feasibility of option

An OBD program either with or without an emissions test is very feasible. Currently 32 states and the District of Columbia operate such a program, or will in the near future. Additionally, new innovative OBD features, such as self-standing, self-serve OBD kiosks, and loaner radio transponders are being implemented or are under development in Washington and California.

IV. Background data and assumptions used

Emission factors were generated by the U.S. EPA MOBILE 6b model. They reflect the Denver area fleet and transportation network for 2007. Repair effectiveness data is from the Colorado IM 240 program, and represents emission data derived from load-mode transient IM 240 testing. Inventories showing mobile source contribution are for the Denver metro area. Mobile sources' contribution is expected to be less in rural areas.

V. Any uncertainty associated with the option (Low, Medium, High)

Low. OBD Programs are proven strategies. A higher uncertainty exists for add-on elements such as implementation of self-standing, self-serve OBD kiosks, and loaner radio transponders. The greatest uncertainty is the integration of the data network with vehicle registration records and county clerk renewal processes. In states, such as Colorado, with existing IM Programs this is not an issue.

VI. Level of agreement within the workgroup for this mitigation option Good general agreement.

VII. Cross-over issues to other source groups

IM (inspection/maintenance) programs offer the ability to assist in controlling mobile source contributions to ozone formation, regional haze, air toxics, and global warming. There will be little cross-over issues with other groups. An IM program could affect gasoline vehicles used in oil and gas production, or other work covered by other groups, but generally there will be minimum cross-over.

As diesel vehicles and off-road vehicles are equipped with OBD features, they could conceivably be included in their own OBD programs. On-road diesels registered in the Front Range of Colorado currently participate in an opacity IM program.

Appendices

Significant Emissions Tests

On-Board Diagnostics

This technology is installed on 1996 and newer light-duty cars and trucks. It uses the vehicle's computer to identify potential emissions problems. If a problem exists, the system is required to warn the driver by displaying a warning light. Also, a "fault code" is simultaneously stored in memory identifying the problem area. Drivers are required to visit a test station periodically to have their vehicles "scanned" for fault codes. This takes only a short amount of time. There is good accuracy in detecting potential problems with this test.

Idle Test

Initially used in New Jersey, Arizona and other states as early as 1974, emissions measurements take place while the engine is at the steady-state condition of idle. Over the years, minor changes were introduced and there are now six different idle test "types." Colorado first used this test in 1981 and still uses a modified version on heavy-duty vehicles, and older light-duty vehicles, in the Denver metropolitan program area. The major advantage of these tests is the relatively low equipment costs ranging from \$15,000 to \$20,000. The major drawback is a high level of false "passes" caused by newer technology on today's vehicles.

Acceleration Simulation Mode

In an attempt to increase accuracy, this newer class of steady-state test uses similar analytical equipment to the idle test, but also includes a dynamometer to "load" or "exercise" the vehicle at a constant speed. This test is designed primarily for states that are not in attainment for ozone.

A good example of the load applied to the vehicle during testing would be comparable to driving at a steady speed of 15 miles per hour on an eight percent grade hill, similar to the section of I-70 between the Morrison and Lookout Mountain exits, or at 25 miles per hour on a five percent grade hill, about half as steep as the previous example. The intent is to simulate an acceleration of the vehicle.

The two major positive elements of this test are the addition of nitrogen oxide emission measurements, and moderate equipment costs of \$35,000 to \$60,000.

Transient Tests

This class of test also utilizes a dynamometer but uses significantly more accurate analytical equipment and varies the vehicle speed during the inspection. The dynamometer load applied to the vehicle drive train is more similar to actual driving on a road. Test accuracy is the major positive element, with high equipment costs, often more than \$100,000 being the major drawback. Because of the cost, transient tests usually are centralized due to economies of scale. The following major options are examples of transient tests.

IM 240

The IM 240 (Inspection and Maintenance, 240 seconds) is a shortened version of the Federal Test Procedure and is used in the Denver metropolitan program area. Vehicle speed is varied between 0 and 57 miles per hour. This test generally is considered to be the best predictor of the Federal Test Procedure.

IM 93

A shortened version of the IM 240, the IM 93 incorporates only the first 93 seconds. Top speed is approximately 36 miles per hour.

BAR 31

The BAR 31 (California Bureau of Automotive Repair, 31 seconds) is another loaded mode test, which has a maximum speed of 30 miles per hour and a driving time of 31 seconds, which can be repeated up to four times before failing the vehicle.

Other Predictive Options

Vehicle "Profiling"

Vehicle profiling runs in parallel with an existing inspection program. Using current inspection information, it is possible to predict whether a vehicle is likely to pass or fail based on the year, make and model. This increases the cost effectiveness of the inspection program by reducing the amount of resources needed for a full inspection test.

Low Emitter Profile

This method attempts to identify vehicles that are likely to be relatively "clean" vehicles or very low emitters. This can be done by analyzing current inspection data and predicting the probability that a certain year, make and model vehicle will pass the test.

High Emitter Profile

This method generally attempts to identify vehicles that are likely to be "dirty" or high emitters. Once identified, either through past inspection records of a specific vehicle, or because certain years, makes and models tend to be high polluters, targeted vehicles are subject to special treatment. Usually, this includes restricting the vehicle inspections to stations with higher quality control procedures and/or increasing the test frequency, e.g., substituting an annual inspection cycle for what would normally be a biennial cycle. Colorado does not use high emitter profiling in its inspection program.

Remote Sensing Clean Screen

Rather than trying to shorten or enhance a state's emission test, this technology attempts to "pre-screen" a vehicle as it drives by a remote sensing device placed on a roadside. If multiple readings indicate the car or truck is a low polluter, the vehicle owner is exempted for one test cycle from having to visit a traditional test station. The major benefit of this program is reduced inconvenience to owners of low polluting vehicles. A drawback is that some vehicles may be exempted that would normally fail the emissions test. However, by monitoring test conditions, this can be kept to a reasonable level that still meets air quality objectives. Additional issues are described in the body of this report.

Remote Sensing High Emitter Identification

As a vehicle drives by a remote sensing device, its emissions are measured. Vehicles with high enough emissions are required to come in for a confirmatory IM inspection.

Model Year Exemption

Another method of Low Emitter Profiling is exempting by model year. For instance, it is extremely unlikely that a new vehicle will fail an emissions test during the first few years from when it was manufactured. The case has been made that it is a waste of inspection resources and an owner's time to test those vehicles. Colorado exempts new cars from testing requirements for four model years.

Mitigation Option: Low Reid Vapor Pressure (RVP) Gasoline

I. Description of the mitigation option

A major source of hydrocarbon emissions is the evaporative emissions produced by gasoline. Evaporative emissions occur during the refining process, through transportation and storage to the service station, and finally in refueling and operation of motor vehicles. The rate at which these emissions are produced is directly related to the fuel's volatility. The higher the volatility of the gasoline, the more volatile organic compounds (VOCs) are emitted at any given temperature.

One method to control gasoline evaporative emissions that contribute to ozone formation is to lower the volatility of gasoline, especially during the summer months. For most areas, summertime volatility is controlled by the U.S. Environmental Protection Agency (U.S. EPA). Under the Clean Air Act Amendments of 1990, the administrator of the U.S. EPA is charged with designating volatility standards for areas based on their air quality needs.

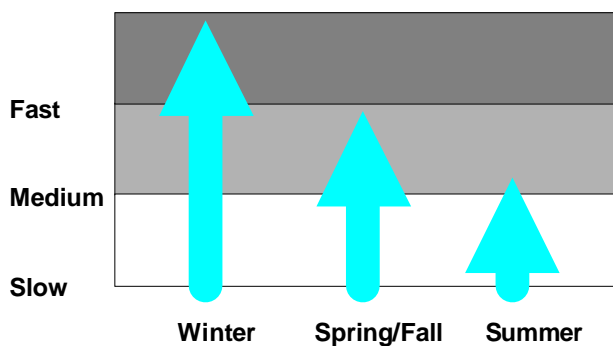
The U.S. EPA has set a gasoline volatility standard of 9.0 pounds per square inch (9.0 lbs.) for northern areas that meet the National Ambient Air Quality Standard for ozone. Air quality agencies with non-attainment areas may choose a different standard in their State Implementation Plan (SIP), or use the default standard set by the U.S. EPA.

Volatility outside the U.S. EPA controlled summer season (May 1st through September 15th) is generally controlled in most states by the American Society of Testing and Materials (ASTM) standards. These standards are set by national committees to reflect standards needed for good automotive operation and drivability.

Generally speaking, higher RVP is useful during the colder winter months to allow for easy cold weather starting and operation. Lower volatility is required during the warmer months, including summer, to prevent vehicle vapor locking and decreased drivability. The following chart shows this relationship.

Seasonal Vaporization Characteristics

Rate of Vaporization



SOURCE: Changes in Gasoline III

Air Quality Benefits of Lower Volatility Gasoline

As part of its efforts to reduce summertime ozone, the Denver area examined the benefits of lower volatility of gasoline. This analysis, part of Colorado's Early Action Compact (EAC) found that reducing gasoline RVP from 9.0 pounds per square inch (lbs.) to 8.1 lbs. would reduce mobile source evaporative emissions by 10 tons of VOC per day. Lowering gasoline volatility still further to 7.8 lbs. was found to reduce evaporative emissions by 13 tons of VOC per day. This represents a 7.8% to 10.2% VOC reduction in mobile source emissions.

Reid Vapor Pressure	Mobile Inventory	Mobile Source Benefit	Total Inventory
9.0 lbs.	128	0	489
8.1 lbs.	118	10	479
7.8 lbs.	115	13	476

Source: CDPHE, Early Action Compact (EAC)

Cost

In examining the use of lower volatility gasoline to reduce VOC emissions, it was estimated that the price of gasoline would be expected to increase by one or two cents per gallon. For the Denver area it was estimated that this would equate to \$8,600 per ton for 8.1 lb. RVP gasoline and \$13,300 per ton for 7.8 lb. RVP gasoline. Because of high ozone measurements in the summer of 2005, and the fact that Denver had been originally been designated as a 7.8 lb. RVP area by the EPA administrator in the early 1990s (though had a received a series of waivers from this requirement), the U.S. EPA reestablished the 7.8 lb. RVP requirement for the Denver area starting with the summer of 2004.

Outside of the Denver area, all of Colorado continues to have a 9.0 lb. RVP maximum for gasoline sold between June 1st and September 15th. Most of Utah (outside of Davis and Salt Lake counties) also has this summer maximum, as does New Mexico and most of Arizona (outside of part of Maricopa County). The following chart, taken from EPA's report, "Study of Unique Gasoline Fuel Blends (Boutique Fuels) Effects on Fuel Supply and Distribution and Potential Improvements," U.S. EPA 2001, diagrams the various summertime fuel specifications for different regions of the U.S.

Summertime Gasoline Requirements

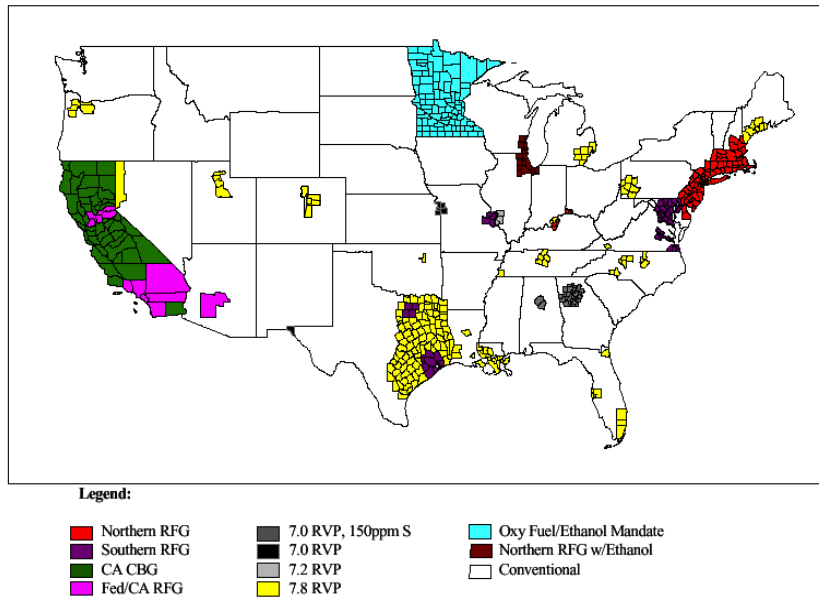


FIGURE II-1: Current Summer U.S. Gasoline Requirements

SOURCE: "Study of Unique Gasoline Fuel Blends ('Boutique Fuels'), Effects on Fuel Supply and Distribution and Potential Improvements" U.S. EPA Oct. 2001

II: Description of how to implement

Implementation of a low RVP program would be through State Implementation Plans. The various states would examine the options available, depending on air quality classification. If low RVP was required as a state program, the state would enforce the requirements. If it was an U.S. EPA program, the federal government would enforce.

III. Feasibility of option:

This option is fairly easy to develop and implement.

IV. Background data and assumptions used

A major assumption is that the Four Corners area will become nonattainment for summertime ozone, either as a result of elevated measurements, or the implementation of a new, lower, more rigorous ozone standard.

V. Any uncertainty associated with the option (Low, Medium, High) Low.

VI. Level of agreement within the workgroup for this mitigation option Good general agreement.

VII. Cross-over issues to other source groups

There does not seem to be much cross over.

Mitigation Option: Use of Reformulated Gasoline

I. Description of the mitigation option

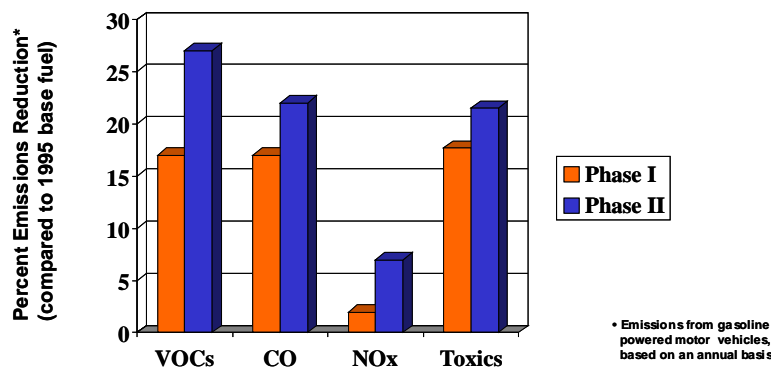
The use of reformulated gasoline (RFG) is an effective way of reducing ozone precursors from gasoline powered motor vehicles. Their use was first mandated in the nine most severe ozone nonattainment areas by the Clean Air Act Amendments of 1990. These areas included: Los Angeles, San Diego, Chicago, Houston, Milwaukee, Baltimore, Philadelphia, Hartford, and New York City. Others areas have since “opted” into the federal program. At last count, there are now 17 states and the District of Columbia that require its use. California implemented its own program beginning in 1992.

Reformulated gasoline is gasoline that has been reformulated to lower ozone precursors. While gasoline is generally formulated for the time of year or season, geographical location, altitude, and other conditions, reformulated gasoline is specifically formulated for emissions. Usually the distillation curve of the fuel (including Reid vapor pressure) is adjusted as well as other properties (light ends, olefin and aromatic content, etc.). By Clean Air Act requirement, an oxygenate, such as ethanol, is added. California reformulated gasoline goes an additional step in weighing hydrocarbon ozone forming reactivity in their performance-based standards.

Air Quality Benefits

Under the original federal specifications, the use of federal Phase I reformulated gasoline (1995) was expected to reduce hydrocarbon and air toxic emissions by 15% compared to conventional gasoline. Phase II reformulated gasoline (2000) was mandated to reduce hydrocarbon and air toxic emissions by approximately 22%.

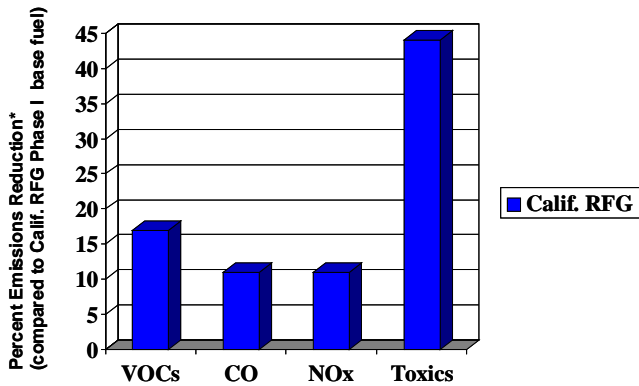
**Emissions Impacts of
RFG Phase I vs. RFG Phase II**



Source: US EPA, "Phase 11 Reformulated Gasoline: The Next Major Step Toward Cleaner Air", Nov 1999, except for air toxics, EIA/DOE

California (CA) reformulated gasoline is even a more stringent formulation. The latest Phase 3 reformulated gasoline standards, based on the CaRFG3 predictive model, are 11% to 17% lower in HC, CO, and NOx emissions and 44% for air toxics compared to the original Phase 1 specifications introduced in 1992, itself a low ozone and air toxics formulation with caps on olefin and benzene content.

Emissions Impacts of Calif. RFG Phase II/III vs. Calif. RFG Phase I



Source: Chevron: "Gas and Air Quality: Reformulated Gasoline", Chevron

California Phase 2 reform (introduced in 1996) was estimated by the California Air Resources Board (CARB) to be twice as effective as Phase I federal reform of the same era. Phase 3 reformulated gasoline is very similar to CA Phase 2 in emissions, but does not use methyl tertiary-butyl ether (MTBE), an oxygenate found to contaminate groundwater if released during fuel spills or leaks.

Cost

Reformulated gasoline is more expensive than conventional gasoline to produce (though this is less so with the implementation of federal Tier II conventional gasoline requirements beginning in 2005). The U.S. EPA estimated that Phase I federal reformulated gasoline typically cost between three and five cents per gallon more to produce than conventional gasoline, with Phase II reform costing an additional one to two cents. CARB estimated California reformulated Phase 2 gasoline to be between five and fifteen cents per gallon more expensive than conventional gasoline.

Supply issues come into play with reformulated gasoline. While most refineries can easily make it, their facilities may not always be optimized to produce it. California reform is even more subject to these limitations.

Approximately 30% of all gasoline now sold in the United States is reformulated. The following chart, taken from EPA's report, "Study of Unique Gasoline Fuel Blends (Boutique Fuels) Effects on Fuel Supply and Distribution and Potential Improvements," U.S. EPA, 2001, diagrams the various reformulated gasoline program areas, as well as summertime fuel specifications for different regions of the U.S.

Summertime Gasoline Requirements

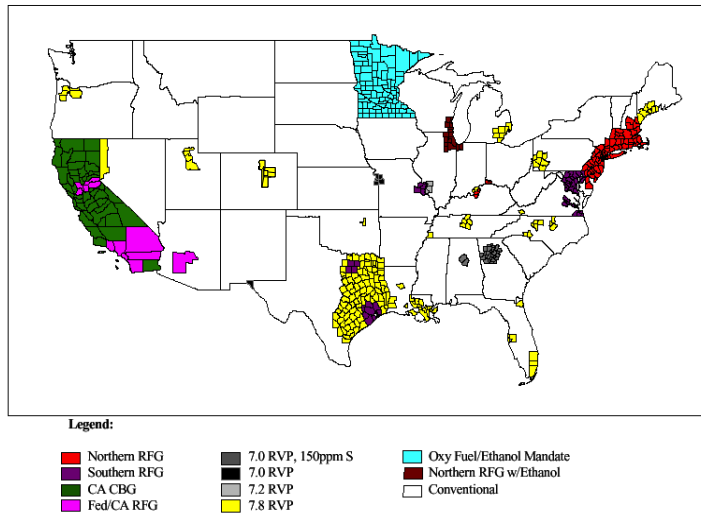


FIGURE II-1: Current Summer U.S. Gasoline Requirements

SOURCE: "Study of Unique Gasoline Fuel Blends ('Boutique Fuels'), Effects on Fuel Supply and Distribution and Potential Improvements" U.S. EPA Oct. 2001

II: Description of how to implement

Implementation of a RFG program would be through State Implementation Plans. The various states would examine the options available, depending on air quality classification. Typically a state will "opt" in to the federal reformulated gasoline program, with the federal government enforcing the program. If so desired the state may implement and enforce their own state RFG program. However, state programs must be identical to federal or California RFG programs.

III. Feasibility of option

This option is fairly easy to develop and implement.

IV. Background data and assumptions used

A major assumption is that the Four Corners area will become nonattainment for summertime ozone, either as a result of elevated measurements, or the implementation of a new, lower, more rigorous ozone standard.

V. Any uncertainty associated with the option (Low, Medium, High)

Medium. The use of reformulated gasoline would require that there be available supplies. A major refiner close to the four-corners area, Valero's McKee refinery located in the panhandle of Texas, already manufactures reformulated gasoline for Texas and other reformulated gasoline markets. The question is whether it and other refineries have the capacity, at a reasonable cost, to produce enough RFG for the Four Corners area.

VI. Level of agreement within the workgroup for this mitigation option

Good general agreement.

VII. Cross-over issues to other source groups

There does not seem to be much cross over.

Mitigation Option: Idle Ordinances

I. Description of the mitigation option

Motor vehicle idling is a source of preventable mobile source emissions. Recognizing that most vehicles do not need to idle, many cities have passed local ordinances banning excessive vehicle idling, specifically for heavy-duty vehicles such as trucks and buses. Voluntary idling programs may also be used, especially for gasoline powered light-duty vehicles.

Most city ordinances set the maximum idling time at two to five continuous minutes. Some have longer time limits. In Maricopa County, Arizona the time limit is five minutes. In Denver and Aurora, Colorado the time limit is 10 minutes in any one-hour period. Philadelphia has a minimum two minutes. The Houston/Galveston nonattainment area has a minimum of five minutes from April 1st through Oct. 31st. Salt Lake City permits up to 15 minutes of continuous idling.

Emissions Reductions

Idling ordinances generally target heavier diesel trucks and buses and particulate (PM) emissions. However, there is no reason to preclude light-duty gasoline vehicles. All internal combustion vehicles emit pollutants and green house gases. It is estimated that larger trucks and buses burn from one-half to one gallon of fuel per hour of idling (1,2), all of which produce unnecessary emissions. Light-duty gasoline vehicle fuel consumption may be half to a quarter of this.

According to Air Watch Northwest, a consortium of air quality management agencies in Washington state, Oregon, and British Columbia (www.airwatchnorthwest.com), cars at idle emit a comparable amount of pollution to when it is driven (3). This is especially true when a vehicle is started cold, before its catalytic converter is warm enough to become effective. Once warm, a catalyst will stay warm for quite some time, so shutting down an engine to conserve fuel and limit emissions will generally have little effect on catalytic effectiveness when the vehicle is restarted.

The following tables list the average emission for vehicles at idle. The first two are for passenger cars and light trucks. The third table lists emissions for heavy-duty trucks and buses. Data is from April 1998. The acronyms used in the charts are listed below. All data is from U.S. EPA, and may be obtained at: <http://www.epa.gov/otaq/consumer/f98014.pdf>

LDGV	Light-duty gas vehicle
LDGT	Light-duty gas truck
HDGV	Heavy-duty gas vehicle
LDDV	Light-duty diesel vehicle
LDDT	Light-duty diesel truck
HDDV	Heavy-duty diesel vehicle
MC	Misc

**U.S. EPA Estimated Idle Emissions
for Passenger Cars and Light Trucks**

Summer Conditions (75 degrees F., 9.0 psi Rvp gasoline)

Pollutant	Units	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
VOC	g/hr	16.1	24.1	35.8	3.53	4.63	12.5	19.4
	g/min	0.269	0.401	0.597	0.059	0.077	0.208	0.324
CO	g/hr	229	339	738	9.97	11.2	94.0	435
	g/min	3.82	5.65	12.3	0.166	0.187	1.57	7.26
NO _x	g/hr	4.72	5.71	10.2	6.50	6.67	55.0	1.69
	g/min	0.079	0.095	0.170	0.108	0.111	0.917	0.028

Winter Conditions (30 degrees F., 13.0 psi Rvp gasoline)

Pollutant	Units	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
VOC	g/hr	21.1	30.7	44.6	3.63	4.79	12.6	20.1
	g/min	0.352	0.512	0.734	0.061	0.080	0.211	0.335
CO	g/hr	371	487	682	10.1	11.5	94.6	388
	g/min	6.19	8.12	11.4	0.168	0.191	1.58	6.47
NO _x	g/hr	6.16	7.47	11.8	6.66	6.89	56.7	2.51
	g/min	0.103	0.125	0.196	0.111	0.115	0.945	0.042

**U.S. EPA Estimated Idle Emissions
for Heavy –Duty Trucks and Buses**

Engine Size	Emissions
Light/Medium HDDVs (8501-33,000 GVW)	2.62 g/hr (0.044 g/min)
Heavy HDDVs (33,001+ GVW)	2.57 g/hr (0.043 g/min)
HDD buses (all buses, urban and inter-city travel)	2.52 g/hr (0.042 g/min)
Average of all heavy-duty diesel engines	2.59 g/hr (0.043 g/min)

These average idle emissions may be compared to average vehicle emissions by comparing the first two tables with the table listed below. This data may be obtained at:

<http://www.epa.gov/otaq/consumer/f00013.htm>

**U.S. EPA Emissions Facts
Average Annual Emissions and Fuel Consumption
for Passenger Cars and Light Trucks**

Component	Car	Light Truck
	Emission Rate Fuel Consumption	Emission Rate Fuel Consumption
HC	2.80 g/mi	3.51 g/mi
CO	20.9 g/mi	27.7 g/mi
NO _x	1.39 g/mi	0.81 g/mi
CO ₂	0.915 lbs/mi	1.15 lbs/mi
Gasoline	0.0465 gal/mi	0.0581 gal/mi

As can be seen by a comparison of the above tables, for volatile organic compounds (VOCs), it will take eight minutes of idling to equal one mile of driving for an average automobile during the summer. For carbon monoxide (CO) this is approximately five and a half minutes, and, for nitrogen oxides (NO_x) this is approximately seventeen and a half minutes.

Particulate Emissions

One reason to adopt idling ordinances or some voluntary program to reduce idling is the exposure to particulate emissions. One of the principle sources of particulate matter (PM) exposure is from diesel vehicles. This is of utmost importance when it comes to school-age children and their exposure to diesel school bus particulate and air toxic emissions. On average, children and adults may be exposed to excessive levels of PM from idling diesel trucks and buses. As the above table points out, an average heavy-duty diesel truck or bus will produce approximately 2.6 grams of particulates per hour. It should be noted that federal health-based PM standards are measured in the micrograms (not grams) range. The short term PM standard for PM₁₀ is 150ug/m³ for a 24-hour average.

Technologies Used to Reduce Truck Idling

A number of strategies can be used to assist vehicles, mostly trucks and buses, from needing to idle while maintaining heating and cooling capacity. For larger trucks and buses, stand-alone direct-fired heating devices are available that cost from \$1000 to \$2000. Automatic engine idling devices may also be used that continue air conditioning when the engine is turned off at a cost of \$1000 to \$2000. Most expensively, small power generating auxiliary power units may be used, each costing from \$5000 to \$7000 (2).

At truck stops, fleet locations, and other stationary parking facilities, truck-stop electrification may be utilized. "Shore power" is provided directly to the parked truck, linking it to the power grid for all its electrical needs. This is estimated to cost \$2500 per truck space and another \$2500 per truck to modify so that it can receive the electricity (2).

References:

- (1). U.S. EPA
- (2). Philadelphia Diesel Difference Working Group
- (3). Air Watch Northwest

II: Description of how to implement

Generally local government may adopt ordinances limiting vehicle idling, principally heavy-duty diesel truck or bus idling. School districts can modify their procedures to prevent excessive school bus idling. Trucking fleets, including oil and gas extraction fleets can also implement updated policies for their drivers.

Local air planning agencies, state, or local government can also implement voluntary programs, aimed at both light-duty gasoline vehicles as well as heavy-duty diesel vehicles. Voluntary programs can be established relatively easily and in a minimal amount of time. Infrastructure to promote auxiliary power for trucks to use at truck stops, distribution centers (think Walmart), etc., would take more time and money to accomplish.

III. Feasibility of option

This is a very feasible option. Idling ordinances and voluntary idling reduction programs have been established for a number of years in many locations.

IV. Background data and assumptions used

Emission estimates are generally those published by the U.S. EPA.

Other Sources
11/01/07

V. Any uncertainty associated with the option (Low, Medium, High)

Low. Idling ordinances and voluntary idling reduction programs are proven strategies.

VI. Level of agreement within the workgroup for this mitigation option

Good general agreement.

VII. Cross-over issues to other source groups

There will be little cross-over issues with other groups, except for fleets, such as involved in oil and gas extraction.

Mitigation Option: School Bus Retrofit

I. Description of the mitigation option

One of the most significant sources of particulate and air toxic exposures that young school-age children are exposed to are diesel school bus emissions. Older diesel school buses contribute a greater proportion of particulate (PM), as well as nitrogen oxide (NO_x) and hydrocarbon (HC) emissions, compared to current buses built to the newest emission certification standards.

While the newest school bus emissions standards have just been implemented, school buses have long lives, permitting older higher emitting school buses to continue to expose children to high levels of diesel exhaust and to contribute to summertime ozone precursors. Reducing emissions from these buses will result in emission reductions that will last for years.

One method of reducing emissions from these older school buses is through school bus retrofit programs. Retrofit programs achieve their air quality benefit by improving the emissions characteristics of the existing school bus. Improvements may range from re-powering school buses with new replacement engines, or adding better emission control equipment, to using cleaner sources of fuel.

Emissions Reductions

PM Emissions

It is estimated by the U.S. EPA that oxidation catalytic converters retrofitted to buses reduce PM emissions by 20% to 30%, at a cost of \$1000 to \$2000 per bus(1). Retrofitting with a particulate trap reduces particulate matter by 60% to 90%, at a cost of \$5000 to \$10,000 per bus(1).

The use of ultra-low sulfur diesel fuel (required since 2006) allows these components to be added without the sulfur in diesel fuel contaminating the retrofitted equipment with a consequential loss in efficiency or damage. Ultra-low sulfur diesel fuel (maximum of 15 ppm sulfur content) is by itself expected to reduce particulate emissions by 5% to 9% (1).

Natural gas fueled school buses, if done correctly, can reduce particulate emissions by 70% to 90% at an additional cost of approximately \$30,000 per bus(1). Replacement engines could reduce particulate emissions by 95% (2) as well as substantially reducing HC and NO_x emissions.

Hydrocarbon and Carbon Monoxide Emissions

For ozone precursors, oxidation catalytic converters can reduce HC emissions by up to 50%. Carbon monoxide emissions may be reduced by up to 40%(2). Particulate traps will give some benefit, but are principally designed to lower particulate emissions.

The use of biodiesel fuel does reduce HC emissions, though its use will tend to increase NO_x emissions (B20 up to 2%, B100 up to 10%(1)). Depending on the technology used, natural gas fueled school buses substantially lower NMHC. The U.S. EPA estimates NMHC emissions are reduced by 60%(1). NO_x emissions, especially if lean-burn natural gas engines are used, may be lowered by a comparable amount. New technology replacement engines, built under the newest emissions certification standards would have substantial HC+NO_x emission reductions.

The U.S. EPA has a technology Options Chart that they developed for their Clean School Bus USA Program. It lists the various technology options, their costs, and their benefits. It can be accessed at: <http://www.epa.gov/cleanschoolbus/technology.htm>.

Sources:

U.S. EPA Clean School Bus USA
Illinois Clean School Bus Program

Funding

There are various sources of funding for school bus retrofit programs. The U.S. EPA has annually funded retrofit programs. In 2007 they received seven million dollars under continuing resolution (H.J.R. 20) to fund projects nationwide. Eligible applicants that may apply for these funds include: state and local government, federally recognized Indian tribes, and non-profit organizations. Other sources of funding and grants include federal Congestion Mitigation and Air Quality (CMAQ) Program funds.

II: Description of how to implement

Local air planning agencies, state, or local government can implement these programs. Generally, they are funded through grants or other funding sources. They can be established relatively easily, with the needed outside infrastructure currently in place.

III. Feasibility of option

This is a very feasible option. School bus retrofit programs are operating throughout the United States.

IV. Background data and assumptions used

Emission reductions are generally those published by the U.S. EPA.

V. Any uncertainty associated with the option (Low, Medium, High)

Low. School Bus Retrofit Programs are proven strategies

VI. Level of agreement within the workgroup for this mitigation option

Good general agreement.

VII. Cross-over issues to other source groups

There will be little cross-over issues with other groups.

Mitigation Option: Subsidy Program for Cleaner Residential Fuels

I. Description of the mitigation option

Many families and individuals are forced by circumstances (economic, lack of availability, insufficient fuel delivery infrastructure, etc.) to use less than desirable fuels for cooking and heating. Many of these fuels, such as wood burning, emit high levels of toxic, or harmful, emissions, and carbon monoxide, hydrocarbon and organic compounds that are ozone precursors.

An option to reduce emissions that contribute to increased VOC, PM, CO, and air toxics is to promote the use of less polluting home heating and cooking fuels, especially electricity, propane, and natural gas in place of wood, coal, and kerosene. If wood is to continue to be used for home heating, at least a high efficiency EPA Phase II certified stove should be used.

Subsidizing Increased Cost of Fuel

Subsidizing the use of propane, natural gas, or electricity may allow low-income families to utilize these fuels in place of wood burning or other fuel sources, such as coal. Subsidy could be pegged to the economic need of the family, much like other welfare programs.

Home Heating

Replacing a traditional, non-certified wood stove with an oil furnace will reduce particulate (PM) emissions by over 99%, from 18.5 g/hr to 0.07 g/hr. Replacement with a natural gas furnace would reduce PM emissions even further to 0.04 g/hr (2).

The use of oil or gas furnaces in place of wood stoves would also have a substantial effect on carbon monoxide and emissions of hydrocarbons and other organic compounds, many of which have high ozone reactivities, as well as being fairly toxic gases. Encouraging the use of substituting electric or gas heat for cooking would similarly give a comparable emissions benefit.

New York State Environmental Protection Bureau estimates that a typical high efficiency (90%) gas or oil forced hot air furnace costs approximately \$2690. This compares to a new EPA certified, catalytic equipped wood stove at approximately \$2425, with a 72% efficiency rating (2).

Cleaner Wood Stoves

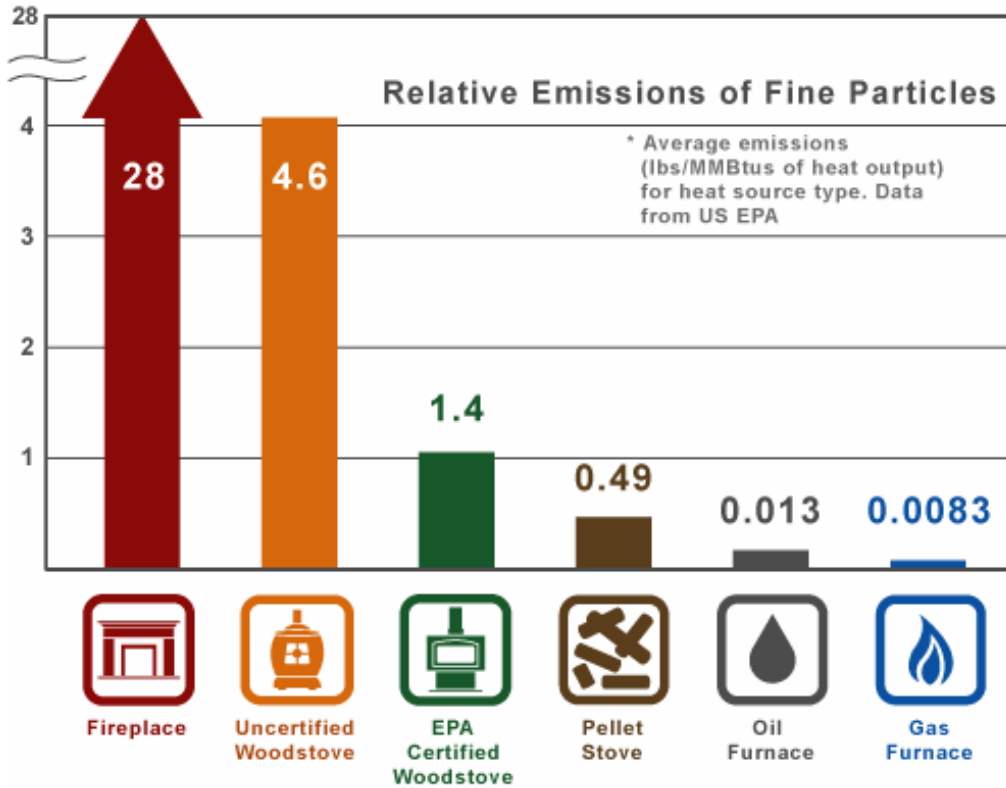
If a woodstove were used, it should be a new EPA certified one that would be expected to reduce fine particulate emission by 70% compared to an older non-controlled stove. Polycyclic aromatic hydrocarbons would be expected to go down from 0.36g/hr to 0.14 - 0.15 g/hr for EPA Phase I certified stoves to less than that for EPA Phase II certified stoves (2).

Nationwide, wood burning accounts for nine percent of home heating needs. However, it accounts for 45% of all particulate emissions from home heating (2). U.S. EPA Phase II standards are 7.5 g/hr PM for non-catalytic equipped stoves, and 4.1 g/hr PM for catalytic equipped ones (1,2). These standards are designed to reduce woodstove emissions by 60% to 80%(1).

In replacing an older uncontrolled stove with a new EPA certified stove, it is important to use an outside source of air for the heater box for combustion purposes. This prevents the stove from depleting a room's oxygen content, as well as preventing emissions from entering the house. Stoves should also have catalytic converters to ensure the lowest emissions. Common models currently may produce from 35,000 to 100,000 BTU, and are able to heat rooms from 400 to 2000, or more, square feet(3). US EPA has a website at: <http://www.epa.gov/woodstoves>, where more information may be obtained.

Chart One
Relative Emissions of Fine Particulates
(Grams per Hour)

U.S. EPA Chart



Source: U.S. EPA

Reference Sources:

- (1). U.S. EPA
- (2). New York State Environmental Protection Bureau
- (3). Chimney Sweep, Inc.

II: Description of how to implement

This program may be organized much like Low Income Energy Assistance programs. A means test or other criteria could be established to prioritize available funding.

Funding this program, or set of programs, may include tax incentives, or other methods, such as voluntary grants from the natural gas extraction industry, mineral surtaxes, or drilling and permit fees. Enforcement penalties could also be used.

III. Feasibility of option

The program is very feasible. It would not only reduce emissions that could aggravate ambient ozone, PM, and CO, but would reduce toxic exposure to inhabitants of the house and nearby homes.

IV. Background data and assumptions used

It is assumed that there is a sufficient population that would benefit from an assistance program.

V. Any uncertainty associated with the option (Low, Medium, High)

Medium. Such a program, unless funded voluntarily as a public outreach program by industry, may require additional statutory authority, requiring legislative action, as well as well as regulatory development and adoption.

VI. Level of agreement within the workgroup for this mitigation option

Good general agreement. The option was agreed upon by the workgroup without dissent.

VII. Cross-over issues to other source groups

There are no cross-over issues identified at the present time.

Mitigation Option: Stage One Vapor Recovery

I. Description of the mitigation option:

Mandatory use of stage-one vapor recover systems will reduce evaporative emissions from service stations.

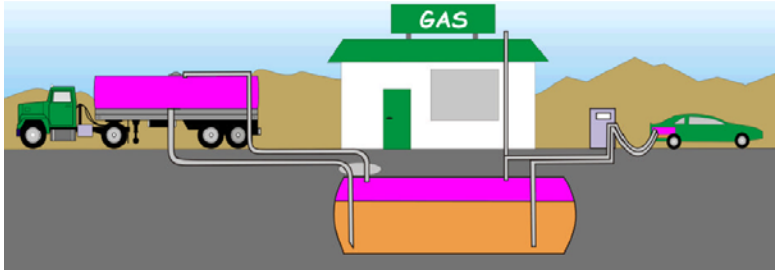
Refueling of underground service station tanks is a major source of evaporative hydrocarbon emissions. VOCs are released as the underground storage tank is refilled, when gasoline vapors in the tank's headspace are displaced. Sources estimate that 10-15 liquid gallons of gasoline are released from vapors displaced from the headspaces of various tanks, each time a gasoline transport truck fully unloads its products (1,2,3). Unless captured through a vapor recovery system, such as Stage I, these emissions will be released directly into the atmosphere.

In many areas, Stage I vapor recovery systems are required to control VOC emissions within the gasoline distribution system, from the refinery to the retail gasoline station. In the Denver metropolitan area, for instance, Stage I is required to control VOC releases that contribute to summertime ozone formation. Fire codes require the use of Stage I at service stations in other areas. But in many places their use is not required, and stations may, or may not, be using any vapor recovery stations, even if they are equipped with them. Stations that are equipped with Stage I vapor recovery systems may not be operating them. Other older stations may not even be equipped with vapor recovery systems.

The following diagram shows how Stage I works. In this diagram the fuel delivery truck unloads its product into the bottom of an underground storage tank through the refueling pipe. A second pipe then draws the vapors being displaced as the underground storage tank is being filling, and discharges them into the now emptying fuel delivery trucks compartment. The empty truck then returns to the refinery or terminal and releases the captured vapors into the refinery's or terminal's vapor recovery system, where they are condensed back into liquid gasoline and reused.

The same illustration also shows how Stage II vapor recovery systems work, by using the same principle, capturing the VOCs produced as an automobile is refueled. As the automobile is refueled, vapors displaced by the car's gasoline tank are drawn back through the dispensing pump back into the underground storage tank by a second refueling tube. There, they either condense into gasoline within the tank, or are directed into the refueling tanker truck, through the station's Stage I system when the underground tank is next refueled by the tank truck.

Stage I Vapor Recovery



Source: Calif. EPA, Nov. 18, 2004

References:

“What You Should Know About Vapor Recovery”, Michigan Department of Environmental Quality.
“Keeping It Clean: Making Safe and Spill-Free Motor Fuel Deliveries,” Petroleum Equipment Institute, December 1992.
“New Hampshire Stage I/II Vapor Recovery Program”, New Hampshire Department of Environmental Services.

Air Quality Benefits of Stage One Vapor Recovery

As part of its effort to reduce summertime ozone, the Denver metropolitan area requires the use of Stage 1 at all service stations. It is estimated that because of Stage I requirements, that perhaps 13.2 million pounds of VOCs (18.1 tons per day) are prevented from being emitted into the air*. Air toxics are also reduced.

Stage I vapor recovery systems are efficient. Up to 95%(1) of underground storage-tank refueling vapors are captured. Stage I is also cost effective. Vapors from the underground storage tanks are collected in the now empty tanker truck’s compartments and taken back to the refinery or terminal, where they are condensed and reused. At \$3.00 a gallon for gasoline seen in the summer of 2007, this equates to \$2.1 million dollars worth of gasoline saved annually.

(1), Hensel, John, and Mike Mondloch, “Stage One Vapor Control In Minnesota”, Minnesota Pollution Control Agency.

* Based on emission factors from the state of New Hampshire (11 lbs. VOC produced per 1000 gallons of gasoline vapors displaced), and 1.2 billion gallons of gasoline delivered to service stations in the Denver metropolitan area each year.

Cost

Many stations, while not operating their Stage I equipment are equipped with it. Others would have to be retrofitted. The Minnesota Pollution Control Agency estimates that retrofitting a station will cost up to \$15,000 per station, with a more typical cost of approximately \$10,000 per station. This is a very reasonable cost for the emissions benefits that can be derived.

II: Description of how to implement:

Implementation of Stage I vapor recovery would be through State Implementation Plans. A state could also adopt such as a program as a state-only program if not part of a SIP. The state would enforce the requirements.

III. Feasibility of option:

This option is fairly easy to develop and implement.

IV. Background data and assumptions used

A major assumption is that the four corners area will become nonattainment for summertime ozone, either as a result of elevated measurements, or the implementation of a new, lower, more rigorous ozone standard.

V. Any uncertainty associated with the option (Low, Medium, High):

Low.

VI. Level of agreement within the workgroup for this mitigation option:

Good general agreement.

VII. Cross-over issues to other source groups:

There does not seem to be much cross over.

Mitigation Option: Stage Two Vapor Recovery and Vehicle On-board Refueling Vapor Recovery Systems

I. Description of the mitigation option:

Mandatory use of Stage-II vapor-recover systems as well as programs designed to maintain vehicle's on-board refueling vapor recovery systems reduce evaporative emissions created during automobile refueling.

Automotive refueling is a major source of evaporative hydrocarbon emissions. As a vehicle's gas tank is filled gasoline vapors in the tank's headspace are displaced. It is estimated that when filling an empty 18-gallon fuel tank, 0.06 pounds of VOCs can be released (1,2), if such vapors are not captured by either a service station's Stage II vapor-recovery system, or for newer vehicles, the vehicle's on-board refueling vapor recovery system (this assumes that 30% of the vehicle's gasoline tank's headspace is composed of gasoline vapors and 70% by air) (2).

In a Stage II system, as an automobile is refueled, vapors displaced in the car's gasoline tank are drawn back through the dispensing pump back into the underground storage tank by a second refueling tube. There, they either condense into gasoline within the tank, or are directed into the refueling tanker truck, through the station's Stage I system when the underground tank is next refueled by the tank truck. The following illustration diagrams this.

Stage II Vapor Recovery System

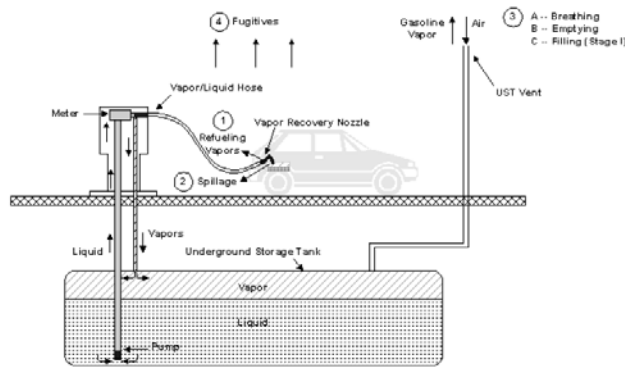


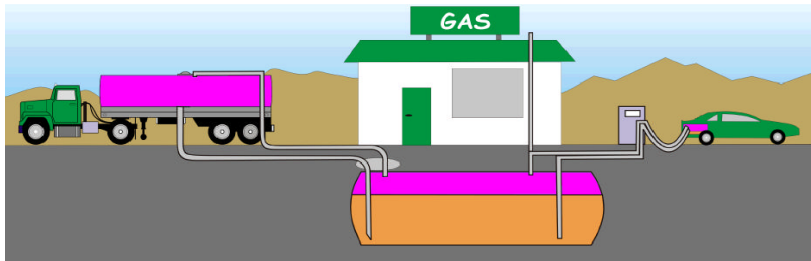
Figure 2. Controlled Stage II Process Operations with vapor recovery system.

Source: "Stage II Vapor Recovery Issue Paper", U.S. EPA, August 12, 2004.
<http://www.ct.gov/depr/air/dep/air/stage2/stage2issuepaper.pdf>

Another illustration also shows how Stage II works in conjunction with Stage I. Vapors from the automobile's gasoline tank are routed back into the headspace of the station's underground storage tank. In this diagram the fuel delivery truck unloads its product into the bottom of an underground storage tank through the refueling pipe. A second pipe then draws the vapors being displaced as the underground storage tank is being filling, and discharges them into the now emptying fuel delivery trucks compartment. The empty truck then returns to the refinery or terminal and releases the captured vapors

into the refinery's or terminal's vapor recovery system, where they are condensed back into liquid gasoline and reused.

Stage I & II Vapor Recovery Systems



Source: Calif. EPA, Nov. 18, 2004

References:

“New Hampshire Stage I/II Vapor Recovery Program”, New Hampshire Department of Environmental Services.

“Stage II Vapor Recovery Issue Paper”, U.S. EPA, August 12, 2004.

Air Quality Benefits of Stage II Vapor Recovery Systems

As part of its effort to reduce summertime ozone, many metropolitan areas across the nation with ozone concerns have adopted the use of Stage II vapor recovery systems at service stations. Stage II vapor recovery systems can be efficient. Depending on the frequency of inspection and equipment maintenance, up to 95%(1) of refueling vapors may be captured. In reducing VOCs, many air toxics, such as benzene and 1,3 butadiene are also reduced.

Modeling conducted by Mobiles Sources Program, Air Pollution Control Division, of the Colorado Department of Public Health and Environment, indicate that implementation of a Stage II vapor recovery program in the Denver Metropolitan area would reduce overall mobile source VOCs by 5.5% in the year 2007, and by 3.8% in the year 2012, when more vehicles are equipped with on-board vapor recovery systems.

On-board Refueling Vapor Recovery (ORVR) systems

On-board refueling vapor recovery (ORVR) systems work by routing escaping vapors from the fuel tank; through a charcoal canister that absorbs VOCs. The trapped VOCs are then pulled from the canister into the engine where they are burnt. ORVR systems have become standard equipment on light-duty automobiles beginning in 1998, and light duty trucks (trucks 1-2 starting in 2001, and trucks 3-4 in 2004).

As stated before, as the fleet penetration of on-board refueling vapor recovery systems increases, the emissions benefit from Stage II decreases somewhat. Currently, in the Denver metropolitan area, 54% of all gasoline motor vehicles now are equipped with on-board vapor recovery systems. As more of the fleet is equipped with on-board refueling vapor recovery systems, the effectiveness of Stage II is reduced. However, working together, they will both reduce refueling losses in the near to medium term, as shown in CDPHE's MOBILE6 modeling results. It should be pointed out that as ORVR systems deteriorate, refueling losses increase. At some point in the future, it may be necessary to implement some sort of inspection program to find and have fixed broken ORVR systems, maintaining the air quality benefits of these systems.

The U.S. EPA in their report "Stage II Vapor Recovery Issue Paper (August 12, 2004) includes a diagram (Figure 5, page 16 - shown below), of the refueling emissions trends for a hypothetical State. From inputs contributed by the American Petroleum Institute, this illustration shows four different scenarios; Stage II vapor recovery controls only (the blue line); on-board refueling vapor recovery only (the red line); Stage II vapor recovery controls with on-board refueling vapor recovery, where the ORVR interferes with the Stage II controls (the green line); and 4) Stage II vapor recovery controls and on-board refueling vapor recovery, where the ORVR does not interfere with the Stage II controls (the black line). The chart diagrams the years from 2005 through 2035 (1).

As seen in this diagram, a state with an existing Stage II vapor recovery program with an 85% effectiveness (blue line) will have a fraction of the refueling VOC emissions as a state that does not (the red line) in the year 2005. As more vehicles are equipped with ORVR systems, this advantage decreases, with at some point before 2015, the benefits of both control measures being equal. The blue line increases over time because of the increase in vehicle miles travels and does not include the effect of ORVR. However, before this time (2015), Stage II vapor recovery programs will give large benefits.

The other two scenarios shown represent decreasing VOCs over time with both control measures. There has been some research showing that Stage II can potentially interfere with on-board refueling vapor recovery systems. This is represented by the green line, where there is some increase in emissions as a result. However, all new Stage II systems certified by the state of California must show no interference with the ORVR. Using these approved systems, total VOCs are reduced for both Stage II and ORVR (the black line), where until 2025 there is a noticeable improvement having both systems.

Refueling Emissions Trends for Four Scenerios:

- 1) Stage II controls only (Blue Line),
- 2) On-board Refueling Vapor Recovery (ORVR) only (Red Line),
- 3) Stage II & ORVR with compatibility issues (Green Line),
- 4) Stage II & ORVR with no compatibility issues (Black Line)

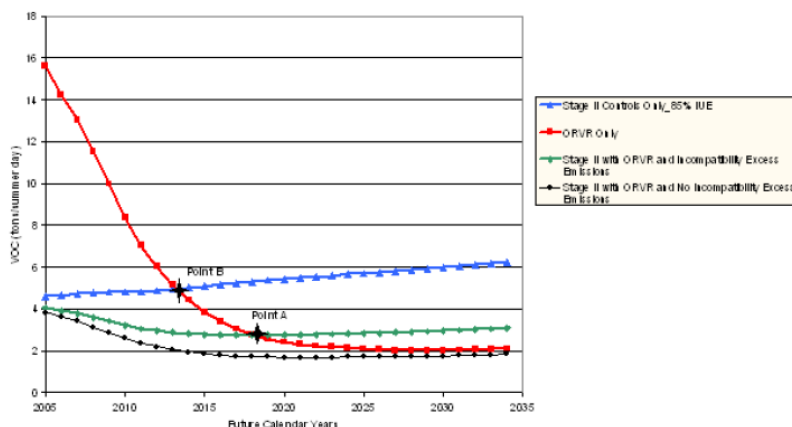


Figure 5. General emissions trends expected for refueling emissions in future calendar years for a hypothetical State (based on API studies).

Source: "Stage II Vapor Recovery Issue Paper", U.S. EPA, August 12, 2004.
<http://www.ct.gov/dep/lib/dep/air/stagell/stage2issuepaper.pdf>

(1) "Stage II Vapor Recovery Issue Paper", U.S. EPA, August 12, 2004.

Cost

There are costs to retrofit service stations with the necessary plumbing and equipment. In some cases this will be a major renovation to the station. Additionally, there will be on-going costs associated with operating and maintaining the Stage II vapor recovery system and equipment.

The state of New Hampshire, which has an operational Stage II vapor recovery program, estimates that the cost of Stage II installation at between \$18,000 and \$30,000 per station, depending on the station (1). They estimate on-going annual maintenance costs to be \$1000 to \$4000 per station yearly (1). Stage II requirements affect any station in that state that sells or has throughput of more than 420,000 gallons of gasoline annually (1).

(1) Environmental Fact Sheet, "New Hampshire's Gasoline Vapor Recovery Program - Protecting the Air We Breathe" New Hampshire Department of Environmental Services, 2004.

II: Description of how to implement:

Implementation of Stage II vapor recovery would be through State Implementation Plans. The state would enforce the requirements.

III. Feasibility of option:

This option is moderately hard to develop and implement. Gasoline service stations that are already plumbed for Stage II, and do not have to tear up concrete to put in vapor recovery plumbing are relatively easy to upgrade. Stations that need extensive work to install will be more difficult. Industry will not be supportive of this option.

IV. Background data and assumptions used

A major assumption is that the four corners area will become nonattainment for summertime ozone, either as a result of elevated measurements, or the implementation of a new, lower, more rigorous ozone standard.

V. Any uncertainty associated with the option (Low, Medium, High):

Low.

VI. Level of agreement within the workgroup for this mitigation option:

Good general agreement.

VII. Cross-over issues to other source groups:

There does not seem to be much cross over.

OTHER SOURCES: PUBLIC COMMENTS

Other Sources Public Comments

Comment	Mitigation Option
<p>Dear Task Force Representative: I work for the Ute Mountain Tribe's Environmental Programs Department. We are about to partner with the EPA and the USGS to monitor radionuclides in the air and water around White Mesa, Utah where there is the only operating uranium mill in the nation. They are increasing production dramatically at the mill. We have significant concerns about radioactive dust blowing around out there. Any assistance that you or your staff could provide, funding if possible, would be a great thing. In the end we will have a publicly available, peer-reviewed report published by USGS and EPA. This could be a very important piece of the 4 corners air quality puzzle for you. My contact information is: Scott Clow, Water Quality Specialist, Ute Mountain Ute Tribe, PO Box 448, Towaoc, CO 81334, (970) 564-5431, scute@fone.net Thanks for considering this. Sincerely, Scott</p>	
<p>The last mitigation option makes me think that it is time to start considering regulating wood and coal burning stoves all-together. We have a tendency in the 4 corners to believe that we are small-fry, but continued urbanization is delivering us many big-city problems. In all, oil, gas and power plants tend to overshadow the cumulative impacts of residential activities. Our county governments should consider mitigation options accordingly.</p>	
<p>It is not enough to address the larger sources of air pollution in the Four Corners area. The efforts of this task force must also address the cumulative effects of the smaller sources.</p>	
<p>This is a great option. The Farmington/Aztec/Bloomfield area is an urban corridor, and the Durango/Bayfield area is quickly becoming so as well. We could easily reduce emissions and highway miles traveled if we were to expand upon park-and-ride systems (I believe I saw an ad for one between Ignacio and Durango) and also municipal transit.</p>	<p>Public Buy-in through Local Organizations to push for transportation alternatives and ordinances</p>
<p>Public outreach is great (often people are unaware of the health problems due to burning), but it may not reach the few and highly resistant people who burn regularly (both commercial and residential). As a resident, I would like to be able to call the sheriff and have enforcement that is effective (a fine, for example).</p>	<p>Develop Public Education and Outreach Campaign for Open Burning</p>
<p>The worst offending vehicles pass because their owners know how to beat the system on testing. Just enforce laws about taking cars off the road that visually are not in compliance. Add a tax based on engine size or exempt smaller engines and low weight vehicles.</p>	<p>Automobile Emissions Inspection Program</p>

Comment	Mitigation Option
<p>IM Programs will only work if all areas in that region are included. If they are not then owners of car will find ways to get around the program. Most of the owners that would do this are the owners of the cars that are the problem. Another way to make sure that your program is effective is to make sure that there is a assistance program for owners that can not afford to get their car emissions fixed.</p>	<p>Automobile Emissions Inspection Program</p>
<p>The IM programs will only be effective for our purposes if they are implemented in all areas. Also, the emissions programs for cars need stricter standards, thus making it economically infeasible to own larger engine, less efficient vehicles. There will always be those who find their way around the laws. However, if those laws are stricter, actually enforced, and applied throughout the Four Corners area then more problem vehicles will be taken off the road.</p>	<p>Automobile Emissions Inspection Program</p>
<p>On a voluntary basis, people could "adopt/subsidize" other vehicles that are not meeting emissions specs. Maybe this adoption could be tax deductible or a tax credit.</p> <p>How do we address the high emitting, newer vehicles (ie large trucks/cars)from the LEV (low emission vehicles)? Maybe a taxing structure would help both reduce the demand for new higher polluting vehicles, and help get high polluting older (the old "beater") vehicles off the road by helping to pay for their improvement/replacement.</p>	<p>Automobile Emissions Inspection Program</p>
<p>I would like City (and County if possible) ordinances to restrict idling. A rule that everyone follows will make it easier to get everyone on board the "no idling" plan. Public outreach also has to follow to teach people why idling causes problems and how "no idling" make make a difference. Signage at parking areas/unloading areas boat ramps, water filling stations/hydrants, the post office, grocery stores and other parking lots and etc. can remind drivers to turn off their engines.</p>	<p>Idle Ordinances</p>
<p>School bus retrofit--Let's do it! Then add public outreach to encourage more students to ride the bus, and we reduce emissions because the parents are not lined up in their cars to pick up/drop off their kids at school.</p>	<p>School Bus Retrofit</p>
<p>Though indirectly related to this topic, homes need to be upgraded weatherized and insulated so that we decrease the amount of fuel needed.</p> <p>Public outreach might help teach people how to build a clean fire. And people are burning trash in their wood stoves (similar to open burning).</p> <p>Coal is often used for heating and is particularly high in emissions, and seems to be equal to open burning.</p>	<p>Subsidy Program for Cleaner Residential Fuels</p>