

# **WHITE PAPER**

## Short-Term Ozone Reduction Strategies December 4, 2007



**REGIONAL AIR QUALITY COUNCIL**

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## Summary of Costs and Benefits of Proposed Short-term Measures in 2008

Proposed Measure	Estimated Costs (2008)	Potential Emission Benefits (2008)	Assumptions/ Comments
<b>HB 1302 High-Emitter Program</b>	\$160,000	0.09 tpd VOC 0.53 tpd CO	Based on repairing 380 vehicles. Does not include fuel economy savings to vehicle owner
<b>High-Emitter Vehicle Scrappage Program</b>	\$135,000	0.17 tpd VOC 0.6 tpd CO	Based on retiring 135 vehicles. Additional funding will result in additional vehicles.
	\$500,000	0.63 tpd VOC 2.2 tpd CO	
<b>Continued fleet turnover to Tier 2 standards</b>	\$100-350/vehicle + \$.02/gal	5.8 tpd VOC 9.6 tpd NOx	
<b>Statewide Oil and Gas Regulations</b>	\$2.0 million/yr*	15.4 tpd VOC** 3.3 tpd VOC**	* Tanks -- \$1.5 million; dehydrators -- \$500,000 -- **statewide estimates
<b>RICE Controls Statewide</b>	Not available	Not available	
<b>Small and nonroad engine fleet turnover</b>	\$20-56/engine + \$.02/gal	2.6 tpd VOC 2.8 tpd NOx	
<b>Diesel retrofit program</b>	\$1.9 million	0.65 tpd VOC 0.07 tpd NOx 6.2 tpd CO	Based on current funding for RAQC's diesel retrofit program
<b>Ozone Outreach Program</b>	\$500,000/yr.	0.5 tpd	4-year program estimated to result in 1.9 tpd benefit in final year.
<b>Promote E85 in Flex-Fuel Vehicles</b>	\$470,000	Uncertain	
<b>Voluntary RVP Reduction</b>	\$750,000-\$3 mm	1.0 tpd VOC	--Based on reduction of 0.5 psi RVP in 30% of gasoline sold --0.5 psi reduction for 100% of gasoline sold
	\$2.5-\$10 million	3.5 tpd VOC	
<b>7.8 RVP in North Front Range</b>	\$100,000-150,000 for 3-month season \$1,000-\$1,500/day	0.4 tpd VOC if all gasoline is 7.8	
<b>Oil and Gas Valve Replacements</b>	\$150-\$1350 per valve depending on service life	0.5 tpd VOC	Emission reduction based on 10% valve replacement
<b>Green Completions</b>	Uncertain	Uncertain	
<b>Mower Trade-Out Program</b>	\$30,000	0.24 tpd VOC	Based on replacement of 150 mowers
	\$100,000	0.8 tpd VOC	Based on replacement of 500 mowers
<b>Landscaping Pilot Program</b>	Not available	0.17 tpd VOC	Based on full changeout of equipment in one medium-sized city
<b>Lower I/M Cutpoints</b>	Not available	0.15 tpd VOC 2.1 tpd CO 0.5 tpd NOx	Benefits for 2-year cycle are 0.9 tpd VOC, 12.7 tpd CO, and 3.0 tpd NOx
<b>Expand Regulation No. 3 VOC requirements to Larimer &amp; Weld counties</b>	Not available	Not available	

## HB1302-06 High-Emitter Pilot Program

### Program Description

The Repair Your Air Campaign (RYAC) – a program utilizing remote sensing equipment to identify high-emitting vehicles – was implemented in 2003. The primary goals of the program are to reduce ozone forming pollutants, educate the public on vehicle maintenance and evaluate the feasibility of a full-scale remote sensing based high-emitter program. Currently, RYAC offers vehicle owners a free emissions test to determine if the vehicle has been accurately identified, up to \$1,000 in emissions-related repairs and a free rental car while the vehicle is being repaired. To date, RYAC has repaired over 500 vehicles.

The RYAC began in May 2003 and operates through the end of 2007 in its current form due to legislation being implemented in 2008. In 2008, the State of Colorado will implement Colorado House Bill 06-1302 (HB1302) requiring a mandatory remote sensing based high-emitter program. This legislation will target high-emitting vehicles and require owners to schedule IM240 compliance testing. Mandatory vehicle repairs are required for vehicles that fail this compliance test.

At this time, the Colorado Department of Public Health and Environment (CDPHE) and RAQC envision RYAC continuing as a repair assistance program under the HB1302 Pilot Program. The primary difference between RYAC and the HB1302 Pilot Program will be that CDPHE and the Colorado Department of Revenue (CDOR) will perform administrative suspension of registrations with possible fines for vehicle owners who do not schedule compliance testing or complete vehicle repairs. Another change may be reducing the repair assistance under the program depending on vehicle volume.

It is important to note that this pilot program is being operated to ensure that the Air Care Colorado Program can handle a much larger volume in 2009. If the estimate that 10% of all vehicles on Denver area roads are high-emitters, over 200,000 vehicles could be identified and require repair in future years.

### Program Costs

RAQC program administrative and repair costs are estimated at approximately \$160,000. Average repair costs per vehicle are approximately \$410 per vehicle (\$300 median cost).

Costs for Department of Revenue enforcement activities, costs associated with remote sensing to identify vehicles and costs to the motorist are not included in this analysis. Additional fuel savings to the motorist for repaired vehicles, estimated at 8 percent, are also not included in this analysis.

### Air Quality Benefit

At this time, it is estimated a maximum of 850 vehicles will be repaired through the HB1302 Pilot High-Emitter Program in 2008. Of these 850 vehicles, an estimated 170 (20%) could be eligible for the salvage portion of the program. Therefore, a maximum of 680 vehicles will be repaired in 2008.

For this analysis, only the 7 month period prior to and during the 2008 summertime ozone season (February – August) will be used to calculate emissions benefits. From the data above, an estimated 380 vehicles will be repaired. Table 1 below indicates this will equate to a minimum estimated 34 TPY HC, 192 TPY CO and 1.7 TPY NOx which translates into 0.09 TPD HC, 0.53 TPD CO and 0.0005 TPD NOx.

**Table 1 – HB1302 Pilot/RYAC Emissions Benefits**

	HC	CO	NOx	Vehicles
Pre-Repair Emissions (gr/mile)	7.2	43.5	1.9	380
Post Repair Emissions (gr/mile)	1.2	9.5	1.6	
Emissions Benefit Per Vehicle (gr/mile)	6.0	34.0	0.3	
Emissions Benefit Per Vehicle Per Day (lb/day)	0.5	2.8	0.0	
TPY	33.8	191.9	1.7	
TPD	0.09	0.53	0.005	

## High-Emitter Vehicle Scrappage Program

### Program Description

A parallel project that will run in conjunction with HB1302 Pilot Program/RVAC is a high-emitter salvage component. This program is currently being developed with CDPHE, DOR and Envirotest.

Some vehicles that will be identified through the HB1302 Pilot Program can not be repaired in a cost-effective manner. Those vehicles that meet program eligibility requirements will be destroyed instead of repaired. Vehicles from Envirotest lanes that meet eligibility requirements may also be eligible for this program. Program eligibility requirements will maximize program benefits and could require:

- High evaporative emissions with tailpipe emissions that are a minimum of double the vehicle's emissions standards;
- Limited remaining vehicle life;
- Vehicle emitting visible smoke; and
- Vehicle repair expenses over \$1,500.

RAQC staff will work with local vehicle dealerships to develop incentives to purchase cleaner vehicles. This might include vehicle price reductions for program participants.

### Program Costs

Currently, \$135,000 is available for this effort. At this time, an estimated \$1,000 salvage stipend will be paid to purchase each vehicle.

Program participants on public assistance may be eligible for a higher salvage stipend. There is also the possibility that an annual RTD bus pass could be offered instead of the salvage stipend. Up to 135 vehicles will be salvaged under this effort. Additional funding will allow the scrappage of additional vehicles.

### Air Quality Benefit

At this time, it is estimated a maximum of 850 vehicles will be repaired through the HB1302 Pilot High-Emitter Program in 2008. Of these vehicles, a maximum of 170 (20%) of the high-emitters identified could be eligible for the salvage portion of the program. Current program funding will only allow for a maximum of 135 vehicles to be salvaged during this effort.

Table 1 below shows that 135 salvaged vehicles will result in an estimated 60 TPY HC and 205 TPY CO which translates into 0.17 TPD HC and 0.56 TPD CO. Additional benefits may be achieved if vehicle volume is increased under CDPHE's HB1302 Pilot Program.

**Table 1 – Salvage Emissions Benefits**

	HC	CO	Vehicles
Pre-Salvage Emissions	31.3	111.7	135
Replacement Vehicle Emissions	1.2	9.5	
Emissions Benefit Per Vehicle (gr/mile)	30.1	102.2	
Emissions Benefit Per Vehicle Per Day	2.4	8.3	
TPY	60.3	204.6	
TPD	0.17	0.56	

## **Continued Vehicle Fleet Turnover**

### **Program Description**

A number of federal emission control programs continue to be phased in and will achieve vehicle emission reductions as older vehicles are replaced by newer vehicles.

#### **> Engine Standards**

Tier 2 gasoline engine standards were phased in starting in 2004 and will continue to 2009. Tier 3 engine standards for on-road diesel vehicles requires 0.01 g/bhp-hr particulate matter (PM) by 2007 and 0.2 g/bhp-hr nitrogen oxide (NOx) phased in by 2010.

#### **> Fuel Standards**

Tier 2 low-sulfur gasoline fuel requirements lowered sulfur to 120 parts per million (ppm) in 2004 and 30 ppm by the end of 2006. For diesel vehicles, 15 ppm was required by late 2006 to complement the engine standards.

### **Program Costs**

Literature from the U.S. Environmental Protection Agency has indicated the costs for the above measures.

#### **> Engine Standards**

Gasoline engine standards raised the cost of light-duty cars by \$100, light-duty trucks by \$200 and medium-duty trucks by \$350. Approximately 125,000 new light-duty vehicles are sold in the DMA/NFR for an increased cost for new engine standards of approximately \$25M. Diesel engine standards increased truck costs by \$1,000 to \$1,600.

#### **> Fuel Standards**

The switch to low-sulfur gasoline adds 2 cents per gallon to fuel costs. Approximately 385,000,000 gallons of gas are sold annually in the DMA/NFR for an increased cost of approximately \$7.7M. The switch to low-sulfur diesel adds 4 cents per gallon to fuel costs. Approximately 122,000,000 gallons of gas are sold annually in the DMA/NFR for an increased cost of approximately \$5M.

### **Air Quality Benefit**

From 2007 to 2008, the federal programs will reduce volatile organic compound (VOC) and NOx emissions due to fleet turnover. These programs will reduce 5.8 tons per day (tpd) VOC and 9.6 tpd NOx.

## **Statewide Oil & Gas Regulations In Regulation No. 7**

### **Program Description**

The implementation of new control thresholds in current Regulation No. 7 for condensate tanks (Section XVII.C.1 & C.2) and dehydration units (Section XVII.D) statewide will become effective May 1, 2008.

The new measures will control uncontrolled emissions  $\geq 20$  tons per year (tpy) for condensate tanks and  $\geq 15$  tpy for dehydration units. This will impact 52 condensate tanks and 59 dehydrator units statewide.

### **Program Costs**

Cost benefit estimates presented at the time of the Air Quality Control Commission (AQCC) Public Hearing in December 2006 indicate that condensate tank reductions would be achieved at a cost of \$263/ton (\$1.5 million), while the dehydrator units would be achieved at a cost of \$396/ton (\$500,000).

### **Air Quality Benefit**

The statewide effort is estimated to achieve a 5,637 tpy (15.4 tons per day) reduction in VOCs from the control of condensate tanks  $\geq 20$  tpy. This is approximately 75% control of statewide non-EAC condensate tank emissions. Control of dehydrator units  $\geq 15$  tpy is estimated to achieve 1,193 tpy (3.3 tpd) reduction in VOCs. This is approximately 33% control of statewide non-EAC dehydrator emissions.

## **Statewide Reciprocating Internal Combustion Engine (RICE) Controls In Regulation No. 7**

### **Program Description**

The implementation of new standards in current Regulation No. 7 for RICE (Section XVII.E.) and the phase in of tighter standards (2007-2011) for new & relocated RICE from out-of-state will continue to achieve further emission reductions.

New RICE standards for engines of 100 to 500 horsepower will become effective January 1, 2008 with a phase in of tighter standards by January 1, 2011.

New RICE standards for engines equal to or greater than 500 horsepower became effective July 1, 2007 with a phase in of tighter standards by July 1, 2010.

### **Program Costs**

Cost impacts for these standards were not estimated by the Division during rulemaking in 2006 because they apply to equipment that is new or relocated from out-of-state.

### **Air Quality Benefit**

This regulation change was designed to control the growth in emissions and, therefore, emission reductions were not estimated by the Division during rulemaking in 2006 because they apply to equipment that is new or relocated from out-of-state.

## **Continued Off-Road and Non-Road Engine Turnover**

### **Program Description**

A number of federal emission control programs continue to be phased in and will achieve vehicle emission reductions as older vehicles are replaced by newer vehicles.

#### **> Engine Standards**

Tier 2 and 3 standards for new off-road and small engines started in 2001 and will continue to be phased in through 2008.

#### **> Fuel Standards**

New standards for low-sulfur gasoline required 30 parts per million by the end of 2006. New standards for low-sulfur diesel fuel require 500 ppm for all off-road vehicles by 2007, which lowers to 15 ppm by 2010. Locomotives are required to use 15 ppm in 2012.

### **Program Costs**

Literature from the U.S. Environmental Protection Agency has indicated the costs for the above measures.

#### **> Engine Standards**

The cost for large off-road engines will increase in cost by about 1 to 3 percent. Smaller engines will increase in cost by about \$20 to \$56 per unit.

#### **> Fuel Standards**

Low-sulfur gasoline adds \$0.02 per gallon to fuel costs. Low-sulfur diesel fuel adds \$0.04 per gallon to fuel costs.

### **Air Quality Benefit**

From 2007 to 2008, the federal programs will reduce volatile organic compound (VOC) and nitrogen (NOx) emissions due to fleet turnover. These programs will reduce 2.6 tons per day (tpd) VOC and 2.8 tpd NOx.

## Clean Air Fleets: Voluntary Diesel Retrofit Program

### **Program Description**

CAF is a regional public-private initiative to educate on- and off-road diesel vehicle operators on how to voluntarily reduce diesel emissions while saving money. While retrofit programs are classified as PM reduction projects, they also get CO and NOx benefits.

The primary goal of this effort is to reduce emissions from heavy-duty diesel vehicles (HDDVs) through the use of simple retrofit and idling reduction technologies and the use of alternative fuels. The equipment includes diesel oxidation catalysts (DOC), closed crankcase filtration (CCF) units and engine pre-heaters and auxiliary power units (APU) to reduce idling. Other technologies will be deployed as they become available. A secondary goal is to provide education and outreach assistance to fleet owners.

While this program focuses on both public and private fleets, the main emphasis thus far has been with public fleets. Prior to the 2008 ozone season, four program elements could have an impact on summertime ozone. These include:

- ✓ Clean Yellow Fleets for Blue Skies (CYFBS) addressing school buses;
- ✓ The Colorado Retrofit Project (CORP) addressing on-road HDDVs from government fleets;
- ✓ The EPA funded APU Project to retrofit idle reduction technology on on-road trucks; and
- ✓ The Rocky Mountain Clean Diesel Collaborative (RMCDC) designed to provide a forum to discuss retrofit efforts in the Denver area as well as the entire EPA Region 8 area.

### **Program Costs**

Between now and the end of Ozone Season, program costs are estimated to at approximately \$1.85M for this portion of a much larger program. Table 1 below shows the program cost breakdown. Reduced fuel usage expenses in the affected fleets are not included in this analysis.

**Table 1 – Program Costs**

	Cost
APU TPY (9 units)	\$80,000
DOC/CCF TPY (390 tandem units)	\$975,000
Preheaters TPY (530 units)	\$795,000
Total	\$1,850,000

### **Air Quality Benefit**

Overall, program partners anticipate installing 390 DOCs, 390 CCF, 530 preheaters and 9 APUs by the summer of 2008. This will equate to a minimum estimated 10 TPY PM, 2,254 TPY CO, 27 TPY NOx, and 237 TPY HC which translates into 0.03 TPD PM, 6.18 TPD CO, 0.07 TPD NOx and 0.65 TPD HC. Additional benefits may be achieved if more equipment installations are finished prior to the 2008 summertime ozone season.

**Table 2 – Diesel Retrofit Emissions Benefits**

	PM	CO	NOx	HC
APU TPY (9 units)	0.06	2.14	3.25	0.28
DOC/CCF TPY (390 tandem units)	9.62	2,236.92	0.00	234.52
Preheaters TPY (530 units)	0.48	17.67	26.90	2.35
Total TPY	10.10	2,254.59	26.90	236.87
TPD	0.03	6.18	0.07	0.65

Additional benefits could be achieved through the outreach and education activities of the RMCDC. As the message of the RMCDC broadens, more fleets may undertake retrofit projects outside the RAQC program.

## **OzoneAware: Reducing Regional Ozone through Education & Outreach**

### **Program Description**

The 2008 program will build on past efforts, which include four major components – media outreach, citizen education and outreach and local government outreach. Together, these components will build on the successes of past programs in raising awareness by providing a deeper understanding of the issues.

#### > Media Outreach

The RAQC will continue its media outreach and education efforts to ensure local media are communicating information about ozone pollution and its health effects during live segments, in print and online.

#### > Citizen Education & Outreach

The RAQC will participate in a number of community outreach events to further educate the citizens on ozone reduction strategies relating to vehicles and vehicle maintenance. In addition, staff will continue to update its OzoneAware.org web site. The program will continue to promote the “Summer Chill” campaign as a means to encourage behavior change.

#### > Local Government Outreach

The RAQC will produce informational materials to assist local government public information staff in increasing the understanding of ozone among employees and citizens. In addition, the RAQC will supply gas cap testing equipment to fleet managers to incorporate testing into best maintenance practices.

### **Program Costs**

At this time, the RAQC has about \$260,000 committed to this education effort. The RAQC submitted a proposal for a \$2.5 million, four-year program to the Denver Regional Council of Governments’ Congestion Mitigation Air Quality funding process. However, funding priorities and projects will not be determined until spring 2008. Should the RAQC receive additional funding next spring, these efforts could be greatly expanded to reach a much larger audience.

### **Air Quality Benefit**

It is very difficult to quantify the air quality benefit received from education and outreach efforts because changes in behavior are voluntary. For the 2008 program the RAQC will continue the education efforts it employed during the 2005-07 comprehensive campaign, building on the successes of the program.

Should the RAQC receive the additional funding for its proposed four-year efforts, the campaign will be greatly expanded. It is estimated the program will achieve a 0.5 ton per day (tpd) reduction in volatile organic compounds (VOCs) in the first year, a 1 tpd reduction in VOCs in year two, a 1.4 tpd reduction in VOCs in year three and a 1.9 tpd reduction in VOCs in year four. The assumptions used for calculating the emissions reductions are based in large part on the results of the RAQC’s October 2007 Ozone Education and Outreach Program Post-Campaign Public Opinion Survey. The survey determined the types of actions and behaviors citizens are engaged in and at what frequency. The campaign will seek to target those people who report “rarely” engaging in the activities communicated in the messaging. Conservative assumptions were made as to what percentage of those groups could be reached in the four years of the campaign, based on the level of ease or difficulty of the action, as demonstrated in the table.

Behavior	% Who “Rarely” Engage in Behavior	% of Target Reached
Limit driving / Take alternative modes of transportation	26%	1.5% by 4 <sup>th</sup> year
Keep vehicle well-maintained	6%	5% by 4 <sup>th</sup> year
Stop at the Click when refueling	12%	20% by 4 <sup>th</sup> year
Refuel in the evening	18%	8% by 4 <sup>th</sup> year
Use low-polluting / water-based products	13%	2% by 4 <sup>th</sup> year
Use earth-friendly lawn equipment	39%	6% by 4 <sup>th</sup> year
Mow in the evening	18%	12.5% by 4 <sup>th</sup> year

These assumptions were calculated with current data including emission inventories, population, vehicle trips and vehicle population, among other factors, to determine the estimated benefit.

## **Use of Ethanol (E85) in Flex-Fuel Vehicles**

### **Program Description**

The RAQC is involved in a two efforts to increase the usage of E85. The first is the Governor's Biofuels Coalition (GBC). This coalition of government agencies, fuel distributors and the public has secured grant and other funding to increase E85 usage throughout the state. The second is a project developed in partnership between the RAQC and Colorado Corn Growers (CC) that focuses on increasing E85 usage in the metro Denver area. The overall goals of these two efforts include:

- Developing public and private E85 pumping infrastructure;
- Increasing the usage of E85 throughout the state;
- Directing motorists to E85 pumps;
- Educating the motoring public;
- Increasing the sales of flex fuel vehicles (FFV) by training dealership staff;
- Promoting E85 at the pump through outreach and signage; and
- Increase energy independence and security.

The GBC effort should result in up to fifty E85 pumps being installed around the state by the end of 2007. The Colorado Corn effort has installed five E85 pumps in Aurora, Brighton, Castle Rock, Denver and Thornton. More pumps will be installed in 2008 as funding permits. In addition, this effort has provided training for staff in 18 dealerships that sell FFVs.

The GBC project has resulted in approximately 730,000 gallons of E85 sold in FFY 4<sup>th</sup> Quarter 2007. The goal of the GBC is to double this amount by FFY 4<sup>th</sup> Quarter 2009. The Colorado Corn effort has resulted in the sale of approximately 470,000 gallons of E85 between April 2007 and September 2007.

### **Program Costs**

Overall, approximately \$210,000 will be expended for the Colorado Corn effort. Approximately \$260,000 will be expended for the GBC effort in the 2008 timeframe. These program costs include pumping infrastructure, program administration and outreach.

### **Air Quality Benefit**

Air quality benefits are difficult to determine at this time due to conflicting data. Estimated tailpipe reductions of criteria pollutants are estimated to be 10 percent – 40 percent depending on the pollutant and the study referenced.

The primary benefit from E85 is lowered benzene and butadiene emissions and lowered fuel volatility. This lower fuel volatility results in less evaporative emissions from the vehicle. Another benefit of ethanol is reduced greenhouse gases. Additional benefits include energy independence and security by reducing America's reliance on foreign oil.

## **Voluntary Reduction in Reid Vapor Pressure (RVP) of Gasoline**

### **Program Description**

Reid Vapor Pressure (RVP) is a measure of gasoline volatility. Lower RVP gasoline during the summer months results lower evaporative hydrocarbon emissions from a vehicle's fuel system. It also has benefits in reducing evaporative emissions from non-road and small engines.

In 1999, in response to a request from the Regional Air Quality Council and the Air Pollution Control Division, gasoline suppliers in the Denver region voluntarily agreed to reduce the volatility of gasoline sold by at 0.5 psi (pounds per square inch) from the current regulatory limit of 9.0 psi. Suppliers ultimately achieved a reduction to 8.2 psi.

After high ozone levels in the Denver area in 2003, EPA lowered the regulatory RVP limit to 7.8 psi beginning in the summer of 2004. The limit is applicable to gasoline sold in the former 1-hour ozone nonattainment area, which includes the counties of Denver, Jefferson, Boulder, Douglas, Broomfield and western portions of Adams and Arapahoe.

Many other ozone nonattainment areas around the country require RVP limits as low as 7.0 psi to further reduce evaporative emissions from gasoline engines. Some refiners that supply the Denver region already produce lower RVP gasoline that provided to other markets in the Southwest and Midwest.

### **Implementation**

Under provisions of the federal Clean Air Act, lower RVP gasoline requirements can only be formally adopted in an area as part of a state implementation plan (SIP) revision that is approved by EPA. Since the new 8-hour ozone SIP will not be approved by EPA until 2009 or later, lower RVP gasoline required by regulation in the Denver/North Front Range region during the 2008 season.

Therefore, the Regional Air Quality Council and/or the Air Quality Control Commission will once again request that suppliers take steps that are readily available to voluntarily reduce the RVP of gasoline sold in the Denver/North Front Range region by the summer of 2008. Options may be limited for some if not all of the refiners supplying the area because of current technological limitations.

### **Program Costs**

Preliminary cost information from EPA and other states indicates the cost of lower RVP gasoline could range from one to three cents per gallon sold. Based on historical amounts of gasoline sold in the Denver/North Front Range area, this could cost between \$2.5 million to \$10 million during the 3-month summer ozone season, or about \$30,000-\$120,000 per day.

### **Air Quality Benefit**

Preliminary modeling by APCD indicates that a 0.5 psi reduction in RVP for all gasoline sold in the Denver/North Front Range region would result in about 3.5 tons per day reduction in VOC emissions. If 30 percent of the gasoline sold in the region achieved a 0.5 psi RVP reduction, the emissions reduction would be about one ton per day.

## **Voluntary Reduction Reid Vapor Pressure (RVP) of Gasoline in North Front Range**

### **Program Description**

Currently 7.8 psi RVP gasoline is required only in the 7-county Denver –hour ozone attainment / maintenance area. In Larimer and Weld counties, the legal limit is 9.0 psi. However, testing by APCD indicates that approximately 80 percent of the gasoline sold in Larimer and Weld counties meets the 7.8 psi RVP level (8.8 for ethanol blends) because of the supply and marketing characteristics in this region.

### **Implementation**

Community leaders in the North Front Range and/or the Air Quality Control Commission would request that suppliers voluntarily supply 7.8 psi RVP gasoline (8.8 for ethanol blends) exclusively in the North Front Range region by the summer of 2008. Most refiners should be able to comply with this request since 7.8 psi base gasoline is already supplied in the majority of the area.

### **Program Costs**

Preliminary cost information from EPA and other states indicates the cost of lower RVP gasoline could range from one to one and one-half cents per gallon sold. Based on historical amounts of gasoline sold in the North Front Range area, this could cost between \$100,000-150,000 during the 3-month summer ozone season, or about \$1,000-\$1,500 per day.

### **Air Quality Benefit**

Preliminary modeling by APCD indicates that if all gasoline sold in the North Front Range region complies with 7.8 psi limit, VOC emissions would be reduced by about 0.4 ton per day.

## **Retrofit and Replacement of High-Bleed Valves to Low-Bleed Valves & New Installations of Low-Bleed/No-Bleed Valves**

### **Program Description**

Pneumatic devices powered by pressurized natural gas are widely used in the natural gas industry as liquid level controllers, pressure regulators and valve controllers. As part of normal operation natural gas powered pneumatic high-bleed control devices release or bleed gas to the atmosphere. Approximately, two-thirds of the pneumatic control devices used by the natural gas industry are utilized in the production sector.

New installation, early replacement or end of service life replacement of high bleed valves to low bleed valves has been found to reduce about 98% of the gas released to the atmosphere. Similar reductions are possible with retrofit kits and good maintenance practices on existing valves. It is estimated that about 80% of all high-bleed devices can be replaced with low-bleed equipment or retrofitted. Some high-bleed valves should not be replaced with low-bleed control devices. The control of very large valves that require fast and/or precise response to process changes often require high-bleed valves.

### **Program Costs**

Early replacement of a high-bleed valve with a low-bleed valve is estimated to cost \$1350. Based on \$3 Mcf gas the payback is estimated at 21 months.

The incremental cost difference of high-bleed valves versus low-bleed valves for a new installation or end of service life replacement is estimated to cost \$150-250. Based on \$3 Mcf gas the payback is estimated at 5-12 months.

Enhanced maintenance, cleaning and tuning, repair/replacing leaking gaskets, tubing fittings and seals on pneumatic devices is estimated to cost up to \$350. Based on \$3 Mcf gas the payback is estimated at 0-5 months.

### **Air Quality Benefit**

The VOC volume and content of the vented natural gas is dependent on a number of variables including pressure in the basin, pressure at the well, drilling depth, characteristics of the gas itself etc. At this time the preliminary estimate for pneumatic valve emissions is about 6.6 TPD, which is based on Wyoming data from the WRAP Phase II Report.

A joint effort of the APCD and industry is currently developing a more refined estimate of completion emissions by January 2008. At that time there will be a better understanding of control requirements and benefits.

However, based on the preliminary estimate this strategy could reduce emissions by  $6.6 * (0.8 * 0.98) = 5.2$  TPD when fully implemented. A voluntary repair/retrofit program could possibly address 10% of the replaceable valves for a reduction of 0.5 tpd.

### **References:**

Natural Gas Star Lessons Learned from Partners  
Draft Final Report – WRAP Area Source Emissions Inventory/Control Strategy Evaluation Phase II,  
Environ for the Western Governor's Association, July 2007  
Air Pollution Control Division 8-hour Ozone Inventory Estimate, August 29, 2007

## **Green Completions for Oil & Gas Well Development**

### **Program Description**

In a gas well drilling operation, a final step before producing the natural gas to a sales line is to “clean up” the well-bore and reservoir immediately surrounding the well. Traditionally, this well completion step involves producing the well to open pits or tankage where sand, cuttings, and reservoir fluids are collected for disposal and the produced natural gas is vented to the atmosphere.

Well completions can require an average of 1 to 8 days depending on the conditions of the gas field. Flaring of the vented gas during completions, when handling large volumes of gas for days, has lower control efficiency (62%-84%) than other typical flaring (95%-98%) operations.

Green Completion methodology on the Western Slope and other western U.S. locations has involved bringing additional equipment on site to clean up the gas sufficiently for delivery to the sales line. The additional equipment may include considerably more tankage, special gas-liquid-sand separator traps, and portable gas dehydration. Reductions of 70% of the gas normally vented have been reported. Flaring of the remaining 30% of gas vented can achieve additional reductions.

Completions in the Wattenberg gas field (Weld County) are reported to require one day or less to produce the well to the sales line and at lower volumes (20-100 mcf) than maybe found elsewhere in the state.

### **Program Costs**

The capital cost for Green Completion equipment includes portable separators, sand traps, and tanks have been reported by one operator to be approximately \$180,000. The equipment can be moved from well site to well site. Amortizing the cost over 10 years results in annual capital charges of \$10,000. Operational costs are over \$1,000 annually. Based on a natural gas price \$3 per Mcf and condensate price of \$19 per barrel, green completions will pay back the costs in about 1 year.

Completions in the Wattenberg gas field (Weld County) do not appear amenable to green completions as discussed above. It is unclear at this time whether it is practical to attempt to flare emissions for less than a day.

### **Air Quality Benefit**

The VOC volume and content of the vented natural gas is dependent on a number of variables including pressure in the basin, pressure at the well, drilling depth, characteristics of the gas itself etc. At this time the APCD preliminary estimate for completions is about 42 TPD, which is based on Wyoming completion data from the WRAP Phase II Report. However, industry representatives reported to the AQCC on November 15, 2007 that completion emissions are nominally 0.5 ton/well and collectively in the Wattenberg field are approximately 1.5 to 2.5 TPD.

A joint effort of the APCD and industry is currently developing a more refined estimate of completion emissions by January 2008. At that time there will be a better understanding of control requirements and benefits.

### **References:**

Natural Gas Star EPA PRO Fact Sheet No. 703  
Draft Final Report – WRAP Area Source Emissions Inventory/Control Strategy Evaluation Phase II, Environ for the Western Governor’s Association, July 2007  
Air Pollution Control Division 8-hour Ozone Inventory Estimate, August 29, 2007  
An Industry Perspective - presentation to Air Quality Control Commission, November 15, 2007

## **Residential Mower Trade-Out Program**

The Regional Air Quality Council will work with a number of partners in its 2008 residential mower trade out program. The goal of the program is to offer free or deeply discounted earth friendly mowers when citizens permanently recycle gasoline-powered mowers. In addition, the program will raise awareness about the many available alternatives to gasoline-powered equipment available today.

### **Program Description**

The RAQC will seek to work with a number of diverse partners in order expand the reach of this program to its full capacity. Citizens can take advantage of the program throughout the course of the spring and summer months online at [OzoneAware.org](http://OzoneAware.org). This program will help secure media coverage throughout the spring and summer months, which will coincide with the activities of the OzoneAware outreach and education campaign.

> Online at [OzoneAware.org](http://OzoneAware.org)

The RAQC will use the comprehensive web pages that were developed in 2007 as part of the Mow Down Pollution mower trade out program. The web pages provide a list of participating manufacturers that offer deep discounts on earth friendly lawn equipment. In addition, the web pages include information on the lawn equipments' contribution to summer ozone pollution and subsequent health effects. Information on recycling gasoline-powered equipment, pricing and extra rebates offered through the RAQC also will be included on the pages.

### **Program Costs**

Currently, the RAQC has \$20,000 for a program in Weld County. In addition, the StEPP Foundation has dedicated \$12,900 for a program covering the metro-Denver region. The retail cost of earth-friendly mowers, similar to the ones offered during the 2007 program, range from \$400 to \$450. If the RAQC subsidizes each mower at \$200, the \$32,900 will subsidize a total of 165 mowers. If additional funding is secured the program can be greatly expanded, which would yield a greater benefit. If a total of \$100,000 was secured, the program could subsidize 500 mowers.

### **Air Quality Benefit**

Based on a \$32,900 program, it is estimated that this program will permanently recycle 165 gasoline-powered mowers. This will achieve an approximate 0.26 ton per day (tpd) reduction in volatile organic compounds (VOCs). A larger funded program would recycle 500 mowers, yielding a 0.8 tpd reduction in VOCs.

## **Preventing Pollution in Public Places: Municipal Landscaping Pilot Project**

### **Program Description**

The Regional Air Quality Council will work with a number of municipal governments throughout the region in early 2008 on a pilot project that will reduce ozone pollution in parks, golf courses and other public places by improving the type of landscaping equipment used. The Preventing Pollution in Public Places (4P) program will offer the needed information and guidance on more earth friendly equipment and services in order to encourage changes in contracts and equipment.

There will be three ways in which municipal governments can take advantage of the informational and educational program – updating contracts with professional landscapers to specify the use of earth friendly equipment, updating equipment owned by the municipalities to more earth friendly alternatives and/or replacing all existing gas cans with no spill, impermeable alternatives. This combination will provide a number of convenient ways in which municipalities can make a difference throughout their cities. The RAQC will act as a clearinghouse of information to assist the local governments with their ozone reduction projects.

#### **> Updating/Renegotiating Landscaping Contracts**

The RAQC will encourage municipal partners to update or renegotiate contracts with landscaping companies who use renewable power sources (such as solar or electric) or for those who turnover equipment in a specified time (to be determined). Where possible, consideration should be given to those professional landscapers who are flexible on the time of day they provide services (later in the day, for example).

#### **> Updating Equipment Owned by Municipalities**

The RAQC will encourage municipal partners to update their old gasoline-powered landscaping equipment with newer, less-polluting or alternatively-powered equipments. This can include mowers, trimmers and leaf blowers. Due to the cost of the equipment, it may be necessary to identify funding sources to help offset the cost to the municipalities.

#### **> Gas Can Change-Out**

The RAQC will partner with municipalities to permanently recycle old gas cans and replace them with no-spill, impermeable alternatives. The newer alternatives are equipped with a no-spill nozzle to avoid spills and leaks and are double-coated on the inside to prevent permeation and evaporation.

### **Program Costs**

The cost of this program will vary among each municipality, depending on the type and quantity of equipment used the rates negotiated in contracts. Until this program is further developed and preliminary information is provided by a number of municipalities, it is impossible to know the cost. However, no-spill, impermeable gas cans cost about \$12/each. A small amount of funding (about \$5,000) has been secured from the StEPP Foundation to replace gas cans. This funding will purchase just over 400 replacement cans.

### **Air Quality Benefit**

Due to the variability of the equipment used among each municipality, it is impossible to know at this time the air quality benefit that will be achieved. However, the total contribution of volatile organic compounds for large-scale/commercial equipment in the Denver region equates to about 34 tons per day (tpd). A detailed inventory taken in the San Antonio region (population of about 2 million) indicated that government operations were responsible for about 10 percent of their total lawn and garden source. If the same is true for the Denver region, we can assume that government operations are responsible for about 10 percent of the total in this source category (3.4 tpd). If this program is successful in reaching a mere 5 percent of the 3.4 tpd, the benefit would be a reduction of about 0.17 ton per day. This is equivalent to one medium-sized local government in the Denver region.

## Tighten Vehicle Inspection/Maintenance Program Cut Points in Reg. 11

### Program Description

The Inspection and Maintenance (IM) Program is designed to reduce motor vehicle emissions through the detection and repair of high-emitting motor vehicles. Vehicles that are due for emissions testing are required to meet certain standards for HC, CO and NOx. The current IM Program was designed as a CO control strategy and has higher cutpoints for HC and NOx. Elevated eight-hour ozone concentrations have shifted the focus of the program to reducing ozone precursor emissions. To more fully utilize the current IM Program in reducing ozone precursors, the emissions standards that are used to identify high-emitting vehicles should be modified and made more stringent.

Overall, reducing cutpoints will increase the number of vehicles failed under the IM Program. This will increase the program emissions reduction but will also increase program costs.

Tightening IM Program cut points would require regulatory action prior to implementation. Currently, CDPHE plans to propose these changes in December 2007 and request a hearing in March 2008. Program implementation could begin in May 2008.

The cutpoints would be designed to ensure maximum repairable emissions while reducing the potential for false failures. Table 3 shows emissions benefits per CDPHE's modeled analysis presented at the November 7<sup>th</sup> Mobile Sources and Fuels Stakeholder Meeting.

### Program Costs

Program costs are currently being developed by CDPHE staff. This cost analysis will include inspection fees, repair costs and fuel economy savings. RAQC staff will provide this information when it is finalized.

### Air Quality Benefit

Overall, program benefits are estimated at 0.88 TPD HC, 13 TPD CO and 3 TPD NOx after a full two year cycle and all vehicles have been subjected to these new emissions standards. Reductions during the 2008 Ozone Season are estimated at 0.15 TPD HC, 2 TPD CO and 0.5 TPD NOx.

**Table 3 – Emissions Benefits Due to Tighter Cutpoints**

	HC	CO	NOx
Repair Benefit After Full Implementation	0.88	12.68	3.05

## **Expand Regulation No. 3 VOC requirements to Larimer & Weld Counties**

### **Program Description**

In revisions to Regulation No. 3 proposed to the Air Quality Control Commission on November 15, the Air Pollution Control Division has proposed expanding RACT (Reasonably Available Control Technology) requirements for new or modified Minor Sources of Volatile Organic Compounds (VOC) to any nonattainment area in the state, which now includes portions of Larimer and Weld counties. This includes new or modified minor emissions units at major stationary sources of VOC and NOx. Coverage for VOCs was inadvertently left out of revisions to Regulation No. 3 several years ago.

In addition, effective with the ozone nonattainment designation on November 20, 2007, the Air Pollution Emission Notice (APEN) reporting threshold for criteria pollutants has been lowered from two tons per year (tpy) to one tpy and the permitting threshold under Regulation No. 3 for VOC sources in the new (DMA/NFR) 8-hour ozone nonattainment area has been lowered from five tpy to two tpy.

### **Program Costs**

A detailed analysis of required controls and costs has not been done by the Division at this time.

RACT in many cases is defined by best management practices. Sources in Larimer and Weld counties, such as surface coating operations or solvent degreasing, etc. may currently be employing best management practices. Therefore, little increased cost for these sources may result.

### **Air Quality Benefit**

As noted above, a detailed analysis has not been done at this time and possible emission reduction benefits have not been quantified.