Appendix F

Control Option 9

Control Option: Alternative/Renewable Energy and Energy Efficiency Requirements

Description:

Power sector NOx (and other pollutant) emissions growth can be offset by utilization of renewable energy resources and energy efficiency measures. The Air Pollution Prevention Forum (AP2) of the Western Regional Air Partnership (WRAP), in which Colorado is a participating State, developed renewable energy and energy efficiency policy and program recommendations that would reduce emissions and electricity production costs in the western region of the U.S.. These recommendations followed on the findings of the Grand Canyon Visibility Transport Commission's (GCVTC), and the WRAP has adopted policy statements in support of the GCVTC's renewable energy goal of 10% generation of electric power from renewable resources by 2005 and 20% by 2015 (known as the 10/20 goal) along with increasing the use of energy efficiency technologies in the region.

The AP2 Forum adopted a definition of renewable energy as "electricity generated by non-nuclear and non-fossil low or no air emission technologies using resources that are virtually inexhaustible, reduce haze, and are environmentally beneficial. The term includes electricity generated by wind energy technologies; solar photovoltaic and solar thermal technologies; geothermal technologies; technologies based on landfill gas and biomass sources; and new low-impact hydropower that meets the Low-Impact Hydropower Institute criteria. Biomass includes agricultural, food and wood wastes. The term does not include pumped storage or biomass from municipal solid waste, black liquor or treated wood."

The GCVTC's support for increasing energy efficiency technologies included the continued development and implementation of national energy efficiency standards for motors, appliances and lighting and recommends the national adoption of the California energy efficiency standards. The GCVTC also supported the construction of energy efficient buildings, both residential and commercial, and proposed the reinstatement of incentives for building energy efficient structures. The GCVTC also suggested the continuation of demand-side management programs. The GCVTC recommended that continuing attention be paid to maintaining the role of energy conservation within the changing electric power industry markets. Energy conservation programs should be preserved and expanded through such mechanisms as "system benefit charges" paid at the distribution level.

Recommendations and reports from the WRAP's AP2 Forum are available to states and tribes for use in developing programs in their areas, including regional haze SIPs for reducing future impacts of NOx emissions growth related to power generation. Five states in the WRAP region that adopted section 309 regional haze SIPs already are required to include a variety of information addressing energy efficiency programs, renewable energy production and consumption, and descriptions of programs and policies each state will rely on towards meeting the GCVTC's regional goal for renewable energy. Colorado's neighboring states of Wyoming, New Mexico, Utah, and Arizona are all section 309 SIP states. Colorado could adopt similar measures as part of their regional haze SIP under section 308.

Benefits of Alternative/Renewable Energy and Efficiency Requirements:

Assessments conducted for the AP2 Forum by ICF Consulting reported that energy efficiency combined with renewable energy measures: could reduce power demand in the West by 8% by 2018; lowers costs for meeting air quality regulations; offers savings in energy and costs of new fossil-fired power plants; provides for increases in affordable and reliable electricity; offers economic development opportunities for rural areas and tribal lands; and creates opportunities for emissions reductions.

The AP2 Forum found that providing financial incentives to both producers and consumers would have the best chance of increasing the West's energy generation through renewable energy sources. Together with energy efficiency measures, increasing renewable generation by 20% by 2015, consistent with the GCVTC's goal, could reduce electricity production costs by an average of $700 million per year as a conservative estimate.

A breakdown of the regional economic impact by state indicates that Colorado would benefit in all 3 categories using the 3 different policy scenarios considered in the assessment. These include annual average changes in employment, gross regional product, and real disposable income considering policies for the renewable energy 10/20 goal only, the energy efficiency measures only, and using the combination of renewable energy with energy efficiency. The annual levelized economic benefits for Colorado in 2001 dollars ranged from $258 million in gross regional product to $288 million in real disposable income based on the combination policy scenario above.

The assessment also indicates that by 2018 the emissions reduction in NOx from implementing the 10/20 goals and energy efficiency recommendations will be between 8,000 to 14,000 tone annually, assuming that such measures displace new gas-fired combined cycle electric generation which would have relatively low NOx emission rates.

In addition, estimated emission reductions in CO2 are projected to be between 40 million and 55 million metric tons, providing a substantial hedge against future CO2 growth.

Costs/Tradeoffs Associated with Alternative/Renewable Energy and Efficiency Requirements:

The economic assessment report prepared by ICF for WRAP's AP2 Forum summarizes the production cost impacts of the policy scenarios above to project a net cost savings, with the 10/20 goal resulting in production cost impacts of 2 to 5% while energy efficiency measures would achieve production cost savings of 5 to 7%. Further, because the 10/20 goals and energy efficiency measures shift production expenditures away from fuel and towards capital, these policy objectives offer some security against fuel price volatility and fuel supply stocks.

Description of How to Implement:

The AP2 Forum of the Western Regional Air Partnership (WRAP) developed specific policy and program recommendations for promoting state and tribal adoption of renewable energy and energy efficiency measures, primarily for the purpose of inclusion into state regional haze implementation plans. WRAP's policy document on these pollution prevention strategies is broadly written to allow states to tailor policies and programs to the unique circumstances existing in their jurisdiction.

Feasibility of Alternative/Renewable Energy and Energy Efficiency Requirements:

The policy, individual, and corporate options included in the AP2 Forum's recommendations for this type of pollution prevention strategy appear to be feasible for the State of Colorado. Many of the strategy elements are already being implemented, but perhaps without a comprehensive,

coordinated State policy or program in place. A pollution prevention program function exists within the CDPHE but is still in its infancy.

Background Data and Assumptions Used:

The WRAP's "Policy on Renewable Energy and Energy Efficiency as Pollution Prevention Strategies for Regional Haze", April 2003.

"Economic Assessment of Implementing the 10/20 Goals and Energy Efficiency Recommendations", October 2002, prepared for WRAP AP2 Forum by ICF Consulting

Uncertainty Associated with Alternative/Renewable Energy and Energy Efficiency Requirements:

The uncertainty associated with the ICF assessment on renewable energy technology cost and performance, and modeling and analytical results estimating emissions reductions, cost, and secondary regional economic impacts is not quantified. Technology cost and performance assumptions were key drivers of the analysis and were based on a variety of different sources, including existing literature, data developed by the Energy Information Administration, data developed by the National Renewable Energy Laboratory, and stakeholder input from the AP2 Forum.

Given that the magnitude of predicted changes were relatively small for analysis of secondary regional economic impacts and many of the costs projected using the Integrated Policy Model were small relative to the total production costs of the sectors modeled, it is difficult to interpret the changes with precision. ICF suggests that using the analysis of broader trends rather than specific numbers would provide a more meaningful description of the impacts.

Appendix G

Control Option 10

Control Option: Local VMT Reductions

Description:

Local vehicle-miles-traveled (VMT) reductions in and near RMNP have been suggested to reduce emissions affecting the Park. Further restricting or banning vehicles in the Park and controlling/reducing VMT in the Estes Park and Northern Front Range region would reduce emissions from those close-in sources. Other methods of reducing VMT include mass transit systems, carpooling/vanpooling, and development of new or modification of existing routing to make it more efficient. Similar to other areas of the State, light and heavy-duty vehicles that account for the VMT near the park are on average becoming cleaner burning with fewer emissions.

The NPS is proactive in seeking innovative approaches to pollution prevention in its national Parks and RMNP is no exception. Opportunities related to the transportation sector include VMT reduction considerations, more in-park transportation systems, low-emissions buses/shuttles, conversion of park vehicle fleets to cleaner fuels, and other available measures. Most recently, RMNP is participating with the local gateway community of Estes Park to review existing, and plan for an improved, transit program that will accomplish emissions reductions throughout the area.

Benefits of Local VMT Reductions:

By reducing the miles traveled by road-use vehicles, mobile source emissions can be reduced. Less VMT can be accomplished by reducing total traffic levels, creating a more efficient route system, or both. In addition to directly reducing emissions due to less miles traveled, another benefit would generally include traffic congestion mitigation, further lowering emissions associated with idling and longer engine operating times for the same distance traveled by a vehicle.

If existing VMT is a factor in traffic congestion, another benefit of reducing VMT might be a higher quality experience associated with travel, including less stress and delays, and likelihood for traffic-related accidents.

The on-road mobile source contribution to NOx emissions in Larimer County based on the 1996 WRAP emissions inventory was approximately 5000 tons per year, or slightly less than 50% of the total for that year. With an accurate, geographically distributed VMT for the county's road traffic system, the Mobile 6 model could be used to predict the effect of local VMT reductions on air quality in the surrounding area, including RMNP.

Costs/Tradeoffs Associated with VMT Reductions:

There would be some cost to plan for and develop systems and programs associated with reducing local VMT. A transportation study will be necessary to better quantify the distribution of local VMT.

Some tradeoffs might include less privacy and flexibility in schedule for those who may be required to use mass transit, for instance, to travel into areas of RMNP that could restrict or ban use of privately owned vehicles.

An air quality assessment would need to be performed to address the potential for increased ozone levels affecting the area. If ozone that often affects the park in summer months is due to long range transport and not generated locally, then local NOx reductions could exacerbate the ozone problem due to potentially less scavenging of the transported ozone as it travels through the local area of NOx emissions.

Appendix H

Control Option 21

Control Options Analysis for Rocky Mountain National Park Initiative

Proposed Implementation of California Low Emission Vehicle (LEV II) Standards Statewide

Purpose

Purpose: This analysis presents the pros and cons of implementing the California LEV II motor vehicle emission standards in Colorado. In California, LEV II emission standards are being phased-in over the 2004 through 2007 model years. In September 2004, the California Air Resources Board (CARB) approved regulations to control greenhouse gas emissions from new LEV II vehicles beginning with the 2009 model year.

Cost/Benefit

Costs: Costs will be determined through a detailed analysis of the most recent information.

Costs: An analysis by the Mass. State Department of Environmental Conservation said it would take one to five years for drivers of cars, smaller sport utility vehicles and pickup trucks to make up for the higher initial cost of their more fuel-efficient vehicles, assuming a gas price of $2 a gallon. For drivers of heavier S.U.V.'s and pickups, it would take one to three years

Benefits: The CA LEV II standards are intended to reduce green house gas (GHG) emissions and may provide some reduction in motor vehicle NOx emissions beyond the federal Tier II emission standards.

Benefits: The current federal emission standard (will be fully phased-in by the 2009 model year) allows vehicle manufacturers to produce autos/light trucks (<10,000 GVWR) that must fall within a range of 8 certification bins but must average 0.07 g NOx/mile. The California LEV II standard for passenger cars and light-duty vehicles < 8,500 GVWR requires all vehicles meet the 0.07 g NOx/mile. Thus, looking beyond 2009, both standards achieve 0.07 g NOx per mile for most vehicle classes except that CA LEVII includes some ZEV (zero emission vehicles) and the federal standard is stricter on vehicles in the 8,500 to 10,000 GVW class which includes most pick-up trucks and sport utility vehicles. A study in North Carolina indicated that CA LEVII would provide a 10% NOx reduction over Federal Tier II by 2030. A similar analysis is necessary to best characterize the benefits of the CA LEVII program using MOBILE 6 modeling.

Implementation

The non-GHG CA LEV II standards could implemented in the 2009 model year time-frame. The GHG requirements would have to be phased in until 2016 to allow vehicle manufacturers adequate time to develop the technologies necessary to comply with the GHG portion of the CA LEV II standard.

Viability

The actual benefits of a CA LEV II would require MOBILE6 modeling to attempt to quantify the full extent of the NOx emissions reduction.

Additional Details

Federal Tier II Emission Standards (phased in over 2004-2009 model year)

(Tier II includes Tier I light-duty vehicles and medium-duty passenger vehicles and any fuel type)

	50,000 miles [grams/mile]					120,000 miles [grams/mile]				
2009 Model Year - Permenant Bins	NMOG	CO	NOx	PM	HCHO	NMOG	CO	NOx	PM	HCHO
8	0.100	3.4	0.14	-	0.015	0.125	4.2	0.20	0.02	0.018
7	0.075	3.4	0.11	-	0.015	0.090	4.2	0.15	0.02	0.018
6	0.075	3.4	0.08	-	0.015	0.090	4.2	0.10	0.01	0.018
5	0.075	3.4	0.05	-	0.015	0.090	4.2	0.07	0.01	0.018
4	-	-	-	-	-	0.070	2.1	0.04	0.01	0.011
3	-	-	-	-	-	0.055	2.1	0.03	0.01	0.011
2	-	-	-	-	-	0.010	2.1	0.02	0.01	0.004
1	-	-	-	-	-	0.000	0.0	0.00	0.00	0.000

Notes:

1. Tier I vehicles includes passenger cars, light light-duty trucks (LLDT below 6000 lbs GVWR), heavy light-duty trucks (HLDT above 6000 but < 8500
2. In addition to Tier I vehicles, Tier II includes a new class of vehicles "medium-duty passenger vehicles" (MDPV) rated between 8,500-10,000 GVWR and are used for personal transportation
3. Vehicle manufacturers have a choice to certify particular vehicles to any of the 8 "certification bins", the average NOx emissions for all the bins must meet 0.07 g/mi.

California Low Emission Vehicle II (LEV II) Standard

(CA LEV II standard is applicable to all passenger cars and LDV < 8500 lbs that applies to both gasoline & diesel fueled engines)

Light-Duty Vehicles	50,000 miles/5 years [grams/mile]					120,000 miles/11 years [grams/mile]				
Category	NMOG	CO	NOx	PM	HCHO	NMOG	CO	NOx	PM	HCHO
Low Emission Vehicle (LEV II):	0.075	3.4	0.05	-	0.015	0.090	4.2	0.07	0.01	0.018
Ultra Low Emission Vehicle (ULEV):	0.040	1.7	0.05	-	0.008	0.055	2.1	0.07	0.01	0.011

Medium-Duty Vehicles	50,000 miles [grams/mile]					120,000 miles [grams/mile]				
Category	NMOG	CO	NOx	PM	HCHO	NMOG	CO	NOx	PM	HCHO
8,500-10,000 lbs LEV II	-	-	-	-	-	0.195	6.4	0.2	0.12	0.032
10,001-14,000 lbs LEV II	-	-	-	-	-	0.230	7.3	0.4	0.12	0.040
8,500-10,000 lbs ULEV	-	-	-	-	-	0.143	6.4	0.2	0.06	0.016
10,001-14,000 lbs ULEV	-	-	-	-	-	0.167	7.3	0.4	0.06	0.021

Appendix I

Control Option 22

Off-Road and Small Engine California Standards (NOx, VOCs, PM)

Description:

California has its own off-road engine emission standards that in some instances are currently more stringent than EPA's off-road standards - particularly in the small (<50hp) engine category. These more stringent CA standards cover engines used in small hand held equipment, lawnmowers, and construction equipment to name a few.

The federal Clean Air Act Amendments of 1990 (CAA) preempt California's authority to control emissions from new farm and construction equipment under 175 hp [CAA Section 209(e)(1)(A)] and require California to receive authorization from the federal EPA for controls over other off-road sources [CAA Section 209 (e)(2)(A)].

With regard to small engines, States are not permitted to incorporate CA standards for spark-ignition off-road engines below 50 horsepower. See Public Law 108-199 Section 428(c) – "No State or any political subdivision thereof may adopt or attempt to enforce any standard or other requirement applicable to spark ignition engines smaller than 50 horsepower."

Under Section 209(e) a State that has a State Implementation Plan (SIP) can adopt and enforce the CA standards for certain non-road engines that have been authorized by EPA. However, there are some parts of CA's off-road vehicle rules that have not received authorization from EPA. In addition as noted above, currently no State can adopt emission standards for spark ignited engines less than 50 horsepower. EPA is proposing national small engine (< 50 hp) standards in the near future that will be comparable to CA's standards.

Benefits:

Since off-road engines, especially small (<50hp) engines, are numerous in the Front Range area, any reduction of NOx emissions from these sources would be beneficial for reducing the nitrogen deposition rates at RMNP. Generally the CA small engine standards are more stringent than current federal standards, and require quicker implementation. For example, the CA standards for 25 hp and below spark ignition engines (model year 1999 and newer) are 3.2 g/hp/hr NOx plus hydrocarbon. Whereas the current EPA standards for the same type engines (model year 1997 and newer) are 10 to 12 g/hp/hr NOx plus hydrocarbon. See EPA's Emission Standards Reference Guide for Heavy-Duty and Non-road Engines. [See http://www.epa.gov/otaq/cert/hd-cert/stds-eng.pdf]

Using an estimate of the inventory of these sources in the Front Range, an upper range estimate of potential NOx reductions from implementing the CA standards could be calculated.

CDPHE Front Range NOx Emission Inventories (tons per average summer day):

Source Category	2002 Base (tons/day)	2007 Base (tons/day)	2007 Control (tons/day)	2012 Control (tons/day)
Lawn & Garden	10.4	10.4	10.5	10.4
Other Off-road	94.2	82.1	82.8	74.1

Total Anthropogenic	452.7	406.6	388.4	349.4

[Referenced from Rocky Mountain National Park Air Quality Initiative Regulatory and Non-Regulatory Options, March 4, 2005 – Attachment 4 http://www.cdphe.state.co.us/ap/rmnp/policyoptions.pdf]

Based on CDPHE's Front Range NOx inventory, lawn & garden and other off-road engines comprise approximately 24% of Front Range NOx emissions. Therefore, implementation of CA-type small engine standards in the Front Range could result in a significant reduction of overall Front Range NOx emissions.

These reductions could be used by Colorado to control growth related increases in NOx emissions, statewide or in the Front Range counties, in order reduce nitrogen deposition rates at RMNP consistent with the stated resource management goals. This would be a State only program and not be incorporated into Colorado's SIP.

For larger non-road engines CA may no longer have more stringent standards than EPA. EPA's most recent standards may be as stringent, or more stringent, than comparable CA standards, which may not have been updated recently.

Feasibility:

Although CO could adopt and enforce the CA non-road standards that have been authorized by EPA, it is not clear what benefit that would have since EPA's non-road standards for larger engines are as stringent, or more stringent, than comparable CA standards.

CO would not be permitted to incorporate into regulation CA standards for spark-ignition off-road engines below 50 horsepower. However, this control option could be used as a voluntary program where manufacturers of CA compliant small engines are asked to sell these lower emitting units in CO. For example, a program modeled on EPA's "Blue Sky" engine standard could be implemented in CO. This program is designed to provide an incentive for manufacturers to voluntarily certify their engines to a new, more stringent (at least 40% lower) standard earlier than required or to certify to an even lower standard once a new, more stringent standard takes effect. This can provide an opportunity for clean labeling and incentives.

See http://earth1.epa.gov/nonroad/2002/f02036.pdf for more information on the Blue Sky Program.

Appendix J

Control Option 23

Control Options Analysis for Rocky Mountain National Park Initiative

Proposed Implementation of Nox Controls on new and existing engines Statewide

Purpose

Purpose: In AQCC Regulation 7, the Division has proposed implementing NOx controls Statewide for new and existing natural gas fired engines greater than 100 hp. This analysis presents the pros and cons based on an EPA analysis of 1 gram per horsepower-hour for engines greater than 300 hp, and 2 grams per horsepower-hour for engines smaller than 300 hp.

Cost/Benefit

Costs: The Divison used the EPA's economic analysis for the NSPS for Internal Combustion Engines to estimate costs for implementing Statewide NOx controls for new and existing engines. This analysis was conducted using manufacturer and inventory data from the years 1998 - 2002. The proposed emission statndards are based on fuel type, meteorology, and the horsepower capacity of Reciprocating Internal Combustion Engines (RICEs). This analysis uses RICE engines ranging from 100 - 600 hp. Currently, Colorado has 50 major (>100 tpy for NOx) engine units and 280 major (Operating Permit) facilities.

Costs: Rich burn RICE are commonly controlled by a non-selective catalyst (NSCR) and an air fuel ratio controller (AFRC). NSCR typically results in NOx reduction of greater than 90% and up to 99%. NOx emissions from lean burn RICE can be controlled by a selective catalyst reduction (SCR) and also results in NOx reduction greater than 90%. Cost data is based on a 90% reduction.

Cost Discussion: Rich burn RICE exhibit typical nitrogen oxides (NOx) emission factors in the range of 10-20 grams/horsepower hour (g/hphr). Four-cycle lean burn RICE have typical NOx and CO emission factors in the range of 1-2 g/hphr. Most 2 cycle RICE operate as lean burn engines with NOx and CO emissions of approximately 2-3 g/hphr. These emission factors are based on AP-42 data.

Cost Discussion: For engines greater than 300 hp, the EPA estimates that the average cost of NSCR per ton of NOx reduced is about $98/ton (for engines up to 2000 hp). The average cost of NSCR per ton of NOx reduced on engines 100 - 300 hp is on average $153/ton. The average cost for SCR on lean burn engines greater than 300 hp is $9133/ton and for engines 100 - 300 hp is $7760/ton.

Benefits: Applying SCR and NSCR to engines will also result in similar CO reductions (average of 90% reduction).

Disadvantages: Ammonia slip is a large concern. The fuel efficiency is reduced on average by 4%. CO reudtion requires an oxidation catalyst (OC).

Implementation and Viability

The cost efficiency for lean burn engines may not be economically feasible. However, for rich burn engines, NSCR and AFRC are already widely implemented in the industry. This option is readily economically and environmentally feasible and will result in drastic NOx reductions Statewide.

Additional Details

The Division did not perform a comprehensive analysis on the number of engines currently present at the State according to horsepower range sizes due to the complexity and inconsistency of the available inventory data. To be able to analyze engines based on horsepower data, inventory information would have to be reconfigured or an extensive amount of time spent on sorting the available data.

However, in 2003, an analysis was conducted to examine RICE controls in the EAC area. This analysis found that all EAC area RICE emitted about 13,000 tons per year. With rich burn Retrofit Controls (for this area), it was found that NOx would be reduced to 44 tons/year wtih NSCR and AFCR controls. This is a preliminary number to exemplify the effects of a RICE control implementation.

Appendix K

Control Option 39

Agriculture Best Management Practices

Standard Operating Procedure: Plan for Ammonia Reduction?
Dr. Jessica G. Davis Professor, Soil and Crop Sciences
Colorado State University

Ammonia used to be considered only as a nuisance odor emitted by dairies and other livestock operations. Now, ammonia is known to react with atmospheric nitric and sulfuric acids to form fine particulate matter (known as $PM_{2.5}$), which is a major contributor to smog production. This fine particulate matter is of concern because it has numerous important human health effects. It can penetrate deep into the lung tissue, contributing to asthma, bronchitis, and other lung diseases, and has also been linked to heart attacks and strokes. In addition, when ammonia is converted to $PM_{2.5}$ it becomes more mobile and can travel longer distances to affect populations and/or be re-deposited to the ground through rainfall or dry deposition. Nitrogen deposition in Rocky Mountain National Park has resulted in increased soil and water N levels, which can cause changes in plant species and eutrophication. So ammonia is not just a nuisance anymore; it can have serious human health and mountain ecosystem impacts,

Regulations concerning ammonia emissions are likely to be developed in the future. There are practices that you can use to be pro-active and reduce ammonia emissions now, and more are in development. **If you use a combination of BMPs, dairies can reduce ammonia emissions by 65-70% (Powell, 2006)**.

Best management practices (BMPs) can be utilized to reduce ammonia emissions. Since the production facility, manure storage and treatment areas, and sites where manure is applied to land are all major sources of ammonia emissions, ammonia BMPs should be chosen in each of the areas of nutrition, production site management, manure storage and treatment, and land application of manure.

Nutrition BMPs focus on precision feeding, the practice of providing the animals what they need and no more. **Overfeeding protein has been shown to increase ammonia emissions from both monogastrics and ruminants, so take care to avoid this practice.** Analyzing feeds regularly is a useful BMP for precision feeding since feed contents are quite variable. Phase feeding is a commonly used practice for meeting livestock nutrient needs without exceeding them. By dividing the herd by growth stage and productivity, more precise diets can be fed that meet animal needs while minimizing ammonia losses to the air. These practices can also save you money! Experiments in Switzerland (Kulling et al., 2001) found dramatic reductions (up to 76%) in ammonia emissions from laboratory simulations of manure storage from dairy cows fed reduced protein in the diet. The milk production of 68 lbs/d was maintained in the low protein diets by supplementation of a commercially available ‘bypass methionine’. A recent study by Misselbrook et al. (2005a) showed that reducing crude protein in dairy diets reduced ammonia emissions when manure was applied to land. **Lower crude protein diets reduced urinary urea-N levels thus leading to less ammonia loss from land application.**

Therefore, nutritional changes continue to reduce ammonia emissions during manure storage and land application.

In pens, dust control BMPs will help to reduce ammonia loss by decreasing the airborne $PM_{2.5}$ potential. Frequent manure harvesting combined with pen moisture management can be very effective in minimizing dust. Watering the pens, especially those areas with low activity and low moisture, is an effective BMP. Another recent study compared ammonia losses from dairies using different bedding types (Misselbrook and Powell, 2005). **Sand bedding reduced ammonia loss by over 50% as compared to chopped corn stalks and composted manure, and chopped straw and pine shavings had intermediate ammonia losses.**

BMPs for manure storage and treatment can also be helpful to reduce ammonia loss to the air. Reducing storage time reduces N loss to the atmosphere by reducing the reaction time. Covering manure stockpiles and lagoons, and keeping stockpiles dry also reduce N emissions. Aerobic lagoons and anaerobic digesters are also known to conserve nitrogen. The crust that sometimes forms naturally on dairy lagoons was recently measured to reduce ammonia emissions by up to 50% (Misselbrook et al., 2005b). Bedding type continues to have an impact if solid manures are composted; wood chip bedding results in much lower nitrogen loss to the air than straw bedding during the composting process (Hao et al., 2004).

When manure is applied to land, BMPs continue to play an important role in reducing ammonia emissions. Incorporation of manure immediately after application is critical to retaining nitrogen in the soil. Slurries should be injected and drop nozzles could be used for sprinkler irrigation to reduce “air time” and minimize ammonia losses.

I don’t mean to alarm you with yet another concern, but ammonia emissions regulation is likely. Decisions made now could ease your compliance later. We’ll keep you up-to-date so you can choose BMPs that are appropriate for your operation.

References

Hao et al., 2004. J. Environ. Qual. 33:37-44.
Kulling et al., 2001. J. Agric. Sci. Camb. 137:235-250.
Misselbrook et al., 2005a. J. Dairy Sci. 88:1765-1777.
Misselbrook and Powell, 2005. J. Dairy Sci. 88:4304-4312.
Misselbrook et al., 2005b. J. Environ. Qual. 34:411-419.
Powell, 2006. Proc. of the Airy Symposium. Visions for Animal Ag. and the Environ.

Appendix L

Control Option 40

Adopt More Stringent Ambient Standards

INTER-OFFICE COMMUNICATION

TO: Stationary Sources Staff and Local Agencies

FROM: Dave Ouimette

DATE: June 8, 1998 First Revision March 1, 2000 Second Revision April 28, 2003

RE: Agricultural Activities Exemption – Memo PS98 - 02

The purpose of this memo is to clarify what activities may be considered to be agricultural when determining if an APEN or permit is needed, or if a regulation applies.

Regulatory History Since February 1972, Regulation No. 3 has contained language that exempts some agricultural activities from APEN requirements. The current language in Regulation No. 3, Part A, Section II.D.1.g. was adopted in July 2002 and exempts:

> *"Agricultural operations such as farming, cultivating, harvesting, seasonal crop drying, grain handling operations that are below New Source Performance Standards de minimis levels (including milling and grain elevator operations), and animal feeding operations that are not housed commercial swine feeding facilities as defined in Regulation No. 2, Part B. This exemption does not apply to an agricultural operation that: (1) is a major stationary source (Regulation No. 3 Part A, section I.B.59; (2) meets or exceeds the storage capacity thresholds of a federal New Source Performance Standard (Regulation No. 6, Part A); or (3) participates in the early reduction program of the Federal Act, section 112. Ancillary operations such as fueling stations located at farms or ranches are not exempt from Air Pollutant Emission Notice and permit requirements unless otherwise below the de minimis emission levels contained in this regulation, and are not exempt from other applicable regulation promulgated by the commission."*

This language replaced the previous APEN exemption, which had been in place since 1980 and exempted:

> "Agricultural operations normally conducted at the farm or ranch including, for example, cultivating and harvesting. This shall not include grain elevator operations, feed mill operations or other post-harvesting activities normally not conducted on the farm or ranch."

In 1992 the Colorado legislature revised the state law to include an exemption from air pollution control laws for emissions resulting from agricultural production. In November 1998, the voters of Colorado approved Amendment 14, which further revised the state law. Amendment 14 required large hog farms (also known as housed commercial swine feeding operations) to meet odor control requirements. The hog farm regulations were approved by the Air Quality Control Commission in April 1999 and are contained in Regulation No. 2, Part B. Consequently the hog farm provisions contained in Regulation No. 2 override the agricultural exemption. Hog farms must submit permit applications for odor sources and hog carcass incinerators. The current language in Colorado Revised Statutes, Section 25-7-109(8) states:

> "Notwithstanding any other provision of this section, the commission shall not regulate emissions from agricultural production such as farming, seasonal crop drying, animal feeding operations that are not housed commercial swine feeding operations as defined in section 25-8-501.1 (2)(b), and pesticide application; except that the commission shall regulate such emissions if they are "major stationary sources", as that term is defined in 42 U.S.C. sec. 7602 (j), or are required by Part C (prevention of significant deterioration), Part D (nonattainment), Title V (minimum elements of a permit program), or are participating in the early reductions program of section 112 of the federal act, or is not required by section 111 of the federal act, or is not required for sources to be excluded as a major source under this article."

The statute makes no differentiation between types of agricultural operations; consequently the exemption appears to apply to all types of operations, including family farms and large commercial farms. The statute also identifies specific operations that are not to be regulated including seasonal crop drying, animal feeding, and pesticide application. This means that all feedlots regardless of size and all pesticide applications are exempt from regulatory requirements (unless the feedlot or pesticide application qualifies as a major source). Ancillary activities not typically considered agricultural (*e.g.*, service stations located at a country cooperative) would still be regulated.

The statute overrides the pre-1992 requirements of Regulation No. 1, Sections II.A. (opacity requirements), III.C. (process weight requirements for alfalfa dehydrators), and III.D.2.k. (livestock confinement operations). Consequently there are no opacity standards for any exempt agricultural activity, no process weight particulate matter standards for alfalfa dehydrators, and no particulate control requirements for livestock confinement operations, including feedlots. Modeling of feedlots may be considered in situations where a feedlot is in the vicinity of a source (*i.e.*, a commercial feed mill) that required a permit. Rather than estimate emissions and model the feedlot, a background ambient air concentration will be developed, considering the feedlot, which will be added to the impact from the new source to ensure that the NAAQS will not be violated.

The statute states that the exemptions would not apply if the source would be a major source for PSD, nonattainment New Source Review, or operating permits (see PS Memo 96-01); or if the source was subject to a NSPS, or applying for an early reduction under the hazardous air pollutant (HAP) program. This means that the source would need to have a potential to emit (PTE) which exceeds 100 tons per year for a criteria pollutant, which is the trigger for operating permits or have a PTE, which exceeds 250 tons per year for a PSD permit (considering that TSP is still a regulated pollutant for PSD purposes only). Fugitive emissions would only be counted for the >listed= source categories contained in the definition of major stationary source (see Regulation No. 3, Part A, I.B.59 and PS Memo 99-04). The operating permit major source levels of 10/25 tons per year for HAPs could also nullify the exemption. The HAPs would include fugitive emissions since they must be counted for operating permit major source status. Major source calculations do not consider controls that are not enforceable when determining potential emissions.

The following activities are not directly related to agricultural production and thus do not appear to be eligible for the agricultural exemption: grain elevators that are above de minimis levels contained in New Source Performance Standards (NSPS), synthetic minor feed mills, food processing plants, poultry waste dryers, and rendering plants. These activities would require APENs and permits if the emissions are above *de minimis* levels. Grain elevators that are major

sources or are subject to NSPS would also be subject to specific standards such as the process weight limits for particulate contained in Regulations No. 1 or No. 6, Part B. (See PS Memo 99-005). Feed mills located on farms where the feed is produced and consumed on site do not need to submit APENs or apply for permits. Feed mills that produce feed for sale that are not located on a farm (i.e., in town) are not exempt and must submit APENs and apply for permits.

The following table summarizes which activities associated with agricultural production may be considered exempt. Each source must be considered individually in view of the applicable statutes, regulations, and circumstances presented. Questions regarding specific sources should be directed to the Construction Permit Unit Leader.

This memo has identified agricultural sources that are exempt from regulatory requirements. There will be some situations where the applicability of regulations to a source is not clear. Those situations will be handled on a case by case basis.

References

U.S. Environmental Protection Agency, *Calculating Potential to Emit (PTE) and Other Guidance for Grain Handling Facilities*, Research Triangle Park, North Carolina, November 14, 1995.

Memo History

March 1, 2000, revision: The memo clarified the exemption status for grain elevators, feed mills, and hog farms. November, 2002 revisions: The memo further clarifies the exemption status for feed mills and alfalfa dehydrators and revises the exemption status for grain elevators.

AGRICULTURAL ATIVITIES EXEMPTION SUMMARY[1,2]

Activity	Exempt
Grain Terminal Elevators This covers grain elevators, which are classified as "grain terminal elevators" under the federal NSPS, even if they are not subject to NSPS due to their construction date. These have a permanent storage capacity > 2.5 million bushels and are not located at facilities manufacturing animal food, pet food, or cereal or at breweries or livestock feedlots.	NO
Grain Storage Elevators This covers grain elevators, which are classified as "grain storage elevators" under the federal NSPS. These have a permanent storage capacity > 1.0 million bushels and are located at wheat flour mills, wet corn mills, dry corn mills for human consumption, rice mills, or soybean oil extraction plants)	NO
All other grain elevators (grain elevators that are generally smaller, seasonally dependent, and serve a local area)	YES
Feed mills[3] where: 1. the feed mill is located on a farm or ranch; or 2. is owned by a farmers cooperative, and 3. the operation is a true minor source.	YES
Food and beverage processing plants, including pet food manufacturing and associated elevators.	NO
Poultry Waste Dryers	NO
Rendering Plants	NO
Boilers exceeding NSPS *de minimis* levels	NO

Alfalfa dehydration plant drum dryers (a.k.a. alfalfa dehydrators)	YES
Field cultivating and harvesting	YES
Pesticide Application and storage	YES
Fertilizer Application and storage	YES
Fuel Storage and dispensing occurring on a farm or ranch	YES
Fuel Storage and dispensing not occurring on a farm (i.e., at a cooperative)	NO
Animal feeding and confinement (including animal feed distribution)[4]	YES
Crop Drying	YES
Open Burning for agricultural purposes	YES
Odors (except odors occurring at housed commercial swine feeding operations)	YES
All roads and haul trucks on a farm or ranch (not including city or county roads)	YES
Engines used for irrigation pumping[5]	YES
Engines used to power electrical generators where the power is only used on site[5]	YES
Housed commercial swine feeding operations	NO

1 Exemptions are not allowed if the operation would be a major source for criteria or hazardous air pollutants, or if the operation is subject to a federal NSPS.

2 Exemption means: no APEN, no permit, no dispersion modeling, no Regulation 1 requirements (opacity, process weight, or fugitive particulate control plans) and no fees.

3 A cooperative may include a grain elevator, a feed mill that includes a separate elevator, and a fueling operation. The grain elevator may be exempt, but the fueling operation may not be exempt. Commercial milling operations will be decided on a case-by-case basis.

4 Except for Housed Commercial Swine Feeding Operations (Hog Farms), which are subject to Regulation No. 2 permitting and odor requirements.

5 The listed activity must occur solely on a ranch or farm.