RECIPROCATING INTERNAL COMBUSTION ENGINE (RICE) SOURCE CATEGORY

NOx Emission 4-Factor Analysis for Reasonable Progress (RP)

I. Source Description

The review of potential RP sources involved an evaluation all Colorado stationary sources with actual SO2, NOx or PM10 emissions over 100 tons per year based on Air Pollution Emissions Notice (APEN) reports from 2007. There were one-hundred-thirteen (113) sources identified as exceeding the 100 tons/year threshold for any of the three pollutants which were further analyzed, using ArcGIS mapping, to determine the exact distance from the centroid of the source to the nearest Class I Area (CIA) boundary. The Q/d was calculated for each source, where "Q" is the sum of the SO2, NOx and PM10 emissions in tons per year and "d" is the source distance from the nearest CIA in kilometers; which resulted in the identification of seventeen (17) point sources with a $Q/d \geq 20$. The Q/d threshold was determined based on conducting a sensitivity analysis of previous subject-to-BART CALPUFF modeling of BART eligible sources that indicated a value of 20 represented about 0.3 deciview of change in visibility impairment.

An evaluation of the 17 RP sources identified only one source directly associated with RICE equipment, a compressor station (Ignacio B Plant) that uses natural gas-fired RICE. The Ignacio B compressor station is located southeast of Durango on Southern Ute Indian Tribal land which is outside the jurisdiction of the State of Colorado; consequently the Division is unable to provide a 4-factor NOx control evaluation and associated determination for this particular RP source.

In addition to individual point sources with a $Q/d \geq 20$, the Division evaluated categories of sources that were determined to be significant and subject to evaluation under RP. The Colorado point source emission inventory indicates that stationary internal combustion engines (see below table), particularly large industrial natural gas fired reciprocating internal combustion engines (RICE), are a significant source category of NOx emissions that represents about 16% of statewide point source NOx emission inventory[1].

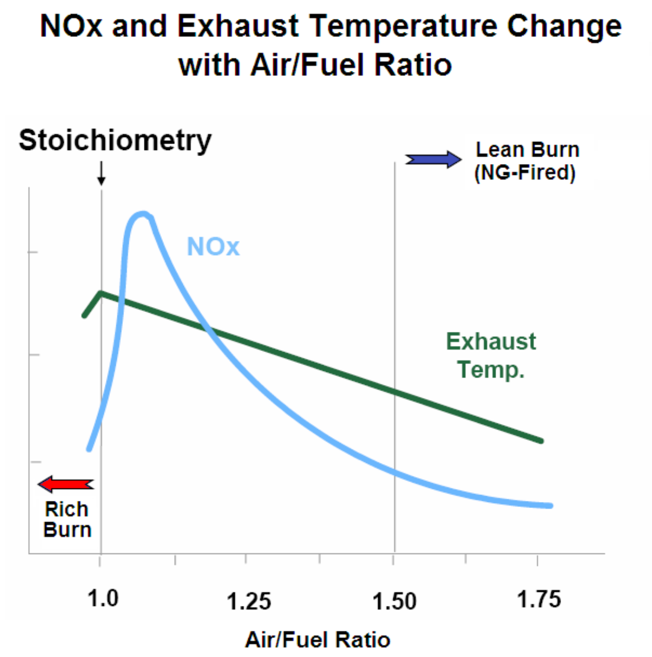
Colorado Internal Combustion Engine NOx Emissions from the PRP 2018b Emission Inventory

Category	Subcategory	2018 NOx Emissions (tpy)
Industrial	Natural Gas Fired	16,199
	Large Bore Engine	256
	Distillate Oil (Diesel)	225
	Liquefied Petroleum Gas	27
	Gasoline	24
Electric Generation	All	4,323
Commercial/Institutional	All	1,152
Engine Testing	All	5
	Total:	22,210

[1] Total 2018 Statewide Point Source NOx is projected at 101,818 tons per year based on the WRAP PRP2018b emission inventory.

The majority of the RICE operating in Colorado are associated with the oil and gas industry. The power generated by these RICE is generally used to compress natural gas for line transmission or to generate electricity in remote locations. The designation "large" refers to RICE that have an engine rating of at least 100 horsepower (hp) for the purpose of this document.

Stationary RICE produce power by combustion of fuel and are operated at various air-to-fuel ratios (AFR). If the stoichiometric ratio is used, the air and fuel are present at exactly the ratio to have complete combustion. An air-to-fuel ratio controller uses exhaust O_2 to control the combustion ratio. RICE that are operated with fuel-rich ratios (exhaust $O_2 < 0.05\%$) at or near stoichiometric, are called rich-burn engines (RB), or alternatively RICE that operate with air-rich ratios (exhaust $O_2 > 7$ to 8%) above stoichiometric, are called lean-burn engines (LB). The undesirable combustion emissions from natural gas fired RICE are primarily nitrogen oxides (NOx, consisting of primarily nitric oxide and nitrogen dioxide), carbon monoxide (CO), and volatile organic compounds (VOCs). Oxides of nitrogen are formed by thermal oxidation of nitrogen from the air. CO and VOCs are byproducts of incomplete combustion.



There are site specific considerations for using either type of engine, depending on the parameters that are most important for the operator. RB engines have lower oxygen levels and higher temperatures in the engine exhaust, which allows for the use of a 3-way catalyst (non-selective catalyst) which is effective at reducing NOx, CO, and VOCs in the exhaust. Because the air-to-fuel ratio is rich with fuel, more fuel is used, which results in increased combustion temperatures, increased engine power, and decreased engine efficiency. Higher temperatures result in more NOx being formed during the combustion process. Conversely, LB engines have higher oxygen levels in the combustion chamber, which decreases the combustion temperature thereby reducing how much NOx is formed. Because the air-to-fuel ratio is lean with fuel, less fuel is used, which results in decreased combustion temperatures, decreased engine power, and increased engine efficiency. The use of an oxidation catalyst on a lean burn engine similarly results in decreases in CO and VOC emissions but the performance for controlling NOx emissions is very low because LB engine exhaust temperatures are below the optimum temperature range for effective NOx control due to reduced catalyst reactivity. The above chart provides the relative change in NOx emissions and engine exhaust temperature as a function of air-to-fuel ratio.

II. Natural Gas-Fired RICE Source Category Emissions - Statewide

Since natural gas-fired RICE comprise over 73% of the NOx emissions in statewide RICE source category, the analysis will focus exclusively on NG-fired RICE. In 2018, the statewide NG-fired RICE source category is projected to contribute the following emissions:

Statewide Natural Gas Fired RICE Source Category Emissions*

Total Number of Sources with NG-fired RICE	Pollutant	Number Sources with RICE > 100 tpy	Number Sources with RICE > 40 tpy	Number Sources with RICE < 2 tpy	2018 Emissions (tpy)
497	NOx	40	85	82	16,199
	SO_2	0	0	486	115

* *Point Source Natural Gas Fired RICE Emissions based on APEN report data supplied to the WRAP for the PRP2018b Emission Inventory.*

Based on the PRP 2018b emission inventory, statewide there are about 497 sources using NG-fired RICE and about 40 sources that emit NOx emissions greater than 100 tons per year. During a recent 2008 rulemaking, the Division conducted a detailed analysis of RICE outside the 9-county metro area (referenced as “statewide”) and determined that there are about 1,340 NG-fired RICE statewide[2], which includes about 593 NG-fired RICE over 500 hp as indicated in the below table.

Statewide Natural Gas-Fired RICE Over 500 Horsepower Outside the 9-County Metro Area

SCC Description	Number of RICE
2-CYCLE LEAN BURN (NG)	84
4-CYCLE LEAN BURN (NG)	204
4-CYCLE RICH BURN (NG)	305
Total:	593

In addition to the 593 RICE listed above, the 2004 Denver Early Action Compact rulemaking identified 139 NG-fired RICE[3] over 500 hp that were subject to control requirements of non-selective catalytic reduction on 79 RB RICE and oxidation catalyst on 60 LB RICE in the 9-county metro area. Consequently, there are a total of 732 NG-fired RICE over 500 hp in Colorado.

It is difficult to readily determine the exact number of NG-fired RICE below 500 hp but over 100 hp because engines were sometimes grouped together in a single permit. However, a preliminary review of APEN data indicates that there are approximately 234 NG-fired RICE below 500 hp but over 100 hp. The remaining 513 NG-fired RICE have design capacities under 100 hp.

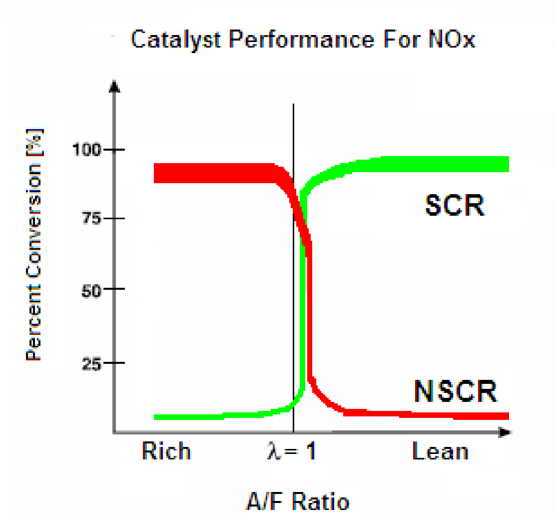
[2] The Statewide RICE count does not include RICE in the 9-county metro area which was subject to an earlier rulemaking, thus the actual number of total RICE in the State of Colorado is higher.

[3] Reference Final Economic Impact Analysis – Revisions to Regulation No. 7, February 11, 2004.

III. NOx Control Technology Evaluation

Step 1: Identify All Available Technologies

Generally in retrofit applications, NOx emissions from engines can be reduced either through combustion controls or adding post combustion emission controls (e.g., catalysts) to the engine exhaust. Catalysts are designed to speed up desired reactions. The rate of chemical reaction is a function of several parameters, including air-to-fuel ratio, engine load and exhaust temperature. Catalysts have specific temperature ranges that must be achieved for optimum NOx reduction. The below diagram roughly depicts the catalyst performance for conversion of NOx emissions using a NSCR and SCR on rich and lean burn engines.



Six retrofit technologies have been identified to lower NOx emissions from rich/lean burn natural gas-fired internal combustion engines.

1. Lean Burn – Air/Fuel Ratio Adjustment
2. Lean Burn – Ignition or Spark Timing Retard
3. Rich Burn – Non Selective Catalytic Reduction (NSCR) Catalyst (3-way)
4. Rich/Lean Burn – Selective Non-Catalytic Reduction (SNCR)
5. Lean Burn – Selective Catalytic Reduction (SCR)
6. Replacement with electric motors

Colorado requires that emissions from rich burn RICE (applicable statewide[4]) be controlled using a 3-way catalyst (NSCR) with air/fuel controller if control costs are below $5,000 per ton. Few of the statewide rich burn RICE demonstrated control costs exceeding the $5,000 cost off-ramp. Consequently, the state concludes that such NSCR controls are installed on the majority of rich burn RICE over 500 HP statewide. Therefore, the following analysis does not evaluate lower benefit NOx controls such as air/fuel adjustment or ignition/spark timing adjustment for rich burn RICE despite the technical feasibility of such controls.

[4] Reference Colorado Regulation Number 7, see section XVII.E.3.a

It is important to clarify that lean burn RICE are not subject to NOx retrofit controls because Regulation 7 requires statewide lean burn RICE over 500 HP to install retrofit oxidation catalyst control, which is only effective for control of VOC and CO, if the VOC control cost is under $5,000 per ton. This Regulation was effective as of July 1, 2010.

Step 2: Eliminate Technically Infeasible Options

Technology #1 - LB (Air/Fuel Ratio Adjustment): This technology is technically feasible.

Technology #2 - LB (Ignition/Spark Timing Retard): This technology is technically feasible.

Technology #3 – RB (3-way NSCR Catalyst): This technology is technically feasible.

Technology #4 – RB/LB (SNCR): This technology is technically feasible.

Technology #5 – LB (SCR): This technology is technically feasible.

Technology #6 – Replace RICE with electric motors: This technology is technically feasible.

Step 3: Evaluate Control Effectiveness of Each Remaining Control Technology

Technology #1 - Lean Burn (Air/Fuel Ratio Adjustment): In lean burn engines, increasing the air to fuel ratio decreases the NOx emissions. Extra air dilutes the combustion gases, thus lowering peak flame temperature and reducing thermal NOx formation. In order to avoid de-rating, combustion air to the engine must be increased at constant fuel flow, requiring a turbocharger. An automatic air-to-fuel ratio controller also will be required. This control method is most effective on fuel-injected engines. Typically, for lean burn engines the air/fuel ratios are increased from normal levels of 50% excess air up to excess air levels of 240%. The upper limit is constrained by the onset of misfiring at the lean limit. This condition also increases CO and VOC emissions. Naturally aspirated engines and engines with fuel injected into the intake manifold plenum do not have identical air-to-fuel ratios in each cylinder, this results in limited ability to vary the A/F ratio. To maintain acceptable engine performance at lean conditions, high energy ignition systems (HEIS) have been developed that promote flame stability at very lean conditions. On lean burn RICE, air/fuel ratio adjustment generally achieves about 5-30% reduction[5] in NOx emissions but is very specific to each engine and typical loading.

Technology #2 - Lean Burn (Ignition/Spark Timing Retard): This adjustment lowers NOx emissions by moving the ignition event to later in the power stroke. Because the combustion chamber volume is not at its minimum, the peak flame temperature will be reduced, thus reducing thermal NOx formation. Ignition timing retard is applicable to all engines. It is implemented in spark ignition engines by changing the timing of the spark, and in compression ignition engines by changing the timing of the fuel injection. For variable loads, an electronic ignition/injection control system is required. On lean burn RICE, ignition/spark timing retard generally achieves about 20% reduction in NOx emissions.

Technology #3 - Rich Burn NSCR: This technology uses three-way catalysts to promote the reduction of NOx to nitrogen and water. CO and hydrocarbons are simultaneously oxidized to carbon dioxide and water. NSCR is applicable only to rich burn engines (i.e. those with exhaust oxygen concentration below about one percent). NSCR, in addition to the catalysts and catalyst

[5] Reference – State of the Art (SOTA) Manual for Reciprocating Internal Combustion Engines, State of New Jersey Department of Environmental Protection, 2003.

housing, require an oxygen sensor and automatic air to fuel ratio controller to maintain an appropriate air to fuel ratio. Some ammonia can be produced particularly as the catalyst ages. The simplified reactions governing NSCR are as follows:

$$NOx + CO \rightarrow CO_2 + N_2$$
$$NOx + HC \rightarrow CO_2 + H_2O + N_2$$

The exhaust passes over a catalyst, usually a noble metal (platinum, rhodium or palladium) which reduces the reactants to N2, CO2 and H20. Typical exhaust temperatures for effective removal of NOx are 800-1200 degrees Fahrenheit. An oxidation catalyst using additional air can be installed downstream of the NSCR catalyst for additional CO and VOC control. This includes 4-cycle naturally aspirated engines and some 4-cycle turbocharged engines. Engines operating with NSCR require air/fuel control to maintain high reduction effectiveness typically around 80 to 90 percent NOx control. Extremely tight control of the air to fuel ratio operating range is accomplished with an electronic air to fuel ratio controller.

Technology #4 - Rich/Lean Burn SNCR: SNCR is applicable to both lean burn natural gas and diesel engines. SNCR involves injecting ammonia or urea into regions of the exhaust with temperatures greater than 1200 – 2000 degrees Fahrenheit. The nitrogen oxides in the exhaust are reduced to nitrogen and water vapor. Additional fuel is required to heat the engine exhaust to the correct operating temperature. Heat recovery from the engine exhaust can limit the additional fuel requirement and concurrent additional emissions from heating exhaust gases. Ten parts per million of ammonia (slip) is considered reasonable for SNCR. Temperature is the operational parameter affecting the reaction - as well as degree of contaminant mixing with reagent and residence time. Additional control of particulate matter (up to 85% diesel particulate matter), volatile organic compounds (up to 90 percent) and carbon monoxide (up to 70 percent) may be realized by the afterburning effect of this technology. On both rich burn and lean burn RICE, SNCR generally achieves about 50 to 95% reduction in NOx emissions.

Technology #5 – Lean Burn SCR: SCR uses catalyzed reduction of NOx with injected ammonia or urea solution. This technology is applicable to lean burn engines only (i.e., those with greater than about one percent exhaust oxygen, as oxygen is a reagent in the selective reduction reaction.) SCR may be used with lean burn (SI), dual fuel or diesel engines (CI). SCR produces unreacted ammonia (slip) and monitors are necessary to provide correct control of ammonia injection rates to minimize slip. When used with diesel engines, it is important to use a low sulfur fuel and sulfur resistant catalyst. Sulfur dioxide in the exhaust can be oxidized over the SCR catalyst to sulfuric acid mist, and when combined with unreacted ammonia, produces sulfate particulate.

For an SCR system using urea, the first stage of the catalyst bed is the hydrolysis catalyst, which converts the urea to ammonia. In the second stage of the catalyst, the ammonia and NOx react to form nitrogen gas and water with some unreacted ammonia passing through. Base metal catalysts, typically vanadium and titanium, are used for exhaust gas temperatures between 450^{o}F and 800 ^{o}F. For higher temperatures (675 ^{o}F to 1100 ^{o}F), zeolite catalysts may be used. Both the base metal and zeolite catalysts are sulfur tolerant for diesel engine exhaust. Precious metal SCR catalysts are useful for low temperatures (350 ^{o}F to 550 ^{o}F). When using precious metal SCR catalysts, attention should be paid to the fuel sulfur content and the appropriate formulation selected. This is not a concern with RICE fired with natural gas.

Reactions of NOx over SCR catalyst:

$6NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O$
$6NO + 4NH_3 \rightarrow 5N_2 + 6H_2O$
$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$
$2NO + 4NH_3 + 2O_2 \rightarrow 3N_2 + 6H_2O$

An SCR system consists of reagent storage, feed and injection system, and a catalyst and catalyst housing. Predictive mapping of engine operating parameters can be used to monitor and control the SCR reaction. Precious metal catalysts can reduce NOx by 80%. Zeolite catalysts can reduce NOx by 90% with minimal sulfur dioxide to sulfur trioxide conversion. Exhaust gas temperatures greater than the upper limit (850 F) will pass the NOx and ammonia unreacted through the catalyst.

Technology #6 – Replace RICE with electric motors: This control technology results in complete reduction of NOx emissions at the RICE location, although the electric power provided to the motor must be supplied by a power plant located at some distant location. There is a net reduction in NOx emissions from consolidating operations although the amount of reduction depends on the distance from the power plant as transmission line losses reduce the effectiveness of this control. Another consideration is the proximity to high voltage lines which may limit the practically of this control option in rural areas.

The below table summarizes each available technology and the technical feasibility for NOx Control.

NG-Fired RICE – NOx Technology Options and Technical Feasibility

Technology	**Emission Reduction Potential (%)**	**Technically Feasible? (Y = yes, N = no)**
Lean Burn (Air/Fuel Ratio Adjustment)	~5-30%	Y
Lean Burn (Ignition/Spark Timing Retard)	~20%	Y
Rich Burn NSCR	~80-90%	Y
Rich/Lean Burn SNCR	~50-95%	Y
Lean Burn SCR	~80-90%	Y
Replace RICE with electric motors	~60-100%	Y

Step 4: Evaluate Impacts and Document Results

Factor 1: Cost of Compliance

Technology #1 - Lean Burn (Air/Fuel Ratio Adjustment): In naturally aspirated LB engines and LB engines where fuel is injected into the intake manifold plenum, each cylinder does not have an identical air-to-fuel ratio, thus changes in the A/F ratio are very limited and therefore of little benefit, although the cost of such adjustment is minimal. Additional NOx emission reduction benefit is gained through the addition of a turbocharger and an automatic air-to-fuel ratio controller. The cost of adding these controls is very specific to the engine size and design but generally ranges between $320 to $8,300 per ton[6] of NOx reduced.

[6] Reference – Supplementary Information for Four Factor Analysis by WRAP States, EC/R Incorporated, May 4, 2009, see table 3-3.

Technology #2 - Lean Burn (Ignition/Spark Timing Retard): Based on a general analysis of NG fired RICE for the WRAP states[4], the cost of this control ranges between $310 to $2,000 per ton of NOx depending on engine size and firing design.

Technology #3 - Rich Burn NSCR: Regulation Number 7 requires rich burn RICE over 500 HP to install retrofit NSCR controls if the cost of control is under $5,000 per combined ton (NOx and VOC) statewide. This Regulation was effective as of July 1, 2010. None of the operators of rich burn RICE outside the metro-area ozone non-attainment area submitted information demonstrating control costs in excess of $5,000 per ton cost threshold, consequently, the majority of natural-gas fired RB RICE over 500 HP must operate an NSCR with an AFR controller.

Emission Reduction from NSCR Retrofit of RICE > 500 hp

Statewide RICE Category*	Count**	NO_x Reduction (tpy)
Lean Burn ≥ 500 HP	288	minimal***
Rich Burn ≥ 500 HP	305	5,800

Notes:
* This data represents statewide RICE, excluding the 9-county metro area (ozone non-attainment area) which was addressed in an earlier rulemaking for the Early Action Compact.
** Data obtained from 2008 APENs
*** Retrofit NSCR for lean burn RICE was not required because of minimal NOx reduction

Annualized Costs for Rich Burn RICE Control Device

Item	Capital Costs (one time)	O&M (recurring)	Total Annualized Cost (15 yrs)
NSCR with AFR Controller*	$35,000	-	
Operating	-	$6,000	
Subtotal Costs:	$35,000	$6,000	
Annualized Costs:	$4,851	$6,000	**$10,851**

Notes:
* Cost estimates obtained from "Denver Early Action Compact Analysis of Stationary Sources" Nov. 3, 2003

Costs Associated with Statewide Retrofit of Natural Gas-fired RB RICE ≥ 500 HP

Category	Number of Devices	Annualized Cost per Device	Total Device Cost	NO_x Reduction [tpy]	$/ton
NSCR & AFR Controller	305	$10,851	$3,309,555	5,800	$571

Technology #4 - Rich/Lean Burn SNCR: SNCR usually requires reheating of the exhaust to achieve the proper temperature range for effective NOx conversion; this is particularly true for lean burn RICE where excess oxygen results in exhaust temperatures well below the required levels. The Division was unable to acquire cost information for this control option, thus no cost estimates have been provided. The scarcity of SNCR data on NG-fired RICE may suggest other post combustion NOx controls are preferred, particularly SCR which has more reliable control effectiveness under a variety of load conditions.

Technology #5 – Lean Burn SCR: Depending on the engine size, catalyst used and the level of sophistication of the control system, SCR costs generally range about $430 to $4,900 per ton of NOx reduced.

Technology #6 – Replace RICE with electric motors: Depending on the engine size, length and capacity of the power line required, the costs generally range from $100 to $4,700 per ton of NOx reduced[7]. These costs do not include any potential impact from increases in electrical load at the power plant. The true cost of replacing RICE with electric motors is dependent on the distance from the power plant and the amount of compression power required. In actuality, larger compressor stations with multiple large engines would produce significant increased demands at a nearby power plant and possibly significant demands on the line transmission system that would escalate the costs to levels much higher than the $4,700 control cost. Colorado has about 40 large compressor stations, thus the estimation of costs would require a case-by-case analysis which was not done for this RP evaluation. Although, if all statewide RICE (above 500 horsepower) were converted to electric motor compression, then a minimum of approximately 600 MW of extra generating capacity would be required. Realistically, the actual generating capacity required is probably much higher when transmission losses and peak demand cycles are factored into the load demands.

Factor 2: Time Necessary for Compliance

Technology #1, 2, 4, 5 and 6: If Colorado was to decide to adopt a particular control strategy, up to 2 years will be needed to develop the necessary rules and undergo Legislative review. Subject sources may then require up to a year to procure the necessary capital to purchase control equipment. The Institute of Clean Air Companies (ICAC) has estimated that approximately 13 months is required to design, fabricate, and install SCR or SNCR technology for NOx control[8]. However, the time necessary will depend on the type and size of the unit being controlled. For instance, in past rulemakings, typically 18 months may be required to install a particular control technology on hundreds of engines. Additional time, up to 12 months may be required for staging the installation process if multiple sources are to be controlled at a single facility. Based on these figures, the total time required achieve the NOx emission reductions for reciprocating engines is estimated at about 5 years.

Technology #3: This control option is implemented and was effective on July 1, 2010.

Factor 3: Energy Impacts and Non Air-Quality Impacts

In general, air-to-fuel-ratio adjustments and ignition retarding technologies have been found to increase fuel consumption by up to 5%, with a typical value[9] of about 2.5%. This increased fuel consumption would result in increased CO_2 emissions. Installation of SCR on any type of engine would cause a small increase in fuel consumption, about 0.5%, in order to force the exhaust gas through the catalyst bed. This would produce an increase in CO_2 emissions. In addition, spent

[7] Bar-Ilan, Amnon, Ron Friesen, Alison Pollack, and Abigail Hoats (2007), *WRAP Area Source Emissions Inventory Protection and Control Strategy Evaluation - Phase II*, Western Governors Association, Denver, Colorado, Chpt 4.

[8] Institute of Clean Air Companies (2006), Typical Installation Timelines for NOx Emissions Control Technologies on Industrial Sources.

[9] Center for Alternative Fuels, Engines & Emissions (2005), Alice Austen Ferry Emissions Tests, M.J. Bradley & Associates, Manchester, NH, Page 13.

catalyst would have to be changed periodically, producing an increase in solid waste disposal[10]. Replacing RICE with electric motors may require construction of additional power plants to accommodate increased power demands.

Factor 4: Remaining Useful Life:

Generally the operational life of a catalyst is approximately 5 to 15 years, depending upon factors such as how it is maintained and the particular duty cycle of the engine.

Step 5: Select Reasonable Progress Control

The state has determined that control technology #3, rich burn NSCR w/air-fuel controller, represents reasonable progress for the natural gas-fired RICE source category in this planning period. The estimated reduction of 5,800 tons/year represents about 36% of the NG RICE total NOx emissions.

The State of Colorado regulates RICE under Colorado Air Quality Control Commission Regulation No. 7 (Reg. 7) Section XVII. Further NOx emission reduction benefits are anticipated in the future because of tighter NOx emission standards in Regulation 7 that require emissions from RICE shall not exceed the following emission performance standards:

Colorado Emission Standards Natural Gas-Fired RICE

RICE Horsepower	**Construction or Relocation Date**	**Emission Standards (grams/hp-hr)**		
		NOx	**CO**	**VOC**
< 100	Any	NA	NA	NA
≥ 100 and ≤ 500	On or after 1/1/08	2.0	4.0	1.0
	On or after 1/1/11	1.0	2.0	0.7
> 500	On or after 7/1/07	2.0	4.0	1.0
	On or after 7/1/10	1.0	2.0	0.7

RICE that are subject to an emissions control requirement in a federal Maximum Achievable Control Technology (MACT) standard under 40 CFR Part 63, a Best Achievable Control Technology (BACT) limit, or a New Source Performance Standard under 40 CFR Part 60 are not subject to Reg. 7 Section XVII.

[10] EPA (2002), EPA Air Pollution Control Cost Manual, 6th ed., EPA/452/B-02-001, U.S. EPA, Office of Air Quality Planning and Standards, RTP.