Recommended Mitigation Runs for Four Corners Modeling Study (9/17/07 draft)

Scenario 1: Model all viable AQTF measures for all source categories

This option includes a high level of mitigation on oil and gas, power plants, and mobile sources. Specifically this run would include oil and gas mitigations from Scenario 3, and power plant control measures from Scenario 4. To characterize the potential effect of transportation control measures a 3 percent reduction in baseline mobile source emissions in 2018 would be included in this scenario. In all scenarios emissions reductions are only applied to the 4 km grid covering the four corners region. Emissions in the 12 and 36 km domains are the same as in the 2018 basecase

Scenario 2: Enhanced control of oil and gas sources (low option).

Environ has processed the 2018 oil and gas emissions into 4 km grids. The emissions have been stratified based on industrial source categories (SCC code) that the emissions preprocessor requires. This grouping does not allow us to separate engine types in defining the modeling scenarios. Thus, for example, emissions reduction measures effecting lean burn engines would be allocated proportionately to the oil and gas emission rate across each 4 km grid, even though the actual spatial distribution of these engines may be different. While not in the scope of the current study it may be useful in a future analysis to reprocess the 4 km O&G emission inventory by engine type.

This option includes modeling credit for implementation of measures that have been adopted on a limited scale elsewhere or are proposed for implementation but not yet adopted. This includes the federal NSPS for stationary engines, the BLM interim NOx limits on compressor engines, and Colorado regulation 7 as shown below:

Controls on New Sources 2006 - 2018 (NSPS/CO Reg. 7/BLM)

HP	NOx	CO	NMHC	Effective Yr	Proj Yr
25-500	2	2	0.7	2011	(growth 2018)
< 300	2	-	-	2005/06*	“
> 500*	1*	2	0.7	2010	“

(* Applies to all new engines >= 300 hp installed in CO (NSJB) in 2006 and to all new compressor engines installed in NM in 2006.)

The relative difference in emissions between the baseline 2018 emissions and the measures noted above are relatively small (about 10,000 tons/yr of NOx) and would not likely make much of a difference in modeling results. Therefore as part of Scenario 2 we are proposing two control measures on existing O&G sources that provide a larger degree

of emission reductions than currently adopted measures but are less restrictive than those contained in Scenario 3.

The additional measures in scenario 2 would include a modest level of control on small rich burn engines emitting more than 4 g/hp-hr in the 90 to 300 hp size range. It assumes implementation of two O&G mitigation options, NSCR system retrofits with an assumed 70% control level for each retrofit and electric compression (EC). The EC component involves swap-out of dirty rich burn RICE engines with electric motors and on-site Gen Sets which results in an equivalent control efficiency of about 97% (0.7 g/hp-hr). The EC component is applied to rich burn engines emitting more than 20 g/hp-hr. The average equivalent emissions from NSCR retrofitted engines are 5.6 g/hp-hr. The average uncontrolled emissions from this group of engines is 17.7 g/hp-hp. Assuming 90% of overall control comes from the specified NSCR retrofits, the "low-option" scenario results in a 30% reduction in the baseline RICE NOx emissions. The calculated scenario 2 emission reduction and control levels are summarized in Table 1.

Table 1. Listing of Oil and Gas Mitigation Options for Modeling Scenario 2

Mitigation Option	NOx Reduction (tons/yr)	CO	VOC
Electric compression for rich burn engines over 20g/hp-hr (on 2005 existing engines)	1,164	446	29
NSCR for NOx control on rich burn engines 90-300 hp (on 2005 existing engines)	14,315	2,538	1,077
NSPS/CO Reg. 7/BLM** ('05 – '18 growth)	9,530	4,632	0
Total Scenario 2 reductions (Tons/year)	25,009	7,616	1,106
Percent reduction of O&G emissions	41%	17%	0.7%

** Scenario 2 assumption for NOx reduction is that the NOx emission increase from '05 to '18 for all compressor engines in Environ's inventory is reduced by 76% based on all new compressor engines meeting a 2 g/hp/hr (NSPS/BLM/Reg 7) standard instead of 8.5 g/hp/hr (the assumed existing engine average NOx emission factor). Assumption for CO reduction is that the CO emission increase from '05 to '18 for all compressor engines in Environ's inventory is reduced by 39% based on all new compressor engines meeting a 4 g/hp/hr (NSPS) standard instead of 6.5 g/hp/hr (the assumed existing engine average CO emission factor). The VOC reduction is 0 since it was assumed that the existing engine average VOC emission factor already meets the 1 g/hp/hr NSPS standard for VOCs. For

the base case ’18 inventory Environ has assumed that compressor engine emissions growth has the same emission factor as for existing engines.

Vehicular dust emissions from traffic on unpaved roads would be reduced by 20 percent in scenario 2. This was based on a composite estimate of the effect of measures to reduce truck traffic (automation of wells, efficient routing of water trucks, and centralized water storage), or mitigate dust generation (Reduced vehicle speeds, rock and gravel on road surfaces).

Scenario 3: Enhanced control of oil and gas sources (High option):

New sources in this option are controlled to the same degree as in Scenario 2; however existing source emissions are mitigated to a much greater degree.

Scenario 3 includes a higher level of control on the 90 to 300 hp “rich burn” engines than Scenario 2. It assumes implementation of the same two O&G mitigation options as scenario 2, but with NSCR system retrofits with an assumed 90% control for each retrofit. The EC component is applied to rich burn engines emitting more than 10 g/hp-hr and involves swap-out of these engines with electric motors and on-site Gen Sets which results in an equivalent control efficiency of about 96% (0.64 g/hp-hr). The emissions from NSCR retrofitted engines are equivalent to1.8 g/hp-hr. By assuming a 50/50 split in overall control from the specified NRCR retrofits and the EC component, Scenario 3 results in an overall reduction of approximately 60% in the baseline RICE emissions. Adding SCR control for lean burn engines larger the 500 hp, results in overall control on RICE engines exceeding 70%. The calculated Scenario 3 emission reduction and control levels are summarized in Table 2 and include installation of oxidation catalyst on lean burns for control of VOC and formaldehyde. Since we don’t have inventory data on diesel engines, emissions reductions for this source category could not be estimated.

Other sectors, such as power plants, would remain at 2018 base case emissions levels in the Scenario 3 run.

Table 2. Listing of Oil and Gas Mitigation Options for Modeling Scenario 3

Mitigation Option	NOx Reduction (tons/yr)	CO	VOC
NSPS/CO Reg. 7/BLM** ('05 – '18 growth)	10,996	8,339	0
Install electric compression for RB engines emitting more than 10g/hp-hr ('05 Existing Engines?)	11,610	7,455	420
NSCR for NOx control on RB engines between 75 & 500 hp (on 2005 existing engines)	11,826	2,466	951
SCR for NOx control on LB engines over 500 hp (on 2005 existing engines)	5,602	9,141	3,814
Oxy catalyst on LB engines for VOC control			1,619
Total Scenario 3 reductions (Tons/year)	40,034	27,401	6,804
Percent reduction of O&G emissions	65 %	60 %	4 %

** Scenario 3 assumption for NOx reduction is that the NOx emission increase from '05 to '18 for all compressor engines in Environ's inventory is reduced by 88% based on all new compressor engines meeting a 1 g/hp/hr (NSPS/BLM/Reg 7) standard instead of 8.5 g/hp/hr (the assumed existing engine average NOx emission factor). Assumption for CO reduction is that the CO emission increase from '05 to '18 for all compressor engines in Environ's inventory is reduced by 69% based on all new compressor engines meeting a 2 g/hp/hr (NSPS) standard instead of 6.5 g/hp/hr (the assumed existing engine average CO emission factor). The VOC reduction is 0 since it was assumed that the existing engine average VOC emission factor already meets the 1 g/hp/hr NSPS standard for VOCs. For the base case '18 inventory Environ has assumed that compressor engine emissions growth has the same emission factor as for existing engines.

Scenario 4: <u>Enhanced control on power plants</u>.

For the San Juan and Four Corners Plants the projected 2018 emissions would be based on the current consent decree and presumptive BART levels as shown in the table below. These estimates are somewhat different than the presumptive limits in the current basecase inventory, thus Environ would be instructed to model the 2018 basecase using the revised emissions shown below. The changes to the 2018 basecase were made to reflect actual stack test data, the higher capacity utilization predicted by WRAP, and slightly different assumptions on coal quality.

Control enhancements in Scenario 4 would include SCR (90+ % to achieve .05 lbs/MM btu) for NOx control at both FCPP and SJCC, enhanced SO2 scrubbing (92%) at both facilities, and additional PM controls at Four Corners. The smaller power plants in the region, Bluffview, Milagro, and Animas would be modeled at the same emissions rates in both the basecase and control case (Scenario 4) runs.

Projected Basecase 2018 Power Plant Emissions Assuming presumptive BART and Consent Decree implementation.

2018 4C Power Plants	Year	VOC	NOx	SO2	PM
SJGS	2018	281	21,582	9,151	1,079
FCPP	2018	17.4	31,715	12,455	830
Bluffview	2018	-'"?"	59	0.7	-"?"
Milagro	2018	-"?"	110	2.5	-"?"
Animas	2018	54.3	54	0.0	-"?"
DREF	2018	166	3,325	3,319	1,701
Total	**2018**	**518.4**	**56,845**	**24,928**	**3,610**

Scenario 4 Power Plant Emissions Assuming Enhanced Controls at the San Juan and Four Corners Facilities

2018 4C Power Plants	Year	VOC	NOx	SO2	PM
SJGS	2018	281	3,597	7,321	673
FCPP	2018	17.4	4,152	11,114	830
Bluffview	2018	-'"?"	59	0.7	-"?"
Milagro	2018	-"?"	110	2.5	-"?"
Animas	2018	54.3	54	0.0	-"?"
DREF	2018	166	3,325	3,319	1,701
Total	**2018**	**518.4**	**11,296**	**21,758**	**3,204**

For air quality planning purposes it would be useful to know if tall stack sources affect different Class 1 areas than low level emissions sources, so for this run we will ask Environ to provide a source receptor attribution breakout in reporting the modeling results

Scenario 5: Held in reserve.

This final run would be held in reserve pending completion of the runs discussed above. This will allow us to address any issues identified in the first runs.