

Appendix C

PM2.5 Reasonable Further Progress Calculations

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The CAA requires SIPs to provide for steady progress in reducing emissions during the years leading to the attainment date. This requirement, added as part of the 1990 amendments, provides a way to measure compliance prior to the attainment date. U.S. EPA requires that the RFP plan show linear progress according to emission reduction milestones the region establishes for 2009, and every three years thereafter until the attainment year.

For PM2.5, U.S. EPA guidance provides two alternatives for assessing RFP for PM2.5 strategies. The traditional approach assesses progress for each precursor against the required rate of progress without considering how much each precursor contributes to ambient PM2.5 concentrations (the “linear” option). The second uses information gained from the attainment demonstration modeling to consider how much reductions of each pollutant contribute to attainment (the “equivalency” option). In essence, the relative contribution approach approximates the progress that will be made in improving air quality

1. Linear RFP Calculation Option

The following table assesses progress made with the proposed South Coast Plan, including the adopted AQMP, and the proposed State Strategy with proposed consensus amendments, using U.S. EPA’s linear reasonable further progress option. The assessment indicates that reductions of directly emitted PM2.5 and NOx do not meet RFP targets in 2009 and 2012 when calculated from a 2002 baseline inventory. Reductions of VOC and SOx, however, exceed linear RFP targets in all years. The District’s air quality models indicate that SOx and directly emitted PM10 reductions have a greater impact on ambient PM2.5 levels than ROG reductions and, to a lesser extent, than NOx reductions. The linear approach does not reflect those impacts.

Table 1
Linear Reasonable Further Progress Calculation

Row	Calculation Step	PM2.5	NOx	SOx	VOC
1	2002 Baseline Inventory	99	1093	53	844
2	Control Ratio Needed to Show Linear Progress in 2009 (%)	7/12	7/12	7/12	7/12
3	2009 Target Needed to Show Linear Progress (tpd)	92	720	33	625
4	2009 Remaining Emissions with Plan (tpd)	99	813	28	578
5	Projected Shortfall (tpd)	7	93	0	0
6	Control Ratio Needed to Show Linear Progress in 2012 (%)	5/6	5/6	5/6	5/6
7	2012 Target Needed to to Show Linear Progress (tpd)	89	561	25	532
8	2012 Remaining Emissions with Plan (tpd)	92	565	21	505
9	Projected Shortfall (tpd)	3	5	0	0
10	2014 Remaining Emissions with Plan (tpd)	87	454	19	469

2. Equivalency RFP Calculation Option

An RFP evaluation that accounts for the differential impacts that each of the PM_{2.5} precursors has on ambient concentrations demonstrates that the proposed strategy also allows the South Coast Air Basin to meet RFP targets. The District's modelers used the results of 2014 modeling, using the strategy recommended for approval, to determine the PM_{2.5} reduction value of each of the precursor pollutants and to assess equivalent progress against RFP targets. The District's methodology is described below.

The PM_{2.5} attainment modeling simulation was conducted using projected emission reductions for control measure implementation for 2014 (CEPA scenario 1). The output of the simulation was averaged by component species for the eight validation sites that represent the Basin. Since a 2005 base year was used for the PM_{2.5} modeling, this basin average PM_{2.5} species profile was then compared to the 2005 data and the difference in concentration between 2014 with implementation of the plan and 2005 ammonium sulfate, ammonium nitrate, organic carbon and particulate (metals and elemental carbon) concentrations were calculated. The particulate component difference concentrations were divided by the emissions reductions for the same period to determine species-specific projected concentrations reductions per unit of emission reduction. These ratios were then used to compute NO_x-equivalent weighting factors for converting species-specific inventory values to NO_x-equivalent inventory values for purposes of comparing RFP targets with projected inventory levels on a NO_x-equivalent basis. The reason for converting inventories to a NO_x-equivalent basis is that emissions reductions in some species will exceed RFP targets in 2009 while other species will fall short. On the whole, however, the cumulative reductions across all species will produce PM_{2.5} concentration reductions that are generally linear with time and that comply with RFP requirements.

Table 2 summarizes the basin-average conversion factors that relate projected emissions reductions with reductions in PM_{2.5} concentrations. Due to differences in particle formation rates, reductions in emissions of SO_x and directly-emitted PM_{2.5} produce much greater reductions in PM_{2.5} concentrations than occur with reductions in emissions of NO_x and ROG. Table 3 presents the NO_x-equivalent weighting factors where the SO_x, ROG and PM_{2.5} basin-average conversion factors are normalized to that for NO_x. These basin-average conversion factors are then used to convert both RFP target emission inventories and plan-projected emission inventories to NO_x-equivalent inventories for comparison purposes as dictated by RFP requirements.

Tables 4 and 5 provide the RFP calculations for the 2002- and 2005 base-years respectively. The tables convert emission inventories to a NO_x-equivalent basis. For the 2002 base year, the 2009 plan-projected inventory falls short of the RFP target by 2.8 percent. For the 2005 base year, the plan-projected inventory in 2009 achieves the target reduction and demonstrates compliance with RFP requirements. Under both alternatives, RFP requirements are satisfied in 2012. Because the basin-average conversion factors were determined from gridded modeling performed for the 2005

emission inventory year, this year is the most appropriate base year for the RFP analysis.

Figure 1 plots the emission inventory totals and the RFP targets under the 2005 base year alternative. When a best fit line is overlaid, it is clear that the emissions reductions are taking place in a linear fashion, not clustered or back loaded. This graphic illustrates the intention of the RFP requirement and lends support that a nominal shortfall of a few percent in near term reductions in 2009 is not inconsistent with the overall annual rate of required emissions reductions.

**Table 2
Basin-Average Conversion Factors**

Basin-Average Conversion Factors		
Pollutant Species	Species	Concentration (ug/m3)
PM2.5	EC & Crustal	0.0345
NOX	Ammonium Nitrate	0.0035
SOX	Ammonium Sulfate	0.0526
ROG	Organic Carbon	0.0015

**Table 3
Normalized NOx-Equivalent Conversion Factors**

Normalized NOx-Equivalent Conversion Factors	
Pollutant Species	NOX Equivalent Factor
PM2.5	9.8571
SOX	15.0286
ROG	0.4286

**Table 4
2002 RFP Anchor Year**

	Required					Annual Change	Required NOx Equivalent			
	2002	2009	2012	2014			2002	2009	2012	2014
PM2.5	99	91	88	86	1.0943%	PM2.5	976	897	867	848
NOx	1093	719	559	452	4.8872%	NOx	1093	719	559	452
SOx	53	34	26	20	5.1887%	SOx	797	511	391	301
ROG	844	628	536	474	3.6532%	ROG	362	269	230	203
Total	2089	1472	1208	1032		Total	3227	2396	2047	1803
	Projected						Projected NOx Equivalent			
	2002	2009	2012	2014			2002	2009	2012	2014
PM2.5	99	99	92	86		PM2.5	976	976	913	848
NOx	1093	819	566	452		NOx	1093	819	566	452
SOx	53	28	21	20		SOx	797	421	313	301
ROG	844	579	505	474		ROG	362	248	214	203
Total	2089	1525	1184	1032		Total	3227	2464	2006	1803

**Table 5
2005 RFP Anchor Year**

	Required					Annual Change	Required NOx Equivalent				
	2005	2009	2012	2014			2005	2009	2012	2014	
PM2.5	102	95	89	86	1.3072%	PM2.5	1005	936	877	848	
NOx	1033	775	581	452	4.6870%	NOx	1033	775	581	452	
SOx	61	43	29	20	5.6011%	SOx	917	646	436	301	
ROG	825	669	552	474	3.5455%	ROG	354	287	237	203	
Total	2021	1582	1251	1032		Total	3309	2644	2131	1803	
	Projected						Projected NOx Equivalent				
	2005	2009	2012	2014			2005	2009	2012	2014	
PM2.5	102	99	92	86		PM2.5	1005	980	904	848	
NOx	1033	819	566	452		NOx	1033	819	566	452	
SOx	61	28	21	20		SOx	917	425	311	301	
ROG	825	579	505	474		ROG	354	248	216	203	
Total	2021	1526	1184	1032		Total	3309	2472	1998	1803	

**Figure 1
RFP Calculations Trend
Linear and NOx-Equivalent, 2005 Base Year**

