

Region III Plan Summary
Baltimore, Maryland 8-Hour Ozone Moderate Nonattainment Area

Title: Rate of Progress (ROP) Plan for the Baltimore 1997 8-Hour Ozone Moderate Nonattainment Area

Federal Register Dates: January 7, 2010, 75 FR 958 (Proposed Rule); June 4, 2010, 75 FR 31709 (Final Rule)

EPA Effective date: July 6, 2010

State Submittal Date: June 4, 2007

Affected Areas: Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties; Baltimore City

Summary of the Plan

On June 4, 2007, the Maryland Department of the Environment (MDE) submitted a SIP revision to address emissions inventory, reasonable further progress (RFP), reasonably available control measures (RACM) analysis, and contingency measure requirements for the Baltimore moderate nonattainment area (Baltimore NAA) for the 1997 8-hour ozone national ambient air quality standard (NAAQS). The SIP revision also establishes a motor vehicle emissions budget (MVEB) for 2008 for the Baltimore NAA.

Pursuant to Phase 1 of the 8-hour ozone implementation rule, an area was classified under Subpart 2 of the CAA based on its 8-hour design value if that area had a 1-hour design value at or above 0.121 ppm (the lowest 1-hour design value in Table 1 of Subpart 2). Based on this criterion, the Philadelphia NAA was classified under Subpart 2 as moderate nonattainment areas.

Emission Inventories

A summary of the Baltimore NAA 2002 base year VOC and NOx emissions inventory is included in Table 1, below.

Table 1. Baltimore NAA 2002 Base Year VOC & NOx Emissions in Tons per Day (tpd)

Emission Source Category	VOC	NOx
Point	13.88	111.88
Stationary Area	116.81	8.18
Non-Road Mobile	70.22	40.96
On-Road Mobile	70.57	177.06
Total (excluding Biogenics)	271.48	338.08
Biogenics	223.20	0

Under the Clean Air Act, the emissions benefits resulting from the Federal Motor Vehicle Control Program (FMVCP) and the Reid Vapor Pressure (RVP) regulations are excluded from the base year inventory. The FMVCP and RVP emissions reductions, determined by the state using EPA's on-road mobile source emissions modeling software (MOBILE6), are then removed from the base year inventory by the state, resulting in an adjusted base year inventory. The emission reductions needed to satisfy the RFP requirement are then calculated from the adjusted base year inventory. These reductions are then subtracted from the adjusted base year inventory to establish the emissions target for the RFP milestone year (2008). The RFP SIP revision must provide for a 15 percent emission reduction (either NOx and/or VOC) accounting for any growth that occurs during the 6-year period following the baseline emissions inventory year, that is, 2002-2008.

The Baltimore ozone nonattainment area under the 1-hour ozone standard had the same boundary as the Baltimore NAA under the 1997 8-hour ozone standard. The Baltimore nonattainment area under the 1-hour ozone standard was classified as severe. On July 12, 1995, Maryland submitted a 15% Plan SIP revision for the Baltimore ozone nonattainment area. On February 2, 2000, EPA approved Maryland's 15% plan for the Baltimore severe ozone nonattainment area (65 FR 5252). Therefore, according to the Phase 2 Rule, the RFP plan for the Baltimore NAA may use either NOx or VOC emissions reductions (or both) to achieve the 15 percent emission reduction requirement.

The Baltimore 2002 anthropogenic base year inventory is summarized in Table 2, below.

Table 2. Baltimore NAA 2002 Anthropogenic Base Year Inventory (Ozone Season tpd)

Source Category	VOC	NOx
Point	13.88	111.88
Area	116.81	8.18
Non-Road	70.22	40.96
On-Road	70.57	177.06
Total	271.48	338.08

Maryland calculated the non-creditable emission reductions between 2002 and 2008 by modeling its 2002 and 2008 motor vehicle emissions with all post-1990 CAA measures turned off, and calculating the difference. The non-creditable reductions are calculated in Table 3, below

Table 3. Baltimore NAA Non-Creditable Emission Reductions (Ozone Season tpd)

Source Category	VOC	NOx
(i) 2002 On-Road	101.876	211.145
(ii) 2008 On-Road	92.778	188.541
Non-creditable Reductions (i) – (ii)	9.10	22.60

Maryland's calculations of the Baltimore NAA 2002 VOC and NOx inventories adjusted relative to 2008 and VOC and NOx target levels for 2008 are summarized in Table 4, below.

Table 4. Baltimore NAA 2008 RFP Target Level Calculations (Ozone Season tpd)

Description		Formula	VOC	NOx
A	2002 Rate-Of Progress Base Year Inventory		271.48	338.08
B	FMVCP/RVP Reductions Between 2002 And 2008		9.10	22.60
C	2002 Adjusted Base Year Inventory Relative To 2008	A - B	262.38	315.48
D	RFP Ratio		0.0800	0.0700
E	Emissions Reductions Required Between 2002 & 2008	C * D	20.99	22.08
F	Target Level for 2008	C - E	241.39	293.40

Projected Inventories and Determination of RFP

Projected controlled 2008 emissions for the Baltimore NAA are summarized in Table 5 below.

Table 5. Baltimore NAA 2008 Projected Controlled VOC & NOx Emissions (tpd)

Emission Source Category	VOC Emissions (tpd)	NOx Emissions (tpd)
Point	15.63	122.64
Area	108.17	8.43
Non-road	54.21	39.60
Mobile	41.23	106.84
Total	219.25	277.50

To determine if 2008 RFP is met in the Baltimore NAA, the total projected controlled emissions must be compared to the target levels calculated in the previous section of this document. As shown below in Table 6, the total VOC and NOx emission projections meet the 2008 emission targets. Therefore, the 2008 RFP in the Baltimore NAA is demonstrated.

Table 6. Determination of whether RFP is met in 2008 in the Baltimore NAA

Description		VOC Emissions (tpd)	NOx Emissions (tpd)
A	Total 2008 Projected Controlled Emissions	219.25	277.50

B	Target Level for 2008	241.39	293.40
RFP met if A < B		Yes	Yes

Control Measures and Emission Reductions for RFP

To meet the RFP requirement for the Baltimore NAA, Maryland used a combination of (1) on-road mobile, (2) non-road mobile, and (3) area source control measures.

(1) On-Road Mobile Measures

Maryland calculated the emission reductions for 2008 RFP using the MOBILE model for the following measures:

- Enhanced Vehicle Inspection and Maintenance (Enhanced I/M)
- Tier I Vehicle Emission Standards and New Federal Evaporative Test Procedures
- Reformulated Gasoline in On-Road Vehicles
- National Low Emission Vehicle (NLEV) Program
- Federal Heavy-Duty Diesel Engine (HDDE) Rule

On-road Mobile 2008 Emission Reductions are: 42.45 tpd VOC and 59.10 tpd NOx.

(2a) Non-Road Measures – NONROAD Model

Maryland calculated the emission reductions for 2008 RFP using the EPA NONROAD model for the following measures:

- Non-Road Small Gasoline Engines
- Non-Road Diesel Engines Tier I and Tier II
- Marine Engine Standards
- Emissions Standards for Large Spark Ignition Engines
- Reformulated Gasoline Use in Non-Road Motor Vehicles and Equipment

Non-road Mobile 2008 Emission Reductions are: 17.89 tpd VOC and 6.74 tpd NOx.

(2b) Other Non-Road Measures

- **Railroad Engine Standards: Tier 2**

This measure establishes emission standards for newly manufactured and remanufactured diesel-powered locomotives and locomotive engines.

The class I line-haul railroad engine NOx emission reduction factors for 2000, 2005, and 2010 are 0.0100, 0.3200, and 0.4600, respectively.

Interpolation for 2002: $0.0100 + (0.3200 - 0.0100) \times 2/5 = 0.134 = \text{CE2002}$

Interpolation for 2008: $0.3200 + (0.4600 - 0.3200) \times 3/5 = 0.404 = \text{CE2008}$

The class I switch railroad engine NOx emission reduction factors for 2000, 2005, and 2010 are 0.0000, 0.0700, and 0.1700, respectively.

Interpolation for 2002: $0.0000 + (0.0700 - 0.0000) \times 2/5 = 0.0280 = CE2002$

Interpolation for 2008: $0.0700 + (0.1700 - 0.0700) \times 3/5 = 0.1300 = CE2008$

To determine the projected uncontrolled 2008 VOC emissions for railroad engines, two source classification codes (SCCs) were identified. Projected emissions were pulling from Appendix C of the Baltimore 8-hour ozone plan. Please note that Appendix C of the Baltimore 8-hour ozone plan uses Federal Information Processing Standard (FIPS) county codes in lieu of county names. See Table 7 for 2008 projected uncontrolled emissions.

Table 7. Rail Road Engine Uncontrolled 2008 VOC Emissions in the Baltimore NAA

County Name & FIPS Code	SCC	Source Subcategory	NOx (tpd)
Anne Arundel 24003	2285002005	railroad line haul engines (Class I Line-Haul)	0.264270646
Baltimore 24005			1.187250336
Carroll 24013			0.518027224
Harford 24025			0.556217163
Howard 24027			0.512464138
Baltimore City 24510			0.988266157
Total			4.026495664
Anne Arundel 24003	2285002010	railroad yard engines (Class I Switch)	0.847887229
Baltimore 24005			0
Carroll 24013			0
Harford 24025			0
Howard 24027			0
Baltimore City 24510			1.877589924
Total			2.725477153

Emissions benefits for both source categories are calculated by multiplying 2008 uncontrolled emissions by the difference between CE2008 and CE2002, and multiplying by the rule effectiveness (RE) and rule penetration (RP) factors.

$$\text{2008 Controlled Emissions} = \text{2008 Uncontrolled Emissions} \times [\text{CE2008} - \text{CE2002}] \times \text{RE} \times \text{RP}$$

Assuming RE and RP of 1, the 2008 emissions benefits for class I line-haul and class I switch railroad engines are as follows:

Class I Line-Haul: $4.026495664 \times (0.4040 - 0.1340) = 1.087 \text{ tpd}$

Class I Line-Switch: $2.725477153 \times (0.1300 - 0.0280) = 0.278 \text{ tpd}$

Railroad Engine Projected 2008 Emission Reductions are: $1.087 + 0.278 = 1.37$ tpd NOx.

3) Area Source Measures

- **Architectural and Industrial Maintenance (AIM) Coatings**

To determine the projected uncontrolled 2008 VOC emissions for AIM coatings, six SCCs were identified. Projected emissions were pulling from Appendix C of the Baltimore 8-hour ozone plan. See Table 8 for 2008 projected uncontrolled emissions.

Table 8. AIM Coating Uncontrolled 2008 VOC Emissions in the Baltimore NAA

County Name & FIPS Code	SCC	Source Subcategory	VOC tpd
Anne Arundel 24003	2401002000	solvent-based architectural surface coatings	1.284027229
	2401003000	water-based architectural surface coatings	1.13343753
	2401008000	traffic paints	0.04781209
	2401100000	surface coatings for industrial maintenance	0.665497033
	2401200000	surface coatings - other categories	0.665497033
Baltimore 24005	2401002000	solvent-based architectural surface coatings	1.976759108
	2401003000	water-based architectural surface coatings	1.744926361
	2401008000	traffic paints	0.066676214
	2401100000	surface coatings for industrial maintenance	1.075350925
	2401200000	surface coatings - other categories	1.075350925
Carroll 24013	2401002000	solvent-based architectural surface coatings	0.430653619
	2401003000	water-based architectural surface coatings	0.380146903
	2401008000	traffic paints	0.041253589
	2401100000	surface coatings for industrial maintenance	0.213519655
	2401200000	surface coatings - other categories	0.213519655
Harford 24025	2401002000	solvent-based architectural surface coatings	0.609513406
	2401003000	water-based architectural surface coatings	0.538030155
	2401008000	traffic paints	0.026703812
	2401100000	surface coatings for industrial maintenance	0.300280879
	2401200000	surface coatings - other categories	0.300280879
Howard 24027	2401002000	solvent-based architectural surface coatings	0.69873877
	2401003000	water-based architectural surface coatings	0.616791239
	2401008000	traffic paints	0.035127521
	2401100000	surface coatings for industrial maintenance	0.327773058
	2401200000	surface coatings - other categories	0.327773058
Baltimore City 24510	2401002000	solvent-based architectural surface coatings	1.570115754
	2401003000	water-based architectural surface coatings	1.385973818
	2401008000	traffic paints	0.014666465

County Name & FIPS Code	SCC	Source Subcategory	VOC tpd
	2401100000	surface coatings for industrial maintenance	0.827892958
	2401200000	surface coatings - other categories	0.827892958
Total for the Baltimore NAA			19.4219826

Please note that Table 8 contains emission information for five of the six identified SCCs. Zero emissions were projected for all counties for the sixth SCC, 2401008999: traffic paint solvents.

AIM Coating Projected 2008 Emission Reductions are: 19.4219826 x 31% = 6.02 tpd VOC.

- **Commercial and Consumer Products, Phase I**

Projected reductions are based on an emission reduction factor of 14.2 percent.

To determine the projected uncontrolled 2008 VOC emissions for consumer and commercial products, one SCC was identified. See Table 9 for 2008 projected uncontrolled consumer and commercial products emissions.

Table 9. Consumer and Commercial Products Uncontrolled 2008 VOC Emissions in the Baltimore NAA

County Name & FIPS Code	SCC	Source Subcategory	VOC tpd
Anne Arundel 24003	2465000000	Emissions from commercial/consumer solvents	5.086061964
Baltimore 24005			7.829989181
Carroll 24013			1.705829083
Harford 24025			2.414296893
Howard 24027			2.767720653
Baltimore City 24510			6.219265318
Total for the Baltimore NAA			26.02316309

Consumer and Commercial Products Projected 2008 Emission Reductions are: 26.02316309 x 14.2% = 3.70 tpd VOC.

- **Portable Fuel Containers Rule, Phase I**

This measure introduces performance standards for portable fuel containers and spouts, and is intended to reduce emissions from storage, transport and refueling activities. The rule also included administrative and labeling requirements.

Implementation of this rule began on January 1, 2003. (69 FR 38849) Projected reductions are based on an emission reduction factor of 75% after full implementation after 10 years.

Emission reduction factor: $75\% \times \frac{5.5 \text{ years}}{10 \text{ years}} = 41.25\%$

To determine the projected uncontrolled 2008 VOC emissions for portable fuel containers, six SCCs were identified. See Table 10, below.

Table 10. Portable Fuel Container Projected Uncontrolled 2008 VOC Emissions in the Baltimore NAA

County Name & FIPS Code	SCC	Source Subcategory	VOC tpd
Anne Arundel 24003	2501011011	Residential - Permeation Area	0.118053
	2501011012	Residential - Diurnal Area	1.015461
	2501011016	Residential - Transport Area	0.05537
	2501012011	Commercial - Permeation Area	0.013581
	2501012012	Commercial - Diurnal Area	0.18178
	2501012016	Commercial - Transport Area	2.763266
Baltimore 24005	2501011011	Residential - Permeation Area	0.196545
	2501011012	Residential - Diurnal Area	1.700588
	2501011016	Residential - Transport Area	0.093543
	2501012011	Commercial - Permeation Area	0.017868
	2501012012	Commercial - Diurnal Area	0.227025
	2501012016	Commercial - Transport Area	3.448473
Carroll 24013	2501011011	Residential - Permeation Area	0.037711
	2501011012	Residential - Diurnal Area	0.324979
	2501011016	Residential - Transport Area	0.017746
	2501012011	Commercial - Permeation Area	0.006655
	2501012012	Commercial - Diurnal Area	0.086513
	2501012016	Commercial - Transport Area	1.318773
Harford 24025	2501011011	Residential - Permeation Area	0.05591
	2501011012	Residential - Diurnal Area	0.483459
	2501011016	Residential - Transport Area	0.026311
	2501012011	Commercial - Permeation Area	0.006578
	2501012012	Commercial - Diurnal Area	0.088799
	2501012016	Commercial - Transport Area	1.351712
Howard 24027	2501011011	Residential - Permeation Area	0.062711
	2501011012	Residential - Diurnal Area	0.541298
	2501011016	Residential - Transport Area	0.029705
	2501012011	Commercial - Permeation Area	0.007701

County Name & FIPS Code	SCC	Source Subcategory	VOC tpd
	2501012012	Commercial - Diurnal Area	0.096818
	2501012016	Commercial - Transport Area	1.474268
Baltimore City 24510	2501011011	Residential - Permeation Area	0.160109
	2501011012	Residential - Diurnal Area	1.382577
	2501011016	Residential - Transport Area	0.075523
	2501012011	Commercial - Permeation Area	0.011077
	2501012012	Commercial - Diurnal Area	0.137956
	2501012016	Commercial - Transport Area	2.094509
Total for the Baltimore NAA			19.71095

Portable Fuel Containers Projected 2008 Emission Reductions are 19.71095 tpd x 41.25% = 8.13 tpd VOC.

RFP Emission Reduction Summary

For certain control measures, the 2008 projected emission reductions calculated in this document differ from the 2008 projected emission reductions that MDE has taken credit for in the Baltimore 8-hour ozone plan. Table 11 summarizes the emission reductions from each control measure and compares EPA's calculated values with the reductions claimed in the Baltimore 8-hour ozone plan.

Table 11. Control Measures and 2008 Emission Reductions in the Baltimore NAA – Comparison of EPA Calculations and Baltimore 8-hour Ozone Plan

Control Measure	EPA Calculation		Baltimore 8-hour Ozone Plan	
	VOC (tpd)	NOx (tpd)	VOC (tpd)	NOx (tpd)
On-road Mobile Measures	42.45	59.10	42.45	59.10
Non-road Model	17.89	6.74	17.89	6.74
Railroads (Tier 2)	0.00	1.37	0.00	1.18
OTC - Consumer Products Phase 1	3.70	0.00	3.70	0.00
OTC – AIM Coatings	6.02	0.00	6.03	0.00
OTC – Portable Fuel Containers Phase 1	8.13	0.00	6.71	0.00
Total	78.19	67.21	76.78	67.02

Contingency Measures

To meet the requirements for contingency emission reductions, EPA allows states to use NO_x emission reductions to substitute for VOC emission reductions in their contingency plans. However, MDE chose to use only VOC reductions to meet the contingency measure requirement in the Baltimore NAA. MDE discusses its Baltimore NAA contingency measures for failure to meet RFP in Section 10.2 of the Baltimore 8-hour ozone plan. MDE calculated the contingency VOC reduction for the Baltimore NAA as shown in Table 12, below. The RFP contingency requirement may be met by including in the RFP plan a demonstration of 18 percent VOC & NO_x RFP. The additional 3 percent reduction above the 15 percent requirement must be attributed to specific measures.

Table 12. Baltimore NAA 2008 RFP Contingency Measure Target Level Calculations

Description		Formula	VOC	NO _x
A	2002 Rate-Of Progress Base Year Inventory		271.48	338.08
B	FMVCP/RVP Reductions Between 2002 And 2008		9.10	22.60
C	2002 Adjusted Base Year Inventory Relative To 2008	A - B	262.38	315.48
D	RFP Ratio		0.0800	0.0700
E	RFP Emissions Reductions Required Between 2002 & 2008	C * D	20.99	22.08
F	Contingency Percentage		3.00	0.00
G	Contingency Emission Reduction Requirements	C * F	7.87	0.00
H	Contingency Measure Target Level for 2008	C - E - G	233.52	293.40

To determine if Maryland meets the three percent contingency measure requirement for the Baltimore NAA, the total projected controlled emissions must be compared to the contingency measure target levels calculated above. As shown below in Table 13, the total VOC and NO_x emission projections meet the 2008 contingency measure targets.

Table 13. Evaluation of the Baltimore NAA 2008 RFP Contingency Measure Requirement

Description		VOC (tpd)	NO _x (tpd)
A	Total 2008 Projected Controlled Emissions	219.25	277.50
B	Contingency Measure Target Level for 2008	233.52	293.40
Contingency measure requirement met if A < B		Yes	Yes

RACM Analysis and Determination

The purpose of the RACM analysis is to determine whether or not reasonably available control measures exist that would advance the attainment date for nonattainment areas. Control measures that would advance the attainment date are considered RACM and must be included in the SIP. To meet the RACM requirement, Maryland must demonstrate that it has adopted all RACM necessary to move the Baltimore NAA toward attainment as expeditiously as practicable and to meet all RFP requirements. Maryland has demonstrated that it has met the RFP requirements for the Baltimore NAA.

Maryland evaluated over 200 potential control measures against these criteria. No measures were found to be RACM. However, Maryland states in the Baltimore 8-hour ozone plan that many of the measures are worthwhile in that they can reduce emissions. Maryland further states that it will consider these potential control measures for future SIP revisions for the Baltimore NAA.

Transportation Conformity Budgets

The Baltimore NAA MVEB for the 2008 RFP is based on the projected 2008 mobile source emissions accounting for all mobile control measures. The MVEBs for the 2008 RFP are shown in Table 14, below.

Table 14. Baltimore NAA 2008 RFP MVEBs

VOC (tpd)	NOx (tpd)
41.2	106.8

In a March 27, 2009 Federal Register notice, EPA notified the public that EPA found that the 2008 RFP MVEBs in the Baltimore 8-hour ozone plan are adequate for transportation conformity purposes. (74 FR 13433) As a result of EPA's finding, the State of Maryland must use the MVEBs from the June 4, 2007 Baltimore 8-hour ozone plan for future conformity determinations for the 8-hour ozone standard.

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