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MARYLAND DEPARTMENT OF THE ENVIRONMENT
Air & Radiation Management Administration
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Modification to the Phase II Attainment Plan for Cecil County: Revising the Mobile Source Emission Budgets, Adding Tier 2 Standards

PROPOSED

November 9, 2000

Air and Radiation Management Administration
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Executive Summary

Under the 1990 Clean Air Act Amendments, Cecil County, as part of the Philadelphia Consolidated Metropolitan Statistical Area (CMSA) was classified as a severe nonattainment area with respect to the National Ambient Air Quality Standard for ozone. The Clean Air Act requires that severe ozone nonattainment areas submit an attainment plan that includes a photochemical modeling demonstration that the area will comply with the federal ozone standard by 2005.

On April 28, 1998, Maryland submitted an attainment plan for the Baltimore Nonattainment Area and Cecil County entitled *Phase II Attainment Plan for the Baltimore Region and Cecil County* (Phase II Attainment Plan). This plan included local and regional modeling and weight of evidence demonstrations that these areas would be likely to achieve compliance with the federal ozone standard if pollution transported from areas outside these nonattainment areas was reduced.

The control measures contained in the Phase II Attainment Plan as modified through December 3, 1999 include: Enhanced Inspection/Maintenance (Enhanced I/M) program, Tier 1 vehicle emissions standards, Reformulated gasoline Phase I and II, Stage II vapor recovery, Open burning ban, Surface cleaning/degreasing controls, Reformulated Architectural coatings, Reformulated Consumer products, Auto refinishing controls, Nonroad diesel engine emission standards, Nonroad gasoline engine emission standards, Marine engine emission standards, Railroad locomotive emission standards, Stage I Vapor Recovery, Graphic art controls, Heavy Duty Diesel Engine emission standards, and the National Low Emission Vehicle Program. The NOx SIP Call regional NOx reduction program is in place in Maryland, however, Cecil County has no large NOx sources.

EPA proposed approval of the Phase II Attainment Plan on December 16, 1999. The SIP approval is contingent on the following conditions:

1. Maryland submits an adequate motor vehicle emissions budget including Tier 2 vehicle standards by December 31, 2000.

2. Maryland reaffirms the intent of its existing enforceable commitment to adopt additional control measures as needed to attain the national ambient air quality standard (NAAQS). The EPA has determined that the Philadelphia Nonattainment Area will need additional emissions reductions to ensure attainment of the ozone NAAQS. The additional reduction requirement are equal to 4.5% of the VOC emissions and 0.3% of the NOx emissions of the 1990 base year inventory for Cecil County.

3. Maryland adopts and submits a rule(s) for the regional NOx reductions consistent with the modeling demonstration, i.e. the NOx SIP Call.

4. Maryland adopts and submits an enforceable commitment, or reaffirmation of existing enforceable commitment to do the following:

a. By 10/31/01 submit measures that achieve the additional emission reductions as required, including a revised motor vehicle emissions budget if additional measures affect the motor vehicle emission inventory.
b. Revise the SIP and motor vehicle emissions budget using MOBILE6 within one (1) year after it is issued.
c. Perform a mid-course review by 12/31/03. A midcourse review of progress toward attainment will be performed in 2003 after the end of the ozone season. The midcourse review will include an evaluation of trends in monitor data, local emissions, implementation of local emissions strategies, and plans to determine progress the region is making towards attainment of the one-hour ozone standard.

This SIP revision fulfills condition number one (1) above which involves modifying the mobile emissions budget due to the adoption of Tier 2 standards. This document also provides a commitment that the MDE (as referenced in December 24, 1999 and April 28, 1998 SIP documents) will continue to adopt additional control measures to ensure that NAAQS standards will be achieved by 2005. Measures that will reduce emissions by an amount equivalent to the identified shortfall will be adopted and submitted to the EPA no later than October 31, 2001. Maryland also commits to completing a mid-course review by 12/31/03 and submitting a revised SIP and motor vehicle emissions budget within one (1) year of the release of MOBILE6.

The purpose of this modification to the Phase II Attainment Plan is to revise the motor vehicle emission budgets to include reductions from Tier 2 Vehicle Standards. Motor vehicle emissions budgets must be established for the attainment year and reflect all control programs used in the attainment demonstration. Motor vehicle emission budgets must be adequate for the purpose of determining whether transportation plans and improvement programs conform to the Phase II Attainment Plan.

On December 21, 1999, the EPA announced new regulations affecting emissions standards for the production of new vehicles beginning in 2004, known as Tier 2 standards. The emissions reduction benefits of this Tier 2 program for the Maryland region will be significant. The new tailpipe standard applies to all classes of passenger vehicles (including Sport Utility Vehicles and light trucks) beginning in 2004. In effect, the rule forces SUV's (Sport Utility Vehicles) and light trucks to meet the same tailpipe emission standards as cars. The rule creates a more stringent emission standard for both. Simultaneously, the EPA announced lower sulfur in gasoline standards, as part of the new tailpipe standard, which are necessary to enable passenger vehicles to meet Tier 2 emission standards.

This current SIP revision incorporates the new Tier 2 standards into the mobile source emission budgets for Cecil County. Using the criteria established in the federal transportation conformity rule at 40 CFR 93.118(e)(4) and federal guidance regarding motor vehicle emission budgets in attainment plans, the 2005 motor vehicle emission budgets for Cecil are 2.6 tons/day VOC and 5.6 tons/day NOx.

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I. Background

The Phase II Attainment Plan

Under the 1990 Clean Air Act Amendments, Cecil County, as part of the Philadelphia Consolidated Metropolitan Statistical Area (CMSA) was classified as a severe nonattainment area with respect to the National Ambient Air Quality Standard for ozone. By November 1994, the Clean Air Act required that severe ozone nonattainment areas submit an attainment plan that included a photochemical modeling demonstration that the area would comply with the federal ozone standard by 2005. In a memorandum dated March 2, 1995, Mary Nichols, Assistant Administrator of the U. S. Environmental Protection Agency (EPA), provided an extended schedule for submitting attainment demonstrations in two phases for serious and severe ozone nonattainment areas. The extended schedule was contingent upon participation in the Ozone Transport Assessment Group and adoption of regional control measures such as the National Low Emission Vehicle (NLEV) Program and regional nitrogen oxides (NOx) reductions from utilities and other large NOx sources.

On April 28, 1998, Maryland submitted an attainment plan for the Baltimore Nonattainment Area and Cecil County entitled *Phase II Attainment Plan for the Baltimore Region and Cecil County.* This plan included local and regional modeling and weight of evidence demonstrations that these areas would be likely to achieve compliance with the federal ozone standard if pollution transported from areas outside these nonattainment areas was reduced. Maryland participated in the Ozone Transport Assessment Group (OTAG) process to identify a suite of regional strategies that would reduce transport across the eastern half of the United States. These regional measures, when combined with federal, state and local measures already included in the Phase II Attainment Plan are likely to result in achieving compliance with the ozone standard in 2005.

The control measures contained in the Phase II Attainment Plan submitted April 28, 1998 include: Enhanced Inspection/Maintenance (Enhanced I/M) program, Tier 1 vehicle emission standards, Reformulated gasoline Phase I and II, Stage II vapor recovery, Open burning ban, Surface cleaning/degreasing controls, Reformulated Architectural coatings, Reformulated Consumer products, Auto refinishing controls, Nonroad diesel engine emission standards, Nonroad gasoline engine emission standards, Marine engine emission standards, Railroad locomotive emission standards, Stage I Vapor Recovery, Graphic art controls, Heavy Duty Diesel Engine emission standards, and the National Low Emission Vehicle Program. On December 3, 1999 a modification to the Phase II Attainment Plan incorporating all the measures identified above that affect highway vehicle emissions into the mobile source emissions budget was submitted to the EPA.

The NOx SIP Call regional NOx reduction program is in place in Maryland, however, Cecil County has no large NOx sources.

Attainment Plan Approved

EPA proposed approval of the Phase II Attainment Plan on December 16, 1999. On June 23, 2000, the EPA determined that the mobile source emissions budget for Cecil County was adequate for use in the conformity process. The approval of the SIP is contingent on the following conditions:

1. Maryland submits an adequate motor vehicle emissions budget including Tier 2 vehicle standards by December 31, 2000.

2. Maryland reaffirms the intent of its existing enforceable commitment to adopt additional control measures as needed to attain the national ambient air quality standard (NAAQS). The EPA has determined that the Philadelphia Nonattainment Area will need additional emissions reductions to ensure attainment of the ozone NAAQS. The additional reduction requirements are equal to 4.5% of the VOC emissions and 0.3% of the NOx emissions of the 1990 base year inventory for Cecil County.

3. Maryland adopts and submits a rule(s) for the regional NOx reductions consistent with the modeling demonstration, i.e. the NOx SIP Call.

4. Maryland adopts and submits an enforceable commitment, or reaffirmation of existing enforceable commitment to do the following:

    a. By 10/31/01 submit measures that achieve the additional emission reductions as required, including a revised motor vehicle emissions budget if additional measures affect the motor vehicle emission inventory.
    b. Revise the SIP and motor vehicle emissions budget using MOBILE6 within one (1) year after it is issued.
    c. Perform a mid-course review by 12/31/03. A midcourse review of progress toward attainment will be performed in 2003 after the end of the ozone season. The midcourse review will include an evaluation of trends in monitor data, local emissions, implementation of local emissions strategies, and plans to determine progress the region is making towards attainment of the one-hour ozone standard.

This SIP revision fulfills item number one (1) above, and makes commitments to fulfill the other conditions in the appropriate timeframe.

Tier 2 Standards

On December 21, 1999, federal regulations were announced tightening tailpipe emission standards for the third time. In the early 1980's, the Federal Motor Vehicle Control Program began with Tier 0 tailpipe standards. These standards reduced emissions by over 90% from pre-control levels. Implementation of Tier 1 tailpipe standards began with the model year 1994. This round of standards made substantial reductions in carbon monoxide and nitrogen oxides. As part of the EPA's program for cleaner vehicles,

cleaner gasoline, and more protective Tier 2 tailpipe emission standards, the EPA announced lower sulfur in gasoline standards. A lower sulfur content in gasoline is needed to enable passenger vehicles to meet the Tier 2 standards.

The benefits of this Tier 2 program for the Maryland region will be significant. The new tailpipe standard applies to all classes of passenger vehicles (including SUV's and light trucks) beginning in 2004. New sulfur in gasoline standards require refiners to place caps on sulfur in fuel. These refiners have a great deal of flexibility under the new standard system that allows them to phase the standard in and even use credits from refiners who reduce emissions early.

II. Motor Vehicle Emission Budgets for the Phase II Attainment Plan

In Cecil County, motor vehicle emission budgets established in the Phase II Attainment Plan are derived by projecting the level of onroad mobile source emissions for the appropriate milestone year or attainment year including the emission reductions from all mobile source control measures identified in the plan. The budgets in this modification were developed using this procedure and include the following control programs: the Federal Motor Vehicle Control Program, Tier 1 and 2; reformulated gasoline Phase I and II; enhanced inspection/maintenance program, NLEV program, and heavy duty diesel engine 2g standard (HDDE2g).

The motor vehicle emission budgets for Cecil County were prepared in conjunction with the Maryland Department of Transportation. The projected traffic volumes developed for Cecil County were based on the Upper Eastern Shore MINUTP transportation planning model. This model, developed by the Maryland State Highway Administration consists of Cecil, Kent and Queen Anne's Counties in Maryland and New Castle County in Delaware.

Land use inputs to the model were provided by the Wilmington Area Planning Council (WILMAPCO). The model was calibrated for the base year. The model develops traffic volumes through a four step process. Following a review of the model outputs, the outputs are input into a d-base program to produce network and trip ends data for use in the MOBILE5b model. Emission factors were developed using MOBILE5b, the EPA approved mobile emission model. The emission factors developed include the following controls: FMVCP, reformulated gasoline Phase I and II, enhanced I/M, Tier 1 and 2, NLEV, and HDDE2g and were based on 1999 vehicle fleet characteristics. Detailed analysis parameters can be found in Appendix A.

Since the application of Tier 2 standards only affects the 2005 budget, only this budget will be modified. The explicit motor vehicle emission budgets for Cecil County for 2005 are 2.6 tons/day VOC and 5.6 tons/day NOx.

III. Consultation

The conformity rule requires air quality planning agencies to develop a consultation process with state departments of transportation and local officials. This process fosters understanding of the development process for air quality plans and transportation plans between the agencies. The Maryland Department of the Environment (MDE) adopted regulations, COMAR 26.11.26, governing consultation between the Maryland Departments of Transportation and the Environment and WILMAPCO with respect to the development of air quality plans and transportation plans. This modification to the Phase II Attainment Plan and the motor vehicle emission budgets in it were developed in accordance with the consultation rule.

IV. Conclusions

The goal of this modification to the Phase II Attainment Plan is to establish new motor vehicle emission budgets for the Cecil County Phase II Attainment Plan. This document clarifies commitments by MDE (as referenced in December 24, 1999 and April 28, 1998 SIP documents) to adopt additional control measures to ensure that NAAQS standards will be achieved by 2005. Additional measures equal to the emissions reduction shortfall identified in the attainment plan approval will be adopted and submitted to the EPA no later than October 31, 2001. Maryland also commits to revising the SIP and the mobile emissions budget using MOBILE6 within one (1) year of its release.

V. Corrections to the Cecil County Rate of Progress Plan

The *Phase I and Phase II Attainment Plan for the Baltimore Region and Cecil County* included a Rate-Of-Progress (ROP) plan for Cecil County. This plan shows how Cecil County will make a 3% per year reduction in VOC emissions after 1996, through 2005. When the EPA approved the 15% plan, EPA discounted the open burning ban reductions to include rule effectiveness. The estimate has been revised, in both the Phase I and Phase II plans, and the revised emission reductions substituted in the ROP calculation and other supporting documentation are included in Appendix C. These calculations demonstrate that Cecil County has achieved the reductions needed to meet ROP requirements.

In addition to rule effectiveness corrections, additional reductions from the application of graphic arts rules to area sources were added to the ROP Plan. Maryland is also changing the 2005 ROP mobile budget to match the 2005 attainment mobile budget. The ROP target levels are met using the 2005 mobile budgets for attainment.

APPENDIX A

MOBILE SOURCE DATA
FOR CECIL COUNTY

10/30/00

Maryland Department of the Environment
Mobile Sources Control Program

Wilmapco Region Conformity Analysis for Cecil County
Milestone Year : 2005

Scenario Reg Mix w/ M5 HDDV Def.		Build (1) 1999	Build (2) 1999 UnCntrld
Emissions Type	Emissions Basis		
Stab/AvgExh VOC	VMT	1.3	5.7
ColdExh VOC	VMT	0.7	1.8
HotExh VOC	VMT	0.1	0.6
SubTot Exh VOC	VMT	2.1	8.1
SubTot NRef Evp VOC	Evnt/VMT	0.7	4.7
Total VOC		2.8	12.8
Refueling VOC		0.1	0.6
Total NonRef VOC	Evnt+VMT	2.7	12.2
Tier 2 Benefits		0.1	0.0
Total NonRef VOC w/ Tier 2		2.6	12.2
Stab/AvgExh NOx	VMT	5.6	12.1
ColdExh NOx	VMT	0.3	0.9
HotExh NOx	VMT	0.1	0.4
TotalExh NOx	VMT	6.0	13.4
Tier 2 Benefits		0.4	0.0
Tot NOx w/ Tier 2		5.6	13.4
VMT	mil/ miles/d	3.6356	
Average Speed	Mph	47.55	
Cold starts	in millions	0.2829	
Hot starts	in millions	0.1913	
Trip Ends	in millions	0.4742	

Note:

1. Emission Modeling includes latest 1999 MD Vehicle Reg. Mixes.
2. Emissions are expressed in tons per day (summer weekday).
3. Uncontrolled scenarios are compiled with 1990 emission factors and the appropriate activity levels for the scenario milestone year
4. Scenario 1 analysis: Stage II, Tier 1, RFG, IM240, NLEV and the new HDE Rule controls included. Benefits from Tier 2 are also included. Scenario 2 is uncontrolled.

APPENDIX B

MOBILE5b INPUT/OUTPUT FILES FOR CECIL COUNTY

MOBILE5b input and output files used in the development of the motor vehicle emission budget for Cecil County are very extensive and have not been reproduced in hardcopy format for inclusion in this document. Hardcopy files of the input/output files can be viewed at the Maryland Department of the Environment. The input/output files can be obtained in electronic format by contacting:

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APPENDIX C

Corrections to the Cecil County Rate-of-Progress Plan

Open Burning Ban

This control measure bans open burning during the peak ozone season.

Description of Source Category

Open burning refers to the method of burning that releases uncontrolled emissions. Open burning is primarily used for the disposal of brush, trees, and yard waste and as a method of land clearing by both developers and individual citizens alike. Emissions from open burning include oxides of nitrogen, hydrocarbons, carbon dioxide, carbon monoxide and other toxic compounds. Emissions levels from open burning are high due to the inefficient and uncontrolled manner in which the material is burned.

Control Strategy

The Department adopted a regulation that prohibits open burning during the peak ozone period (June to August). The seasonal prohibition would affect only those counties that lie within the serious and severe nonattainment areas, such as Cecil County.

Estimated Emissions Reductions, Sample Calculation and Methodology

The 1990 base year emissions estimate for Cecil County using EPA approved emission factors for this category was 4.4 tons per day of VOC and 0.9 tons per day of NOx. No growth is assumed for the projected emissions.

The control measure for this category consists of an open burning ban, therefore, the emissions reductions expected would equal the emissions estimate.

The expected emission reductions in tons per day are **(without rule effectiveness):**

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil	4.4	0.9	4.4	0.9	4.4	0.9

Applying rule effectiveness assumes that the effectiveness of the rule is 80%. Therefore, the expected emission reductions per day are 20% less.

Calculation for Rule Effectiveness:

1990 Emissions (Tons Per Day) * BEA Growth Factor * Rule Effectiveness (Percent) = Expected Emission Reductions in 2002 (Tons Per Day)

Example:

4.4 * 1.0 * 0.8 = 3.5 tons per day

The expected emission reductions in tons per day **(with rule effectiveness):**

	1999 VOC	**1999 NOx**	**2002 VOC**	**2002 NOx**	**2005 VOC**	**2005 NOx**
Cecil	3.5	0.7	3.5	0.7	3.5	0.7

Due to a surplus in both VOC and NOx reductions in the Rate-of-Progress Plan, the change in rule effectiveness does not adversely affect the Rate of Progress demonstration.

Screen Printing

This measure requires certain small printing operations to install RACT.

Description of Source Category

A screen printing process is used to apply printing or an image to virtually any substrate. In the screen printing operation, ink is distributed through a porous screen mesh to which a stencil may have been applied to define an image to be printed on a substrate. The printed substrate is then placed on a drying rack or in a drying unit. After the screen is used, it is transferred to a screen reclamation process to be cleaned for reuse. During this process the ink residue is removed with solvents. Sometimes stencil material and hardened ink appears as a "ghost image" from previous stencil applications. Separate solvent material is used to remove this image.

VOC emissions result from the evaporation of ink solvents and from the use of solvents for cleaning. The major source of VOC emissions is the printing process.

Control Strategy for Source Category

Because the users of these coatings are relatively small, requiring the use of add-on control devices is technically and economically infeasible. Reductions in VOC emissions are obtained through the use of ink reformulation, process printing modification, and material substitution for cleaning operations.

Ink reformulation is the process of modifying the current formulation of the ink to a lower VOC content. Ink reformulation can involve one or several of the following approaches:

- Replacing the VOC solvents with non-VOC solvents;
- Increasing the solids content of the coating;
- Altering the chemistry of the resin;

In a printing process modification, a typical VOC solvent based printing operation may be replaced with an ultraviolet (UV) ink operation. The UV inks are cured by exposing the printed substrate to an ultraviolet light source. Ultraviolet inks do not contain VOC nor is VOC added to the inks during the operation. For a high production facility, a cost saving can be attributed to using an ultraviolet system over a conventional ink system. For the screen cleaning process there are a number of cleaning systems which contain lower amounts of VOC.

The Department has promulgated a regulation with ink standards that depend upon the printed substrate. The cleaning solvents are required to have a lower VOC content. The regulation reflects standards similar to the South Coast Air Quality Management District's (SCAQMD) regulation for screen printing.

This regulation became effective on June 5, 1995 and was submitted to the EPA on July 12, 1995**.**

Expected Emissions Reductions, Methodology and Sample Calculation

The Department estimates approximately 3 to 5 percent of the graphic arts area source inventory can be attributed to screen printing sources.

Based upon the SCAQMD rule reductions, the Department expects to obtain a 35% emissions reductions from the implementation of this rule (SCAQMD, 1991b). Using this emissions reduction percentage the expected emissions reductions for this category is 0.5 tons per day. The 2002 emissions reductions were calculated as follows:

1990 Emissions (Tons per day) * BEA Growth Factor * Expected Emissions Reduction (Percentage) * Rule Effectiveness (Percentage) * Penetration (Percentage) = Expected Emissions Reduction (Tons per day)

1990 Emissions (Tons per day) * BEA Growth Factor * Expected Emissions Reduction (Percentage) = Expected Emissions Reduction (Tons per day)

0.178 Tons per day * 1.19 (1.24 in 2005) * 0.35 * 0.8 * 0.05 = 0.003 Tons per day

The expected emission reductions by 2002 and 2005 in tons per day are:

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil	0.0028	0.0	0.003	0.0	0.0031	0.0

Graphic Arts – Lithographic Printing

This measure requires smaller printers to use control devices and/or low VOC materials to reduce VOC emissions.

Description of Source Type

This source category consists of numerous small sheet-fed printers that perform non-continuous printing and web printers that print on a continuous web or roll. Heat-set web printers use drying ovens to force dry the printed matter. Web printing sources perform high volume printing on paper or paperboard.

VOC emissions to the air are caused by evaporation of the ink solvents, alcohol in the fountain or dampening solution, and equipment wash solvents. Emissions from sheet fed presses are minimal because most of the VOC from the inks are absorbed in the printed matter. About one third of the VOC from web printing ink is absorbed in the printed matter. Higher VOC emissions are caused by heat-set inks because of the elevated temperatures. These VOC discharges may also cause visible emissions and nuisance odors.

Historically, lithographic web printers have used up to 35 percent isopropyl alcohol (IPA) in the fountain solutions. The volatile alcohol evaporated relatively quickly causing significant VOC emissions. The industry eventually found non-volatile substitutes for the isopropyl alcohol. Web printers are able to utilize 100 percent substitution, however, sheet fed printers with older design printing presses may require a limited amount of alcohol to achieve the required dampening.

Control Strategy for Source Type

Although several control devices were evaluated over the years for web printers, a catalytic oxidizer has proven to be most successful. For heat-set web printers, the dryer emissions are ducted directly into the oxidizer yielding a 100 percent capture of emissions. A typical oxidizer yields 96-98 percent destruction of VOC.

The proposed measure would require that:

- Web printers use no alcohol in the fountain solutions;
- Heat-set web printers install an afterburner on the oven exhaust if plant wide emissions exceed 20 pounds per day; and
- Sheet fed printers use no more than 8.5 percent isopropyl alcohol in the fountain solution and the solution must be refrigerated to 55^{o}F or less.

The CTG included the following controls:

Emission Source	CTG Recommended Control
Inks	90% control (condenser filters) for heatset plants
Fountain Solution	1.6% isopropyl alcohol (IPA) for heatset plants (90% reduction) alcohol substitution for non-heatset (99% reduction) 5% IPA for sheet-fed (50% reduction)
Cleaning Solutions	30% VOC content limit (70% reduction)

The emission reductions described in the 15% RPP for this control measure takes into consideration only one type of printer, lithographic printing. The Department adopted a regulation (COMAR 26.11.19.11 C & D) that limits the amount of isopropyl alcohol in the fountain solutions. Web printers are prohibited from using IPA (100 percent control) while sheet-fed printers are limited to no more than 8.5 percent IPA in the fountain solution. Previously, fountain solutions typically contained 16 percent IPA in the fountain solution (46.88 percent reduction). The IPA requirements became effective on January 1, 1992.

Expected Emissions Reductions, Methodology, and Sample Calculations

Based on the CTG (based on employment), it was assumed that offset lithographic printing accounts for 64% of total graphic arts emissions. This percentage contribution was applied to total graphic arts area source emissions to estimate total emissions from offset lithography.

The CTG estimated overall reduction for four model plants: heatset web, non-heatset web, non-heatset sheet-fed, and newspaper non-heated web. Since the CTG did not classify the population of sources into these model plants, the numerical average of the overall sources was used for the nonattainment area reductions.

The average control efficiency of 75% (from the CTG) and the 64 % penetration were applied to area source graphic art emissions to determine total reductions.

The expected area source emission reductions for 2002 are calculated as follows:

1990 Emissions (Tons per day) * BEA Growth Factor * Expected Emissions Reduction (Percentage) * Rule Effectiveness (Percentage) * Penetration (Percentage) = Expected Emissions Reduction (Tons per day)

0.178 Tons per day * 1.166 (1.194 in 2005) * 0.75 * 0.8 * 0.64 = 0.0797 Tons per day

The total expected emission reductions for the Graphic Arts – Lithographic category in tons per day are:

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil	0.0774	0.0	0.0797	0.0	0.0816	0.0

Graphic Arts – Flexographic and Rotogravure Printing

This measure requires smaller printers to use control devices and/or low VOC materials to reduce VOC emissions.

Description of Source Type

This source category consists of numerous small flexographic or rotogravure printers that perform non-continuous sheet fed printing and continuous web or roll printing.

Flexographic printing employs plates with raised images and only the raised image comes in contact with the substrate during printing. Typically, flexographic plates are made of plastic, rubber, or some other flexible material, which is attached to a roller or cylinder for ink application. Modern presses are now equipped with enclosed doctor blade systems which eliminate the fountain roller and fountain, thereby reducing evaporation loss. In a typical flexographic printing operation, the cylinder plate is removed from the press and is cleaned in a separate area.

Gravure printing uses almost exclusively electro-mechanically engraved copper image carriers to separate the image area from the non-image area. Typically, the gravure image carrier is a cyclinder. In gravure printing, ink is applied to the engraved cylinder, then wiped from the surface by the doctor blade, leaving ink only on the engraved image area. The printing substrate is brought into contact with the cylinder with sufficient pressure so that it picks up the ink left in the depressions on the cylinder. In a typical gravure printing operation, the cylinder is removed from the press and is re-plated for the new process.

VOC emissions to the air are caused almost entirely by evaporation of the ink solvents.

Control Strategy for Source Type

Although several control devices were evaluated over the years for rotogravure and flexographic web printers, a catalytic oxidizer has proven to be most successful. For heat set web printers, the dryer emissions are ducted directly into the oxidizer yielding nearly a 100 percent capture of emissions. A typical oxidizer yields 96-98 percent destruction of VOC.

The proposed measure would require that:

- Printers reduce emissions by using water-based inks that contain less that 25 percent VOC by volume of the volatile portion of the ink, or high solids inks that contain not less than 60 percent nonvolatiles; or

- If compliance with these requirements cannot be achieved, reduce the VOC content of each ink, or reduce the average VOC content of inks used at each press as follows;

- 60 percent reduction for flexographic presses,
- 65 percent reduction for packaging rotogravure presses, and
- 75 percent reduction for publication rotogravure presses.

Maryland adopted a printing regulation in 1987 that required any person who causes or permits the discharge of any emissions of VOC from any roll-printing utilizing flexography, packaging rotogravure, or publication rotogravure in excess of 550 pounds per day to reduce the discharge by the following percentage indicated:

Roll Printing Method	
Flexography	60%
Packaging Rotogravure	65%
Publication Rotogravure	75%

This regulation is applicable only to sources emitting over 550 pounds per day and thus only addresses certain point sources. Some web printers were in compliance with this requirement in 1990. Also many printers installed stack afterburners or oxidizers because they were cited for visible emission or nuisance odor violations. Most sources were in compliance with all requirements by early 1992.

The Maryland regulation was amended at the end of 1993 to change the trigger level for installing a control device to 100 pounds per day. In addition, the regulation now addresses all flexographic, packaging rotogravure and publication rotogravure printers who apply a clear protective coating over the printed matter. The provisions of the regulation do not apply to printing on fabric, metal or plastic.

Therefore, the expected point source emission reduction from this control measure are included in the base year uncontrolled emission inventory. However, area source controls have not been reflected in the base year emission inventory.

Expected Emissions Reductions, Methodology, and Sample Calculations

Based on a November 1996 EIIP document entitled Graphic Arts, the estimated percentage of product market share for rotogravure printing is 18 percent and the estimated percentage of market share for flexographic printing is 18 percent. This percentage contribution was applied to total graphic arts area source emissions, to estimate total emissions from either flexographic or rotogravure printing.

The average control efficiency for flexographic printers is assumed to be 60% (from COMAR 26.11.19.10) * 90% (estimated percent of emissions attributable to evaporation of ink solvent).

The average control efficiency for rotogravure printers is assumed to be 70% (from COMAR 26.11.19.10) * 90% (estimated percent of emissions attributable to evaporation of ink solvent).

The average control efficiency for each type of printing operation and the 18 % penetration were applied to area source graphic art emissions to determine total reductions.

The expected area source emission reductions for 2002 are calculated as follows:

1990 Emissions (Tons per day) * BEA Growth Factor * Expected Emissions Reduction (Percentage) * Rule Effectiveness (Percentage) * Penetration (Percentage) = Expected Emissions Reduction (Tons per day)

Flexographic Printing
0.178 Tons per day * 1.166 (1.194 in 2005) * (0.6 * 0.9) * 0.8 * 0.18 = 0. 161 Tons per day

Rotogravure Printing
0.178 Tons per day * 1.166 (1.194 in 2005) * (0.7 * 0.9) * 0.8 * 0.18 = 0.019 Tons per day

The total expected emission reductions in tons per day are:

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil	0.034	0.0	0.0351	0.0	0.0358	0.0

The total expected emission reductions in tons per day from all printing operations are the following:

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil	0.1142	0.0	0.1178	0.0	0.1205	0.0

Changes to SIP Tables

The following tables in the *Phase II Attainment Plan for the Baltimore Region and Cecil County* submitted on April 28,1998 will be altered due to the above changes from an alteration to the Open Burning Rule.

Table/ Chart Identification	Page # in Phase II Plan	New Table Association
Table 3.D.2	Page 3-24	Table 1.2a
Table 1.2	Appdx. E Page 4	Table 1.2a
Table 6.2	Appdx. E Page 64	Table 1.2a

Reflecting Changes in the Mobile Source Emissions Budget in the ROP Plan

The 2005 attainment budget for mobile sources was established using 1999 vehicle registration. This change increased mobile source emission estimates for VOC. Uncontrolled emissions for 2005 increased from 11.7 tons/ day VOC (from Phase II, 1998, Table 3.D.4), to 12.2 tons/ day. This raises the 2005 projected Uncontrolled Emissions in Table 1.2a to 24.5 tons/day. The 2005 mobile emission reductions including nLEV, HDDE2g and FMCVP are 9.5 tons/ day. This results in an Emissions Level Obtained of 9.1 tons/ day, which is 0.3 tons/ day lower than the 2005 VOC Target Level (Emission Level Required) of 9.4 tons/ day. The NOx emission budget for 2005 remains unchanged. Uncontrolled NOx emissions decreased from 14.4 tons/ day to 13.4 tons/ day. The 2005 total NOx mobile emission reductions including nLEV, HDDE2g are FMCVP are 7.4 tons/day. This results in an Emission Level Obtained of 9.8 tons/ day NOx, which is 1.9 tons/day lower than the 2005 NOx Target Level (Emission Level Required) of 11.7 tons/day for NOx.

Table 1.2a - Summary of Emission Benefits For Cecil County (Tons per Day)

	1999		2002		2005	
Control Measure	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**
Enhanced I/M	1.8	1.4	1.8	1.5		
Tier I	0.2	0.8	0.7	1.1		
Reform Gas	0.2	0.0	1.2	0.3		
Stage II/Refuel	0.3	0.0	0.4	0.0		
FMVCP/RVP	3.7	2.7	4.3	3.4		
Total Mobile					9.5*	7.4*
Open Burning	3.5	0.7	3.5	0.7	3.5	0.7
Surface Cleaning/ Degreasing	0.2	0.0	0.2	0.0	0.2	0.0
Architectural Coatings	0.2	0.0	0.2	0.0	0.2	0.0
Consumer Products	0.1	0.0	0.1	0.0	0.1	0.0
Auto Refinishing	0.2	0.0	0.2	0.0	0.2	0.0
Stage I Vapor Recovery	0.8	0.0	0.8	0.0	0.8	0.0
Nonroad Small Engines	0.4	0.0	0.5	0.0	0.8	0.0
Nonroad Diesel Engines	0.0	0.2	0.0	0.3	0.0	0.5
Railroads	0.0	0.0	0.0	0.1	0.0	0.2
Screen Printing	0.0	0.0	0.0	0.0	0.0	0.0
Graphic Arts - Lithography	0.1	0.0	0.1	0.0	0.1	0.0
Graphic Arts – Rotogravure & Flexographic	0.0	0.0	0.0	0.0	0.0	0.0
Total	**11.7**	**5.8**	**14.0**	**7.4**	**15.4**	**8.8**
Projected Uncontrolled Emissions	**22.2**	**17.4**	**23.6**	**18.2**	**24.5**	**18.6**
Emission Level Obtained	**10.5**	**11.6**	**9.6**	**10.8**	**9.1**	**9.8**
Emission Level Required	**12.6**	**12**	**10.9**	**11.8**	**9.4**	**11.7**
Surplus	**2.1**	**0.4**	**1.3**	**1.0**	**0.3**	**1.9**

This table supercedes all other tables summarizing reductions achieved to meet rate of progress requirements for Cecil County.

*** Total Mobile Reductions include nLEV and HDDE2g.**

Contingency Measures

This Act requires the State to adopt specific contingency measures that will take effect without further action by the State or the EPA if the State fails to reduce VOC/ NOx emissions by 3 percent per year from 1997 through 2005.

The contingency measures identified by the State must be sufficient to secure an additional 3 percent reduction in ozone precursor emissions in the year following the year in which the failure has been identified. If the shortfall is less than 3 percent, a contingency measure need only cover that small percentage. If the shortfall is greater than 3 percent, the State, in an annual tracking report to the EPA, must either identify the additional actions it will take to cure the shortfall before the next milestone or maintain a reserve of contingency measures capable of covering a shortfall greater than 3 percent. Early implementation of an emission reduction measure to be implemented in the future is acceptable as a contingency measure.

In the event that measures listed in Chapter 6, of Appendix E do not result in meeting the post-1996 3 percent-per-year target levels, the following contingency plan has been developed.

Surplus Reductions for Existing Measures

Some emission control strategies, listed to meet the Post-1996 target levels are expected to result in more emission reduction that are needed to meet the requirements. If other measures fail to meet expected reductions, the excess from the non-mandated measures, such as open burning controls, will be used to make up the difference.

The following table indicates the amount of reductions needed to fulfill the contingency measure requirement.

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil County	0.492	NA	0.486	NA	0.477	NA

VOC and NOx emission reductions from the open burning rule included in this ROP demonstration result in surplus emission reductions equal to the required VOC reductions for 1999 and 2002. EPA guidance allows the use of NOx substitution for required VOC contingency reductions if NOx is needed to attain the federal ozone standard. Attainment demonstration modeling has shown that NOx reductions are needed in Cecil County. Therefore, for 2005, Maryland will use NOx substitution to meet the VOC contingency requirement remaining after the VOC surplus has been utilized.

	1999 VOC	1999 NOx	2002 VOC	2002 NOx	2005 VOC	2005 NOx
Cecil County*	2.1	NA	1.3	NA	0.3	0.7

***Emissions Available for use as Contingency Measures**