

State of Maine

**State Implementation Plan Revision to
Terminate the Stage II Vapor Recovery Program**

March 2016

**Demonstration of Compliance with the
Comparable Measures Requirement
of CAA section 184(b)(2)**

**Prepared by the
Bureau of Air Quality**



Background

The Stage II vapor recovery program is required by section 182(b)(3) of the Clean Air Act (CAA), 42 U.S.C. 7511a(b)(3). The CAA directs state or local air pollution control agencies with “moderate” or worse nonattainment areas for ozone national ambient air quality standards (NAAQS) to require Stage II vapor recovery systems (VRS) at gasoline dispensing facilities (GDFs) as a reduction control measure for volatile organic compound (VOC) emissions. However, section 202(a)(6) of the CAA, 42 U.S.C. 7521(a)(6), provides the Environmental Protection Agency (EPA) with authority to waive the Stage II requirements of section 182(b)(3) when on-board refueling vapor recovery (ORVR) systems are determined to be in widespread use throughout the motor vehicle fleet.

For the Ozone Transport Region (OTR), which is comprised of eleven Northeastern states and the District of Columbia, there are additional requirements in section 184(b)(2) of the CAA, 42 U.S.C. 7511c(b)(2) for:

(1) EPA to “*complete a study identifying control measures capable of achieving emission reductions comparable to those achievable through vehicle refueling controls contained in section 7511a(b)(3) of this title, and such measures or such vehicle refueling controls shall be implemented in accordance with the provisions of this section*” (referred to as “comparable measures”), and

(2) OTR states to revise their State Implementation Plans (SIPs) to require Stage II controls or comparable measures in OTR areas. The results of the comparable control measures study are provided in *Stage II Comparability Study for the Northeast Ozone Transport Region* (EPA Publication No. EPA-452/R-94-011, January 1995). This requirement under section 184(b)(2) is not affected by any future widespread use determination under CAA section 202(a)(6) by the EPA.

Nine Maine counties were designated as nonattainment of the 1-hour ozone NAAQS under the 1990 CAA: York, Cumberland and Sagadahoc counties (Planning Area 1); Androscoggin and Kennebec counties (Planning Area 2); and Knox and Lincoln counties (Planning Area 3) were designated as “moderate” nonattainment, while Hancock and Waldo counties (Planning Area 4) were designated as “marginal” nonattainment for ozone. Hancock and Waldo counties were redesignated to attainment for the 1-hour ozone standard in 1996. Maine had two nonattainment areas under the 1997 8-hour ozone NAAQS. The Portland Nonattainment Area consisted of the 57 cities and towns comprising York, Cumberland and Sagadahoc Counties along with the Town of Durham in Androscoggin County, and was designated as “marginal” nonattainment for the 8-hour ozone standard; while the MidCoast Nonattainment Area consisted of 55 coastal towns and islands in Hancock, Knox, Lincoln and Waldo counties, and was designated as a “Basic/General” nonattainment area for the 8-hour ozone standard. Based on ambient air quality monitoring data for the period from 2003-2005, both the Portland and MidCoast 8-hour ozone nonattainment areas were attaining the 1997 8-hour ozone NAAQS, and were redesignated to attainment on 12/11/06 (70 FR 71489). EPA found that the entire state of Maine was meeting the 2008 8-hour NAAQS for ground-level ozone on May 21, 2012 (77 FR 30127).

In accordance with section 182(b)(3) of the CAA, 42 U.S.C. 7511a(b)(3), on July 19, 1995, the Maine Department of Environmental Protection (DEP) amended Chapter 118 of the Department’s rules, “Gasoline Dispensing Facilities Vapor Control,” and submitted the amendment to EPA as proposed changes to its SIP. The amendment required Stage II Vapor Recovery Controls on any

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gasoline dispensing facility located in York, Cumberland, and Sagadahoc counties whose annual throughput ever exceeded the initial applicability threshold of 1,000,000 gallons per year. Facilities exceeding this threshold were required to install and place into operation an approved Stage II vapor recovery system no later than November 15, 1996. EPA approved the proposed changes to Maine's SIP on October 15, 1996, and the Stage II program in these three counties provided emission reductions of 1.11 tons per summer weekday in 1996.

In 2008, the Maine Legislature enacted legislation, 38 M.R.S.A. § 585-E(7), repealing the Stage II vapor recovery requirement for all gasoline dispensing facilities as of January 1, 2012.

Stage II Controls vs. On-Board Refueling Vapor Recovery

Pursuant to CAA section 202(a)(6), EPA developed standards for ORVR controls on new light-duty vehicles, which were promulgated and phased in between 1998 and 2002. Vacuum-assist Stage II control systems are not fully compatible with ORVR-equipped vehicles. Studies have demonstrated that ORVR controls impact the effectiveness of vacuum-assist Stage II VRS, resulting in an increase in emissions when compared to the refueling of a non-ORVR-equipped vehicle. Due to the recognized conflict with ORVR technology required by the CAA section 202(a)(6) on 1998 and newer vehicles and the potential for this conflicting technology to actually increase refueling related emissions as the ORVR-equipped fleet becomes predominant (i.e. in "widespread use"), DEP now seeks to remove the Stage II requirement as part of the Maine SIP.

DEP has determined that due to the predominance of ORVR-equipped vehicles in the counties where Stage II was in place, vapor recovery controls provided only *de minimis* emissions reductions. This benefit will disappear altogether over the next several years as more ORVR-equipped vehicles enter the fleet and more non-ORVR-equipped vehicles are retired.

Therefore, DEP proposes to remove from Maine's SIP the requirement to install and operate Stage II controls on new or significantly modified GDFs, effective immediately. Procedural requirements for discontinuing the use of a Stage II vapor recovery system are detailed in Appendix A of 06-096 CMR 118, "Gasoline Dispensing Facilities Vapor Control."¹

Maine's Ozone Air Quality Status

Maine had two nonattainment areas under the 1997 8-hour ozone NAAQS. The Portland Nonattainment Area consisted of the 57 cities and towns comprising York, Cumberland and Sagadahoc Counties along with the Town of Durham in Androscoggin County, and was designated as "marginal" nonattainment for the 8-hour ozone standard; while the MidCoast Nonattainment Area consisted of 55 coastal towns and islands in Hancock, Knox, Lincoln and Waldo counties, and was designated as a "Basic/General" nonattainment area for the 8-hour ozone standard.

Under CAA Section 110(l), EPA may approve a SIP revision that removes or modifies existing Stage II gasoline refueling vapor control measures only if the state's submittal provides a basis for concluding that approval of the revision would not interfere with attainment of the NAAQS, reasonable further progress, or any other requirement of the CAA.

Based on ambient air quality monitoring data for the period from 2003-2005, both the Portland and

¹ See attached document: "CMR 06-096 Chapter 118."

MidCoast 8-hour ozone nonattainment areas were attaining the 1997 8-hour ozone NAAQS, and were redesignated to attainment on 12/11/06 (70 FR 71489). EPA found that the entire state of Maine was meeting the 2008 8-hour NAAQS for ground-level ozone on May 21, 2012 (77 FR 30127).

VOC Emissions Estimates and Comparable Measures

To support the proposed withdrawal of the Stage II program in Maine, DEP conducted an analysis using the methodology described in the EPA document “Guidance on Removing Stage II Gasoline Vapor Control Programs from State Implementation Plans and Assessing Comparable Measures” (EPA Office of Air Quality Planning and Standards (EPA-457/b-12-001)) (Guidance). This document provides calculations and regional data that may be used by states to estimate the loss of area-wide emissions control resulting from the phasing out of the Stage II control program. This document states that EPA “believes it is reasonable to conclude that the incremental emissions control that Stage II achieves beyond ORVR is *de minimis* if it is less than 10% of the area-wide emissions inventory associated with refueling highway motor vehicles.”

DEP used Equation 1 below, from EPA’s Guidance, to calculate the overall *increment* for 2012, which represents the percentage change in area-wide emissions control gained or lost from Stage II installations at GDFs while accounting for the phase-in of ORVR technology. Using both locally measured and EPA-supplied factors, DEP calculated that the potential change in emissions reductions due to removal of Stage II controls in 2012 is a decrease of between 6.23% and 9.24%, which meets EPA’s *de minimis* criterion.

Equations

Equation 1 – Overall Stage II/ORVR Increment:

$$\text{Increment}_i = (Q_{\text{SII}})(1 - Q_{\text{ORVR}_i})(\eta_{\text{iusII}}) - (Q_{\text{SIIva}})(CF_i)$$

Where

Increment_i is the annual area-wide emission control gain during year *i* from Stage II installations at GDFs as ORVR is phased in;

Q_{SII} is the fraction of highway gasoline throughput covered by Stage II VRS (While Maine utilized the EPA Guidance default value of 0.90 in its analysis, DEP recognizes that using the default results in a very conservative estimate for the effect of removing Stage II VRS from Maine’s SIP, since only those stations with at least 1,000,000 gallons per year throughput were required to install and operate Stage II VRS. DEP attempted to collect station-by-station throughput data for the area affected by the Stage II requirements for 2012 and other years, but the project was plagued with noncompliance by numerous GDFs and the data gathered was not deemed useful.);

Q_{ORVRi} is the fraction of gasoline dispensed to ORVR-equipped vehicles during year i (The EPA Guidance provides a default value of 0.777 for 2012 in Appendix Table A-1; again, a conservative estimate for the purpose of this submission.);

η_{iUSII} is the current best estimate of Stage II in-use control efficiency (The EPA Guidance provides a default value range of 0.60-0.75 in Section 3.2.1.);

Q_{SIIva} is the fraction of highway gasoline throughput dispensed through vacuum-assist type Stage II VRS (The EPA Guidance provides a default value of approximately 0.95 for Maine in Appendix Table A-6. DEP data confirms that 95% of the 123 GDFs that use Stage II VRS are using vacuum-assist VRS.); and

CF_i is the compatibility factor representing the increase in vent pipe emissions from underground storage tanks (UST) in year i due to the operation of vacuum-assist technology in cases where it is not necessary (refueling of ORVR-equipped vehicles) and the consequent venting of displaced fumes from the UST. The EPA Guidance provides that $CF_i = (0.07645)(VMT_{ORVRi})$, where VMT_{ORVRi} is the annual area-wide fraction of total vehicle miles traveled by ORVR-equipped vehicles for year i , using a value of 0.80 as provided in Appendix Table A-1 of the EPA Guidance.

Equation 2 – Overall Stage II/ORVR Delta:

$$Delta_i = (Q_{SII})(\eta_{iUSII}) - (Q_{SIIva})(CF_i) - (Q_{ORVRi})(\eta_{ORVR})$$

Where

$Delta_i$ represents the difference between Stage II efficiency and ORVR efficiency when both technologies are in effect;

$(Q_{SII})(\eta_{iUSII})$ multiplies the Stage II in-use control efficiency (default value range of 0.60-0.75 per EPA Guidance as described above) by the fraction of highway gasoline throughput covered by Stage II VRS (default value of 0.90 per EPA Guidance as described above) to represent the vapors recovered by Stage II VRS in refueling highway vehicles in a particular year;

$(Q_{SIIva})(CF_i)$ accounts (as above) for the vapors lost through UST vents when vacuum-assist technology is applied to refueling of ORVR-equipped vehicles; and

$(Q_{ORVRi})(\eta_{ORVR})$ multiplies the fraction of annual gallons of highway fuel dispensed to ORVR-equipped vehicles in a given year (default value of 0.777 per EPA Guidance as described above) by the efficiency of those in-use systems (EPA Guidance recommends a value of 0.98 in Table 2) to represent gasoline vapors lost in refueling those vehicles.

Equation 3 – Total Impact on Area-Wide VOC Inventory:

$$Tons_i = (Increment_i)(GC_i)(EF)$$

Where

Tons_i represents the total mass of highway vehicle refueling vapor emissions in tons for the year *i*;

GC_i is the projected gasoline consumption for the year *i* (254,936,273 gallons in 2012 for the three-county area affected by Stage II requirements, per DEP data²); and

EF represents the fuel vapor emissions that would result in the absence of controls. (EPA Guidance defines $EF = \exp[-1.2798 - 0.0049(\Delta T) + 0.0203(Td) + 0.1315(RVP)]$. The value for ΔT used below is taken from EPA Guidance Appendix Table A-3; for *Td* from EPA Guidance Appendix Table A-2; and for *RVP* from EPA Guidance Appendix Table A-7.)

Calculations

Compatibility Factor

$$\begin{aligned} CF_{2012} &= (0.07645)(VMT_{ORVR2012}) \\ &= (0.07645)(0.80) \\ &= 0.06116 \text{ (no units)} \end{aligned}$$

Increment

$$\begin{aligned} \text{Increment}_{2012} &= (Q_{SII})(1-Q_{ORVR2012})(\eta_{iUSII}) - (Q_{SIIva})(CF_{2012}) \\ &= (0.90)(1-0.777)(0.60) - (0.95)(0.06116) \text{ \underline{or} } (0.90)(1-0.777)(0.75) - (0.95)(0.06116) \\ &= 0.12042 - 0.058102 \qquad \qquad \qquad \underline{or} \qquad 0.150525 - 0.058102 \\ &= 0.062318 \qquad \qquad \qquad \underline{or} \qquad 0.092423 \end{aligned}$$

This shows that in 2012, the *Increment* percentage impact of removing Stage II on the refueling inventory is between 6.23% and 9.24%, as calculated across the range of default values for Stage II in-use control efficiency (η_{iUSII}) provided by EPA in the Guidance. This meets EPA's *de minimis* criterion for the effect of Stage II controls on the area-wide inventory of emissions associated with refueling of motor vehicles, as described on page 6 of the EPA's Guidance.

Delta

$$\text{Delta}_{2012} = (Q_{SII})(\eta_{iUSII}) - (Q_{SIIva})(CF_{2012}) - (Q_{ORVR2012})(\eta_{ORVR})$$

² See attached spreadsheet: "Stage II gasoline consumption.xlsx"
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$$\begin{aligned}
&= (0.90)(0.60) - (0.95)(0.06116) - (0.777)(0.98) \text{ \underline{or}} (0.90)(0.75) - (0.95)(0.06116) - (0.777)(0.98) \\
&= 0.54 - 0.058102 - 0.76146 \qquad \qquad \qquad \underline{\text{or}} \qquad \qquad \qquad 0.675 - 0.058102 - 0.76146 \\
&= -0.279562 \qquad \qquad \qquad \underline{\text{or}} \qquad \qquad \qquad -0.144562
\end{aligned}$$

This shows that the use of ORVR technology provides between 14.4% and 27.9% greater emission reduction benefits than the Stage II vapor recovery program alone, as calculated across the range of default values for Stage II in-use control efficiency (η_{iusII}) provided by EPA in the Guidance.

Tons

$$\text{Tons}_{2012} = (\text{Increment}_i)(GC_i)(EF)$$

$\text{Increment}_{2012} = 0.062318 \text{ or } 0.092423$ as calculated above, and has no units.

$GC_{2012} = 254,936,273$ gallons, as described above.

$$EF = \exp[-1.2798 - 0.0049(5.7) + 0.0203(61) + 0.1315(7.8)]$$

$$= \exp[-1.2798 - 0.02793 + 1.2383 + 1.0257] = \exp[0.95627] = 2.60197 \text{ grams per gallon}$$

$$\begin{aligned}
\text{Tons}_{2012} &= (0.062318)(254,936,273)(2.60197) \qquad \text{or} \qquad (0.092423)(254,936,273)(2.60197) \\
&= 41,337,806 \qquad \qquad \qquad \text{or} \qquad \qquad \qquad 61,307,553
\end{aligned}$$

This equation gives a result in grams for the year analyzed, in this case 2012. To convert to the average tons emitted per day, the result must be divided by (453.59 grams per pound) and then by (2000 pounds per ton); and that result divided by (365.25 days per year).

$$((41,337,806/453.59)/2000)/365.25 = 0.125 \text{ or } ((61,307,553/453.59)/2000)/365.25 = 0.185$$

So the range of emissions increase due to removal of Stage II VRS in the three-county area would be from 0.125 to 0.185 tons per day, or between 45 and 68 tons per year, on average.

Comparable Measures Requirement

As discussed above, all areas in the Northeast OTR are subject to the requirements of CAA Section 184(b)(2), the “comparable measures” requirement. Section 184(b)(2) requires these areas to either implement a Stage II VRS program, or “control measures capable of achieving emissions reductions comparable to those achievable” by Stage II VRS. As described in the Guidance, OTR states are not required to implement measures to achieve reductions equivalent to a Stage II control program; the CAA only requires that reductions be “comparable”. The Guidance states that the EPA believes that a state may demonstrate that the comparable measures requirement is

satisfied if it can show that removal of a Stage II control program will have no, or a *de minimis* loss of area-wide emissions control. The Guidance defines a *de minimis* loss as less than ten percent of the area-wide emissions inventory associated with refueling highway motor vehicles. The *Increment* calculation above shows that, at worst, removal of Stage II VRS in Maine would result in a 9.2% increase in emissions associated with refueling highway motor vehicles. DEP staff therefore feel that the EPA’s “comparable measures” requirement has been met.

Stage II Rule Amendment

Based on the demonstrated lack of significant benefit from Stage II vapor recovery in Maine, DEP requests EPA approval for withdrawal from the Maine SIP of the existing requirement for Stage II controls as described in Chapter 118 of the Department’s Rules: *Gasoline Dispensing Facilities Vapor Control*.

[Supplement with dates and citations for rule changes, public notice/comment, etc. Attach new rule and admin materials for rulemaking and SIP revision submission. Attach spreadsheet and Chapter 118.]