

**Technical Support Document
For The Proposed Amendments to 7 DE Admin. Code 1124**

**Section 26.0
Gasoline Dispensing Facility Stage I Vapor Recovery**

**Section 36.0
Vapor Emission Control at Gasoline Dispensing Facilities**

**Division of Air Quality
Department of Natural Resources and Environmental Control
Delaware**



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Acronym List

AST	-----	Aboveground storage tank
CAA	-----	Clean Air Act Amendments of 1990
CARB	-----	California Air Resources Board
CF	-----	Compatibility factor
CPM	-----	Continuous pressure monitoring
DAQ	-----	Division of Air Quality
DNREC	-----	Department of Natural Resources and Environmental Control
EVR	-----	Enhanced vapor recovery
GDF	-----	Gasoline dispensing facility
GPM	-----	Gallons per month
NAAQS	-----	National Ambient Air Quality Standards
OBD	-----	Onboard diagnostics
ORVR	-----	On-board refueling vapor recovery
PEI	-----	Petroleum Equipment Institute
SIP	-----	State Implementation Plan
TPY	-----	Tons per year
TSD	-----	Technical support document
UST	-----	Underground storage tank
VOC	-----	Volatile organic compound
VRS	-----	Vapor recovery system
OTR	-----	Ozone Transport Region

1. Introduction and Background

1.1 Background and Federal Requirements

Since early 1990s, the ambient air quality in Delaware, in particular in New Castle County, has been in nonattainment for the health-based national ambient air quality standard (NAAQS) for the pollutant ground-level ozone (O₃). Because gasoline vapors contain mainly volatile organic compounds (VOC) that contribute to the formation of ground-level ozone in the ambient air, Section 182(b)(3) of the Clean Air Act Amendments of 1990 (CAA) requires states with moderate and higher ozone nonattainment areas, including Delaware,¹ to revise their State Implementation Plans (SIP) to require “owners or operators of gasoline dispensing systems to install and operate.....a system for gasoline vapor recovery of emissions from the fueling of motor vehicles.”

To comply with the above CAA requirement, Delaware has required, since 1993, gasoline dispensing facilities (GDF) in the state to install Stage II vapor recovery systems (VRS) to control gasoline vapor emissions from motor vehicles during refueling processes. Stage II VRS controls gasoline vapor emissions by collecting gasoline vapors displaced from vehicle’s gasoline tank during the transfer of gasoline from GDF to vehicle’s tanks, and returning the collected vapors to GDF’s underground storage tanks (UST) or aboveground storage tanks (AST). Delaware has also required, since 1993, the GDFs to install Stage I VRS for their gasoline storage tanks to control gasoline vapor emissions during gasoline delivery. Stage I VRS controls gasoline vapor emissions by collecting gasoline vapors displaced from GDF’s UST or AST when a delivery truck delivers gasoline into the UST or AST, and returning the collected vapors to the tank of the delivery truck. A properly designed and installed Stage I system will assist in maintaining a vapor tight UST or AST and thereby prevent the escape of gasoline vapors during the daily operation at a GDF.

Since 1998, automobile manufacturers in the United States have been required by Section 202(a)(6) of the CAA to install on-board refueling vapor recovery (ORVR) systems on new vehicles. Both Stage II and ORVR systems are effective for controlling gasoline vapor emissions during vehicle refueling. However, the vacuum-assist Stage II systems² and the ORVR systems are incompatible. When such Stage II-equipped GDFs are refueling ORVR-equipped vehicles, the ORVR system will force the Stage II’s vacuum pump to pull fresh air into the UST or AST, causing vapor pressure growth in the storage tanks. The vapor pressure growth leads to additional vapor emissions from the USTs or ASTs, especially when those tanks are not vapor-tight.

In May 2012, the US Environmental Protection agency (EPA) determined that the ORVR systems were in widespread use nationwide on gasoline-powered vehicles, and issued a final rule

¹ In early 1990s, two counties in Delaware, New Castle and Kent, were designated as “severe non-attainment areas” under the 1-hour ozone national ambient air quality standard.

² There are two types of Stage II vapor recovery systems, the vacuum-assist system and the balance system. The Stage II systems installed at Delaware GDFs are all vacuum-assist systems.

to waive Section 182(b)(3) Stage II requirements (77 *FR* 28772).³ The final rule aimed at reducing the adverse effect of the functional overlap and incompatibility between the vacuum-assist Stage II systems at GDFs and the ORVR system on vehicles. Under the final rule, the states in the Ozone Transport Region (OTR), including Delaware, are allowed to remove their GDF's Stage II vapor recovery requirements, provided the overall emissions from the GDFs without Stage II systems do not increase. Section 184(b)(2) of the CAA requires the Administrator of the EPA to identify "control measures capable of achieving emission reductions comparable to those achievable through vehicle refueling controls" and for states that are in OTR to adopt "such [comparable] measures or such vehicle refueling controls."

Since Delaware's Stage II systems are all vacuum-assist systems, Delaware has proposed to decommission the Stage II systems installed at all GDFs in Delaware, through amendments to **7 DE Admin. Code** 1124 Section 26.0 "Gasoline Dispensing Facility Stage I Vapor Recovery" and Section 36.0.0 "Vapor Emission Control at Gasoline Dispensing Facilities".⁴

In addition, as an OTR state, Delaware has proposed a State Implementation Plan (SIP) revision to include (1) a demonstration that Delaware will achieve emissions reductions comparable to those that would be realized if the Stage II program remained in place, as required by Section 184(b)(2) of the CAA, and (2) a demonstration that emissions increases associated with the discontinuation of the Stage II requirement will not contribute to violations of the 2015 ozone NAAQS, as required by CAA Section 110(l).⁵

This technical support document (TSD) presents background information, Delaware GDF vapor emission data, regulatory impact analyses, and relevant technical issues for the proposed amendments to **7 DE Admin. Code** 1124 Section 26.0 and Section 36.0.

1.2 Existing Regulations and Amendments

In September 2015, the Division of Air Quality (DAQ) of the Department of Natural Resources and Environmental Control (DNREC or the Department) revised Delaware's Stage II regulation and established certain requirements for existing GDFs to decommission their Stage II systems and for new GDFs to operate without Stage II systems. The revised regulation is **7 DE Admin. Code** 1124, Section 36.0.0, "Vapor Emission Control at Gasoline Dispensing Facilities" (hereafter referred to as the "2015 Stage II Regulation"). The 2015 Stage II Regulation allowed Delaware GDFs to either decommission Stage II systems or continue operating Stage II systems for an unspecified trial period.⁶

³ Federal Register 77 *FR* 28772, May 16, 2012. Widespread Use for Onboard Refueling Vapor Recovery and Stage II Waiver, at <https://www.govinfo.gov/content/pkg/FR-2012-05-16/pdf/2012-11846.pdf>.

⁴ At the time of developing this technical support document, the proposed amendments to Section 26 and Section 36 are expected to be effective in the spring 2020.

⁵ The proposed Delaware SIP revision will be submitted to EPA in the spring 2020 for approval.

⁶ The 2015 Stage II Regulation did not specify the length of the trial period when it was revised in September 2015. However, DAQ believed that the vapor emission reduction benefit of maintaining Stage II systems would be diminishing in about 3 years after 2015 due to excess vapor emission caused by functional incompatibility of GDF's vacuum-assist Stage II systems and vehicle's ORVR systems.

During the trial period, the existing GDFs could choose the option of decommissioning their Stage II systems, and the new GDFs could choose the option of not installing Stage II systems. Such non-Stage II GDFs were then required to maintain their gasoline underground storage tanks or aboveground storage tanks vapor-tight by installing one of the California Air Resources Board (CARB) approved Stage I enhanced vapor recovery (EVR) systems. To monitor the proper function of the Stage I EVR systems, these non-Stage II stations were further required to (1) install a continuous vapor pressure monitoring (CPM) system, or (2) perform an annual pressure decay test under a no pre-test-repair condition (the so-called “cold condition”) and follow other requirements.⁷

After more than 3 years of implementation of the 2015 Stage II Regulation, DAQ started the process to amend the 2015 Regulation in early 2019. The purposes of the amendments are to (1) finalize the deadline for decommissioning all Stage II systems in Delaware, (2) implement necessary requirements for GDFs to ensure that gasoline vapor emissions are well-controlled at both existing and new GDFs, and (3) provide to GDFs flexibilities for adopting new and revised requirements. The 2019 amendments to Section 36.0 is presented in Appendix 6.1 of this document, and hereafter referred to as the “2019 Stage II Regulation”. The 2019 Stage II Regulation is expected to become effective in the spring of 2020.

Together with the 2019 Stage II Regulation, the 2002 version of 7 **DE Admin. Code** 1124 Section 26.0, “Gasoline Dispensing Facility Stage I Vapor Recovery,” has been amended as well. The purpose of the proposed amendments to the 2002 Stage I regulation is to establish an effective connection between Section 26.0 and Section 36.0, so that the GDFs in Delaware under Section 26.0 will be subject to the relevant Stage I EVR requirements in the 2019 Stage II Revision. The 2019 amendment to the Section 26.0 is hereafter referred to as “the 2019 Stage I Regulation” (Appendix 6.2 of this document). The 2019 Stage I Regulation is expected to become effective in the spring of 2020.

Relevant issues of regulatory requirements and technology availabilities for the 2019 Stage I Regulation and the 2019 Stage II Regulation are discussed in Section 2 of this document. Cost information for implementing the regulatory requirements of the 2019 Stage I Regulation and the 2019 Stage II Regulation are presented in Section 3 of the this document.

1.3 State Implementation Plan Revision

As mentioned previously, DAQ has proposed a State Implementation Plan (SIP) revision to demonstrate that the 2019 amendments to Section 26.0 and Section 36.0 of 7 **DE Admin. Code** 1124 will meet the federal requirements in CAA Section 184(b)(2) and Section 110(l). This SIP revision is hereafter referred to as “DE 2019 Stage I-II SIP Revision” (Appendix 6.3 of this document).

⁷ The other requirements include conducting monthly inspection by the station owner or operator, and performing 4 consecutive quarterly re-tests after necessary repair of the Stage I system if it failed an annual pressure decay test at the cold condition.

In the DE 2019 Stage I-II SIP Revision, DAQ has followed the methods and procedures outlined in the 2012 EPA guidance document, entitled “Guidance on Removing Stage II Gasoline Vapor Control Programs from State Implementation Plans and Assessing Comparable Measures” (Reference 5.1, hereafter referred to as “the 2012 EPA guidance”). A brief description and summary of Delaware’s analyses in the DE 2019 Stage I-II SIP Revision will be presented in Section 4 of this document.

1.4 Stakeholder and Public Involvement

DAQ initiated the public involvement process for the 2019 amendments to Section 26.0 and Section 36.0 with the first public workshop in April 2019, in which DAQ introduced to the public the reasons and intention for amending Section 26.0 and Section 36.0. Following the first workshop, DAQ formed a review committee which consisted of representatives of the regulated community (i.e., GDFs’ owners or operators), testing companies, regional organizations of gasoline distribution industry, environmental organizations, and regulatory agencies. Four committee meetings were held from May to August, 2019, to discuss technical and cost issues in the 2019 amendments. DAQ held the second public workshop in October 2019 to report to the public the draft language of the amendments as the outcomes of the discussion of the four review committee meetings, and to seek for further comments from the public.

After incorporating the comments from the second public workshop, the Department published the proposed 2019 amendments to Section 26.0 and Section 36.0 on December 1, 2019, in Delaware Register of Regulations for continuous review and comment from the public. At the time this TSD document is being prepared, a public hearing has been scheduled in January 2020.

All public workshops and review committee meetings were announced in advance to the public on two state-wide newspapers (the review committee meetings were not announced in the newspapers), on DNREC’s public meeting calendar, or via an email list of the review committee members. The DAQ developed a meeting summary after each review committee meeting and distributed it among the committee members for confirmation of accuracy, as well as for further comments.⁸

2. Technology Availability and Feasibility

2.1 Decommission of Stage II Vapor Recovery System

As indicated previously in Section 1 of this document, the incompatibility of the GDF-equipped Stage II system and the vehicle-equipped ORVR system results in increased gasoline vapor pressure in GDF’s gasoline storage tanks, and leads to additional vapor emissions from the

⁸ The DAQ’s workshop and review committee meeting announcements, presentation slides, and summary for each review committee meeting are available at <https://dnrec.alpha.delaware.gov/air/permitting/under-development/>, under the title “Amendments to the Control of Volatile Organic Compound Emissions (Vapor Recovery at Gasoline Dispensing Facilities).”

storage tanks, especially when those tanks are not vapor-tight. In DE 2019 Stage I-II SIP Revision, DAQ estimates that vapor emission increases of about 30 tons in the ozone season or 71 tons annually in 2021 would occur if the vacuum-assist Stage II systems in Delaware were not removed (see Section 4 of this document).

To avoid the excess vapor emissions due to the Stage II-ORVR incompatibility, the 2019 amendments to Section 36.0 prohibit installations of Stage II systems on all new GDFs in Delaware⁹ and require all existing GDFs in Delaware to decommission their Stage II systems by the end of 2021. As required by both the 2015 Section 36.0 and the 2019 amendments to Section 36.0, decommissioning of Stage II systems in Delaware shall follow the procedures detailed in Chapter 14, except Section 14.6.14, of the Petroleum Equipment Institute's (PEI) "Recommended Practices for Installation and Testing of Vapor-Recovery Systems at Vehicle-Fueling Sites", PEI/RP300-0919 (2019).¹⁰ The technology and methods specified in PEI/RP300-19 have been widely accepted and used effectively nation-wide.

Decommissioning of Stage II systems has been performed in Delaware since September 2015 (i.e., when the 2015 Stage II Regulation became effective for the trial period). Since then, more than 100 GDFs in Delaware have decommissioned or are in the process to decommission their Stage II systems.¹¹ DAQ staff members have communicated with owners or operators of the decommissioned GDFs, and two major decommissioning contractors. To date, DAQ has received no report of technical difficulties for decommissioning.

Two implementation issues have been discussed during the public review process for the 2019 amendments to Section 36.0: (1) whether to allow the separation of decommissioning Stage II system from the installation of Stage I EVR system (for installation of a Stage I EVR system, see subsection 2.2), and (2) whether to allow a mix-match use of components specified in different CARB executive orders (discussion of this issue is presented in subsection 2.2).

In the current 2015 Stage II Regulation, decommissioning of a Stage II system at existing GDFs is an optional requirement for GDFs to select (i.e., GDFs can choose to, or not to, decommission their Stage II systems in the trial period). However, if a GDF selects this option to decommission its Stage II system, it is required to install and operate a California Air Resources Board (CARB) approved Stage I EVR system (see subsection 2.2). During the public review process for the 2019 amendments to Section 36.0, the industry representatives stated that decommissioning process alone was relatively easy and straightforward to complete. In contrast, installation of a Stage I EVR system is more complicated and involved breaking concrete at the station, and thus resulted in a greater capitol expenditure.

⁹ New GDFs are the facilities that will start dispensing operation on or after the effective date of the 2019 amendments to Section 26.0 and Section 36.0.

¹⁰ The copyright-protected document "Recommended Practices for Installation and Testing of Vapor-Recovery Systems at Vehicle-Fueling Sites", PEI/RP300-0919 (2019), can be ordered from Petroleum Equipment Institute's website <http://www.pei.org>, in the section of "Recommended Practices."

¹¹ At the time this TSD document is developed (the fourth quarter of 2019), the permit records of Tank Management Section-DNREC show that 74 GDFs in Delaware have decommissioned-GDF operation permits and 30 GDFs have construction permits for decommissioning.

Based on the cost data collected (see subsection 3.3 of this document), DAQ discussed with the industry representatives and agreed to separate implementation schedules of decommissioning Stage II systems and installing Stage I EVR systems. Under the separate implementation schedules proposed in the 2019 amendments to Section 36.0, GDFs are required to decommission their Stage II systems by the end of 2021 and are allowed to install and operate Stage I EVR systems by the end of 2025. Therefore, the existing GDFs are provided a grace period of more than 4 years for planning and budgeting their Stage I EVR installation projects. GDFs in Delaware can install and operate their Stage I EVR systems on any date within the grace period after decommissioning their Stage II systems.

The above separate implementation schedules, however, present a minor technical issue when decommissioning Stage II system, which is to cap Stage II system's vapor-return pipe at the dispenser end. Capping at the tank is required if the return vapor line is accessible or when the pipe is exposed during excavation activities. DAQ believes that capping at dispenser end will provide GDF owners flexibility in decommissioning Stage II systems and installing Stage I EVR systems, and will not affect the tightness of the UST vapor systems.

Capping the vapor return pipe will keep a small amount of vapor residue in the capped pipes until they are finally removed when the GDFs install Stage I EVR systems. The following equation is used to estimate the amount of this vapor residue in the vapor-return pipes:

$$W_{v-r} = n L \pi (D/2)^2 d_v$$

where W_{v-r} is the amount of vapor residue;
 n is the number of dispensers at GDF;
 L is the average length of the vapor-return pipe;
 D is the diameter of the vapor-return pipe, assuming 2 inches;
 d_v is the gasoline vapor density, approximately 0.036 lb/gal.

For estimation purpose, it is assumed for a common GDF that $n=4$ and $L=20$ feet. Then, for a common GDF, the vapor residue capped in the vapor return lines is approximately:

$$W_{v-r} = n L \pi (D/2)^2 d_v = 4 (20 \text{ feet}) \pi (2 \text{ inches}/2)^2 (0.036 \text{ lb/gal}) = 0.001 \text{ ton}$$

Such a one-time release of 0.001 ton gasoline vapor from each of 174 GDFs¹² during a 4-year grace period from December 2021 to December 2025 will have negligible effect on Delaware's ambient air quality.

2.2 Installation of Stage I Enhanced Vapor Recovery System

¹² Delaware has a total of 278 existing GDFs under the requirements the 2019 Stage II regulation. At the time this TSD document is developed (the end of 2019), the permit records of Tank Management Section-DNREC show that 74 GDFs in Delaware have operation permits and 30 GDFs have construction permits. Therefore, the maximum number of the GDFs with the capped vapor residue would be $278-74-30=174$.

The proposed 2019 amendments to Section 36.0 require the GDFs in Delaware to install a CARB approved Stage I Enhanced Vapor Recovery (EVR) systems by the end of 2025. DAQ estimates that installation of Stage I EVR systems would result in a 58 TPY vapor emission reduction after 2025 (see Appendix 6.3 and Section 4 of this TSD document).

Technology, procedures and skills for installing Stage I EVR systems have matured in California. In Delaware, DAQ staff found that a few GDFs had non-EVR pressure/vacuum (P/V) valves and dust caps installed in their Stage I EVR systems. Immediate on-site investigations of the testing technicians revealed that these non-EVR components were apparently the major reasons of the failures of the annual pressure decay tests. During a meeting with the industry in November 2017, the industry representatives expressed the same concern regarding Stage I EVR system installation.¹³ To address this concern, the 2019 Stage II regulation will require companies performing Stage I EVR installation in Delaware to obtain timely training and certification from the EVR system manufacturers.

Another technical issue discussed by the review committee was whether to allow component mix-match when installing the CARB approved Stage I EVR systems. During the review committee meetings, the industry representatives expressed their preference to allow mix-match use of components from different CARB approved EVR systems at one single GDF, because (1) the mix-match use of components would reduce costs and (2) other states such as New Jersey and Massachusetts allow the mix-match of EVR components. DAQ believes that the mix-match approach could be a convenient option in the EVR system repairs, but a mix-match system cannot guarantee the 98% control efficiency. DAQ provided the review committee its reasons based on the information from other state agencies and its experiences from its field observation.¹⁴ In brief,

- DAQ presented information that a mix-match Stage I EVR system could not guarantee 98% control efficiency. This conclusion was based on the information gathered from other states' documents (Massachusetts and New Jersey),¹⁵ CARB technical staff,¹⁶ and a major Stage I EVR system manufacturer.¹⁷ Therefore, the

¹³ In a meeting on November 15, 2017, DAQ staff members and the industry representatives shared their experiences regarding the causes of the pressure decay test failures at Stage II-decommissioned stations. The industry representatives, including GDF owners/operators and testing company technicians, suggested that several failures of the first annual pressure decay tests at the decommissioned stations appeared to be due to Stage I EVR installation issues, such as missing components in installation. Missing a face-seal adaptor at one GDF was specifically reported at the meeting.

¹⁴ Details of the discussions on the Stage I EVR component mix-match are presented in the review committee meeting summaries, available at <https://dnrec.alpha.delaware.gov/air/permitting/under-development/>, under the title "Amendments to the Control of Volatile Organic Compound Emissions (Vapor Recovery at Gasoline Dispensing Facilities)."

¹⁵ NJ regulation allows component mix-match for Stage I EVR system but the system must have at least 98% control efficiency, per NJ 7:27-16.3 (d) (Effective 01/16/2018). MA regulation allows component mix-match for Stage I EVR system without specifying 98% control efficiency, per MA 310 CMR 7.24(3) (Effective 03/09/2018).

¹⁶ CARB does not have any studies on mix-match Stage I components so has no data on verifying 98% efficiency of a mix-match EVR system, via personal email communication between F. Gao of DAQ-DNREC and S. Vogt of Vapor Recovery Section-CARB, May 13, 2019.

requirement for installing a complete Stage I EVR system specified in one CARB executive order, as required in the current 2015 Stage II Regulation, should remain to ensure the 98% control efficiency.

- Based on the field observations over the past two years, DAQ believes that installing a complete Stage I EVR system specified in one CARB executive order will lead to additional cost savings for a GDF with fewer test failures and less down time during testing.
- The mix-match approach may result in cost savings from part purchases. However, the committee members from the industry explained that (1) cost savings from mix-match EVR parts would be minimal, and (2) the major cost saving would be from using a correct or compatible spill bucket at the time of Stage I EVR installation to avoid multi-time breakings of concrete pad.
- After taking into consideration the comments from the review committee and reviewing the available technical data, DAQ proposed that the 2019 amendments to Section 36.0 should include: (1) all GDFs will be required to install and operate one complete Stage I EVR system and (2) mix-match of EVR components from different CARB executive orders is not allowed.

2.3 Monthly Inspection and Annual Pressure Decay Tests

Monthly inspection is required in the current 2015 Stage II Regulation and maintained with some clarifications in the 2019 amendments to Section 36.0. In field observations, DAQ staff found that the monthly inspection can be easily fulfilled by GDF operators with limited experience, usually from 20 to 30 minutes depending on the number of gasoline storage tanks at GDFs. DAQ believes that the monthly inspections do not add any technical and operational burden to the GDF owners or operators.

DAQ and the industry representatives have agreed that properly performed monthly inspections can effectively identify leak points that are created by routine fuel delivery practices and such findings can raise early warnings and lead to timely repairs. Thus, leaks of gasoline vapors can be quickly and effectively avoided. DAQ field observations have encountered cases where failures of the annual pressure decay tests can be avoided if proper monthly inspections are conducted.^{18,19}

¹⁷ “If products other than those listed in the Executive Order are used, 98% efficiency performance cannot be guaranteed,” in a business communication letter from Wolfgang Sanyer, Product Manager, OPW Retail Fueling, to Peter Rollo, Engineer, Tank Management Section-DNREC, June 5, 2019.

¹⁸ In two field observations over annual pressure decay tests, DAQ and the GDF’s testing contractors found that the pressure decay tests failed due to damaged or unfit non-EVR dust caps. Those failure-causing dust caps can be easily identified in monthly inspections.

¹⁹ In the 11/15/2017 meeting, the industry representatives stated that most decommissioned stations did not perform the EVR monthly inspection, but felt that, if the monthly inspections were followed, the currently observed pressure decay test failures may have been avoided.

The requirement to perform annual pressure decay tests to monitor and ensure the vapor-tightness of gasoline storage tanks at all Stage II-equipped GDFs has been in effect in Delaware since 2002. The test procedures and tools are well established and specified in Test Procedure TP-96-1 of the San Diego Protocol, Revision III (Reference 5.3 of this document).

In the 2015 Stage II Regulation, the test procedure in the above San Diego Protocol is maintained for the trial period. And in addition, the test is required to be performed under the “cold condition,” i.e., without any corrective action taken before or during the test on the day of the test, for those GDFs that have installed Stage I EVR systems. DAQ believes that the test under the cold condition can reflect the actual status of the vapor-tightness of the gasoline storage tanks. A test failure under the cold condition will establish that the vapor system of the gasoline storage tanks was actually vapor-leaking before the testing day. Therefore, necessary and timely repairs must follow. After a test failure and necessary repairs, the GDF is required to conduct and pass four consecutive quarterly tests to ensure the vapor-tightness of the tanks system before resuming its annual testing schedule.

In the proposed 2019 amendments to Section 36.0, the testing requirements in the 2015 Stage II Regulation are maintained with one modification, which is to reduce the four consecutive quarterly tests to two consecutive quarterly tests after an annual test failure. This modification was requested by the GDF owners and supported by the testing companies. DAQ agrees that conducting and passing two consecutive quarterly tests should be adequate to demonstrate that the vapor system of the gasoline storage tanks returns to a vapor-tight condition after timely repairs.

2.4 Continuous Pressure Monitoring System

In the current 2015 Stage II Regulation, installation of a continuous pressure monitoring (CPM) system is an optional requirement when a GDF installs the Stage I EVR system, in lieu of the requirement of performing monthly inspection and annual pressure decay test. The CPM systems specified in the 2015 Stage II Regulation is a component system of the CARB approved in-station diagnostics (ISD) systems (see subsection 36.11.5 of Appendix 6.1 of this document). The system design, technical protocol and operational features the CPM systems are well defined and developed by CARB and the manufacturers of the approved CPM systems.

Since the adoption of the 2015 Stage II Regulation (i.e., September 2015), only three GDFs in Delaware have installed CPM systems.²⁰ DAQ believes that the limited use of the CPM systems in Delaware is mainly due to the unfamiliarity of the local industry to the technology, and the capital cost of installation. Although the total number of the CPM stations is small, DAQ and the industry agree that in a long run the CPM systems can be expected to provide cost-savings for GDF owners by avoiding (1) annual pressure decay tests, (2) quarterly re-tests if the annual test fails, and (3) interruption of the dispensing operation due to station shut-down for conducting tests.

²⁰ The three GDFs that installed CPM systems include one existing station and two new stations.

Another important consideration for installing CPM systems versus performing annual pressure decay test is the environmental benefits from the CPM systems. As specified and required in the 2015 Stage II Regulation and the 2019 amendments to Section 36.0, a CPM system is capable of determining, during its weekly data collection, a vapor leaking problem of the UST (underground storage tank) or AST (aboveground storage tank) at a GDF. If determined, the vapor leaking problem is required to be corrected within 21 days. In other words, a CPM system ensures that a vapor leaking problem of UST or AST can be detected in a week and be fixed within a maximum time span of one month.

In comparison, the annual pressure decay test can also detect a vapor leaking problem, but cannot determine when the problem start after the previous annual test conducted a year ago. In the event a UST or AST leaks, a CPM system can prevent a significant amount of gasoline vapor from escaping to the atmosphere during an undetermined period of time. In addition, the quick CPM detection and the resultant repairs of the gasoline storage tanks will likely provide a cost-saving for the facility owners by avoiding excessive fuel loss via vapor leaking. Therefore, the industry and DAQ agree to retain CPM as an optional requirement for GDFs with Stage I EVR systems.

3. Cost Analyses of Proposed Amendments

The cost estimates presented in this subsection are for a typical GDF in Delaware, consisting of two underground storage tanks (UST) and four double sided dispensers. The information related to costs was reported by individuals and chain gasoline dispensing facilities (GDFs), installation contractors, testing and repair companies, manufactures, part and component supplies and state agencies, in response to requests from DAQ-DNREC.

3.1 Savings from not installing Stage II system at new GDFs

The removal of the requirement for installing a Stage II vapor recovery system will have the greatest cost-saving impact on newly constructed GDFs. A capital saving of approximately \$80,000 could be realized depending on the individual site. The saving is mainly from avoiding purchase of components, underground pipe layout, system installation and related labor. Additionally, the elimination of the Stage II system a GDFs will simplify the maintenance requirements of a complex mechanical system and will eliminate the associated maintenance costs and the costs for part replacements.

3.2 Decommissioning Stage II Systems at Existing GDFs

Under the proposed 2019 amendments to Section 36.0, a GDF has the option of decommissioning its current Stage II system independently from installing a Stage I EVR system. The decommissioning process includes the capping of the vapor-return line at each dispenser, the reprogramming of all dispensers and associated controls, and the replacement of the hanging hardware (hoses, nozzles, etc.). The reported cost is approximately \$1,800 per dispenser, or a total of \$7,200 for four dispensers at a typical GDF, including the components and the related labor.

3.3 Installing Stage I Enhanced Vapor Recovery Systems

As mentioned in Section 1, existing GDFs in Delaware have been required to install regular Stage I systems since early 1990s. Under the current 2015 Stage II regulation and the proposed 2019 amendments, these GDFs are required to install a CARB approved Stage I EVR system. The cost of components of the Stage I EVR system is approximately \$3,200 more than the component cost of the regular Stage I system (i.e., pre-EVR system).

For a new GDF, since the tank top will be exposed during the construction of the new GDF, no additional cost would be incurred for labor. Therefore, the only additional cost for a new GDF is the \$3,200 EVR component cost above the pre-EVR component cost.

For an existing GDF, the process of installing the Stage I EVR system requires the breaking of concrete pad to access the tank top components, making labor the majority of the estimated installation cost, which is reported to be \$14,800. Therefore, for an existing GDF, the total cost for the components and installation for the Stage I EVR system is approximately \$18,000 (i.e., the sum of the labor cost of \$14,800 plus the EVR component cost of \$3,200).

3.4 Installing Continuous Pressure Monitoring Systems

Under the current 2015 Stage II regulation and the proposed 2019 amendments, an existing GDF has the option to install a continuous pressure monitor (CPM) system. The component cost from the manufacture is listed at \$7,647. At a new GDF, an addition cost of \$2,500 will occur for the installation of electrical connections that would not be required without the CPM. At an existing station, the installation cost the CPM would be higher, approximately another \$2,500, since the installation will require the excavation of concrete ground to complete the required electrical connection.

Although the option of installing a CPM comes with an initial capital cost, there are significant benefits to the GDF owner when compared to a non-CPM site. A station with a CPM is not required to conduct the annual pressure decay test, thus the station can avoid being shut down for at least an hour. Therefore, the CPM station is able not only to incur the savings of the test costs but also to prevent the loss of revenue during facility shut down.

3.5 Monthly Inspection and Annual Testing

Under the current 2015 Stage II regulation and the proposed 2019 amendments, a GDF not installing a CPM system is required to perform monthly inspections and annual pressure decay test for its Stage I EVR system. For the monthly inspection, no cost data was reported to DAQ by the GDF owners or operators. However, the cost is assumed to be low. DAQ observed a few monthly inspections in 2017 and 2018.

For the annual pressure decay test, the cost is approximately \$300 per test, as reported by several testing companies. Under the current 2015 Stage II Regulation, if the annual pressure decay test fails at a GDF, four consecutive quarterly tests are required to be conducted and

passed before returning to the annual test schedule. The proposed 2019 amendments to Section 36.0 have reduced the number of post-failure quarterly tests from four to two. The reduction in post-failure tests is a saving of \$600 for the test cost, and also provides an unquantified saving from avoiding the revenue loss during two GDF shut-downs.

4. Impacts of Proposed Amendments on Emissions and Air Quality

This section presents a summary of DAQ's analyses for assessing impacts of the proposed 2019 amendments to Stage I and Stage II regulations on Delaware state-wide GDF VOC emission inventory. The analyses follow the methods and procedures outlined in the 2012 EPA guidance document, entitled "Guidance on Removing Stage II Gasoline Vapor Control Programs from State Implementation Plans and Assessing Comparable Measures" (Reference 5.1, hereafter referred to as the "2012 EPA guidance"). Details of the DAQ analyses are presented in the DE 2019 Stage I-II SIP Revision (Appendix 6.3 of this document).

4.1 Emission Benefits of Decommission of Stage II Systems

With the increase of ORVR-equipped vehicles in Delaware's fleet, decommission of the vacuum-assist Stage II systems in Delaware has become critical. DAQ's analysis demonstrates that, if not removed, the vacuum-assist Stage II systems in Delaware would lead to an emission increase of 30.87 tons in the ozone season,²¹ or 71.13 annually (tons per year, or TPY) in Delaware's VOC emission inventory of 2021, which is Delaware's attainment year for the 2015 ozone NAAQS (see subsection 3.3 of Appendix 6.3).

The proposed 2019 amendments to Section 36.0 establish a decommissioning deadline of December 31, 2021 for Delaware's GDFs.²² As shown in subsection 3.4 of the DE 2019 Stage I-II SIP Revision (Appendix 6.3), GDFs that decommission their Stage II systems before the 2021 ozone season starts (i.e., before May 1, 2021) will not contribute to the incapability excess emissions during the 2021 ozone season and the remainder of the year. Only those GDFs retaining their Stage II systems after May 1, 2021 will contribute to the ozone season and annual VOC emission increases in 2021. DAQ estimates that the remaining ozone season and annual VOC emission increases in 2021 due to the Stage II-ORVR incompatibility will become 7.59 tons and 17.48 tons, respectively.

4.2 Emission Benefits of Installation of Stage I EVR Systems

As mentioned previously, the 2015 Stage II Regulation includes decommissioning Stage II as an optional requirement for Delaware GDFs. When a GDF selects the decommissioning option, however, the facility must install a CARB approved Stage I EVR system. A properly designed and installed Stage I system will assist in maintaining a vapor tight UST or AST and thereby prevent the escape of gasoline vapors during the daily operation at a GDF. It is

²¹ The ozone season is the five-month period from May 1 to September 30 in the calendar year.

²² The deadline should be set up before the ozone season starts in 2021. However, the deadline is set at the end of 2021 to give GDFs 8 more months to plan and fulfill their decommissioning projects.

estimated that a total of 104 GDFs in Delaware have or will have completed decommissioning projects and installed the Stage I EVR systems before the effective date of the 2019 amendments to Section 36.0.²³

The Stage I EVR systems that are installed before the effective date of the proposed 2019 Stage II amendments to Section 36.0 will provide Delaware 9.13 tons and 21.03 tons emission reduction benefits for the ozone season and the entire year of 2021, respectively. Those reduction benefits will be enough to offset the remaining Stage II-ORVR incompatibility VOC emission increases in the ozone season and the entire year of 2021: 7.59 tons during the ozone season and 17.48 tons annually.

As mentioned previously, the 2019 amendments to Section 36.0 require Delaware's GDFs to install the Stage I EVR systems by the end of 2025. After 2025, the Stage I EVR systems, which are more efficient for controlling vapor leaks than the pre-EVR systems, will create long-term VOC emission reduction benefits to help Delaware maintain the ozone NAAQS. DAQ estimates those emission reductions in 2026 using the emission factors of pre-EVR system and EVR system in Reference 5.2²⁴ and Delaware state-wide gasoline throughput projection (see subsection 3.3 of Appendix 6.3). DAQ's estimates show that implementation of Stage I EVR systems in Delaware by the end of 2025 will provide a VOC emission reduction of 58.74 TPY in 2026.

4.3 Summary of VOC Emission Reduction Benefits

A summary of VOC emission reduction benefits, as detailed in the DE 2019 Stage I-II SIP Revision, is presented below:

- The vacuum-assist Stage II systems installed in Delaware's GDFs lost the emission control benefit in 2017 due to their incompatibility with the ORVR systems installed on the fleet vehicles (see subsection 3.3.4 of Appendix 6.3). The Stage II-ORVR incompatibility emissions of gasoline vapor from Delaware's GDFs may increase to 30.87 tons in the ozone season or 71.13 tons annually for the year of 2021, which is Delaware's attainment year for the 2015 ozone national ambient air quality standard.
- Implementation of the decommissioning requirements in the 2015 and the proposed 2019 Stage II regulations will reduce the 2021 Stage II-ORVR incompatibility emissions to 7.59 tons and 17.48 tons for the ozone season and the entire year, respectively.
- The Stage I EVR systems that have been installed after the 2015 Stage II Regulation was implemented will provide Delaware 9.13 tons and 21.03 tons emission reduction benefits

²³ At the time this TSD document is developed (January 2019), the permit records of Tank Management Section-DNREC show that 74 GDFs in Delaware have operation permits and 30 GDFs have construction permits.

²⁴ In Reference 5.2, CARB provides the revised emission factors for both Phase I pre-EVR and Phase I EVR systems (note that CARB uses the term "Phase I" which is equivalent to the term "Stage I" used in this document).

for the ozone season and the entire year of 2021, respectively. These reductions are enough to offset the remaining Stage II-ORVR incompatibility VOC emission increases in the ozone season and the entire year of 2021.

- Implementation of Stage I EVR requirement by the end of 2025 under the 2019 Stage I and Stage II Regulations will provide Delaware a 58.74 TPY emission reduction benefit in 2026. This emission reduction benefit will likely increase after 2026.
- Delaware, by implementing the requirements of Stage II decommissioning and Stage I EVR installation in its Stage I and Stage II regulations, will avoid an increase of VOC emissions of 71.13 TPY in 2021, and will reduce VOC emissions by 58.74 TPY in 2026. Overall, Delaware will achieve a total of $(71.13 + 58.74) = 129.87$ tons of long-existing VOC emission benefit. This long-term benefit will help Delaware maintain its air quality under the ozone national ambient air quality standard.

5. References

- 5.1 Guidance on Removing Stage II Gasoline Vapor Control Programs from State Implementation Plans and Assessing Comparable Measures. EPA-457/B-12-001, US Environmental Protection Agency, August 7, 2012.
- 5.2 Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities. Monitoring and Laboratory Division, California Air Resources Board, December 23, 2013.
- 5.3 Test Procedure TP-96-1 of the San Diego Protocol, Revision III. San Diego County Air Pollution Control District, March 1, 1996.

6. Appendices

- 6.1 Proposed Amendments to 7 **DE Admin. Code** 1124 Section 36.0 Vapor Emission Control at Gasoline Dispensing Facilities.
At <http://regulations.delaware.gov/documents/December2019c.pdf> , under the title “1124 Control of Volatile Organic Compound Emissions”, Delaware Register of Regulations.
- 6.2 Proposed Amendments to 7 **DE Admin. Code** 1124 Section 26.0 Gasoline Dispensing Facility Stage I Vapor Recovery.
At <http://regulations.delaware.gov/documents/December2019c.pdf> , under the title “1124 Control of Volatile Organic Compound Emissions”, Delaware Register of Regulations.
- 6.3 Delaware State Implementation Plan Revision: Decommissioning Stage II Vapor Recovery Systems and Requiring Stage I Enhanced Vapor Recovery Systems at Gasoline Dispensing Facilities.
At <http://regulations.delaware.gov/documents/December2019c.pdf> , under the title “1124 Control of Volatile Organic Compound Emissions”, Delaware Register of Regulations.