Oregon Department of Environmental Quality

Initial Data and Analysis

Gasoline Dispensing Facility Emissions 2022 Rulemaking

RAC Meeting #1

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Background

Gasoline dispensing facilities (GDFs) use vapor control devices at two stages of the gasoline dispensing train. Stage I gasoline vapor recovery systems (VRS) capture vapors expelled from underground storage tanks at gas stations when being refilled by tank trucks. Stage II VRS capture gasoline vapors that would otherwise be vented during individual vehicle refueling at gas stations.

Stage I requirements apply statewide to storage tanks at GDFs with a capacity of 250 gallons with annual throughput of 480,000 gallons of gasoline or more, or monthly throughput of 100,000 gallons of gasoline or more. In Clackamas, Multnomah, or Washington Counties the minimum annual throughput is 120,000 gallons of gasoline or more. Stage I requirements also apply to all GDF tanks with a capacity of 1,500 gallons or more in the Portland AQMA, Medford AQMA, or Salem-Keizer in the SKATS. Figure 1 and Table 1 summarize the existing GDF Stage I regulations in Oregon.

Stage II requirements apply to GDFs in Clackamas, Multnomah and Washington counties with annual throughputs exceeding 600,000 gallons. Stage II controls are also included as a control strategy in the Portland-Vancouver Ozone Air Quality Maintenance Area (Oregon Portion) and Salem-Keizer Area Ozone Maintenance Plan. Stage II controls are part of Oregon’s State Implementation Plan for the Portland-Vancouver Ozone Air Quality Maintenance Area (Oregon Portion). Therefore, any changes to the regulations must not increase emissions of ozone precursors and also require EPA approval. Figure 2 and Table 2 summarize the existing GDF Stage II regulations in Oregon.

Volatile organic compounds and nitrogen oxides are the primary precursor pollutants to ozone formation. Gasoline emissions are composed of volatile organic compounds. According to the 2020 National Emission Inventory data, annual VOC emissions from gas stations are 2,577 tons statewide, and 670 tons in Clackamas, Multnomah, and Washington Counties.

Figure 1: GDF Stage I requirement areas

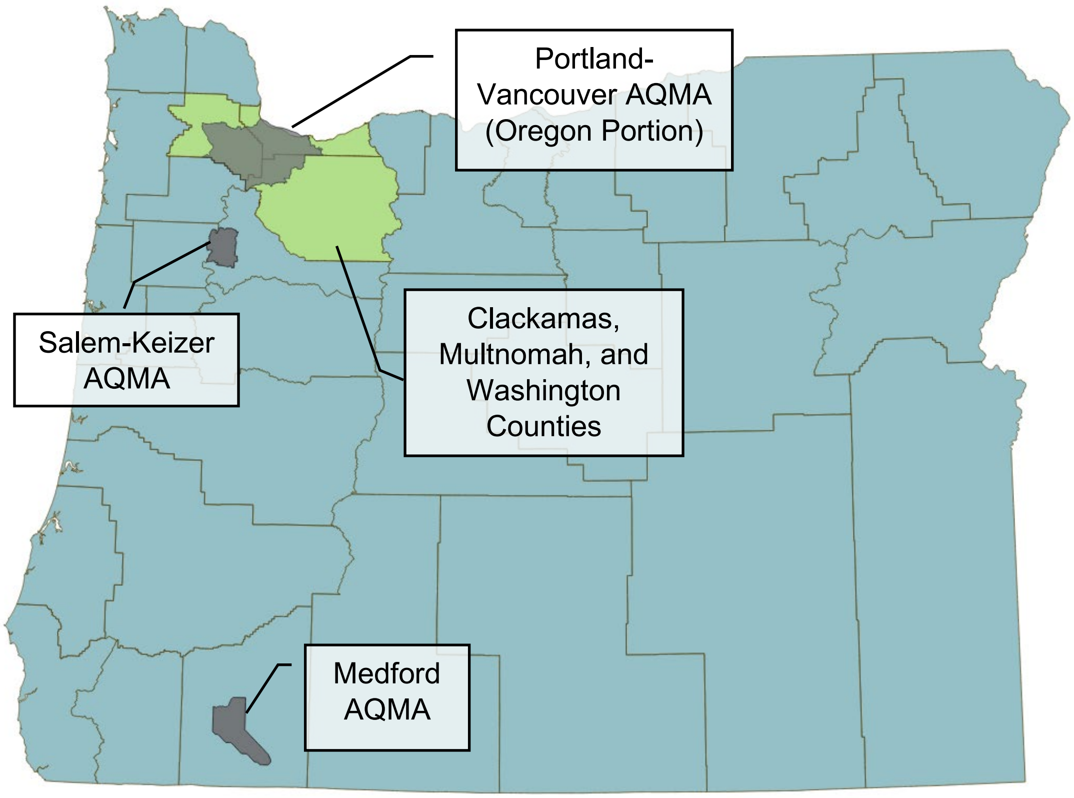


Table 1: GDF Stage I requirements

<table>
<tr><th rowspan="2">Area</th><th>General Permit: AQGP-022
Rule: OAR 340-244-0234</th></tr>
<tr><th>Affected sources</th></tr>
<tr><td>State-wide</td><td>250 gallons or larger tanks with:
o annual throughput: 480,000 gallons or more, or
o monthly throughput: 100,000 gallons or more</td></tr>
<tr><td>Clackamas, Multnomah, and Washington Counties</td><td>All tanks with annual throughput of 120,000 gallons gasoline or more</td></tr>
<tr><td>Portland-Vancouver AQMA</td><td rowspan="3">Tanks with a capacity of 1,500 gallons or more</td></tr>
<tr><td>Salem-Keizer AQMA</td></tr>
<tr><td>Medford AQMA</td></tr>
</table>

AQMA = Air Quality Management Area

Figure 2: GDF Stage II requirement areas

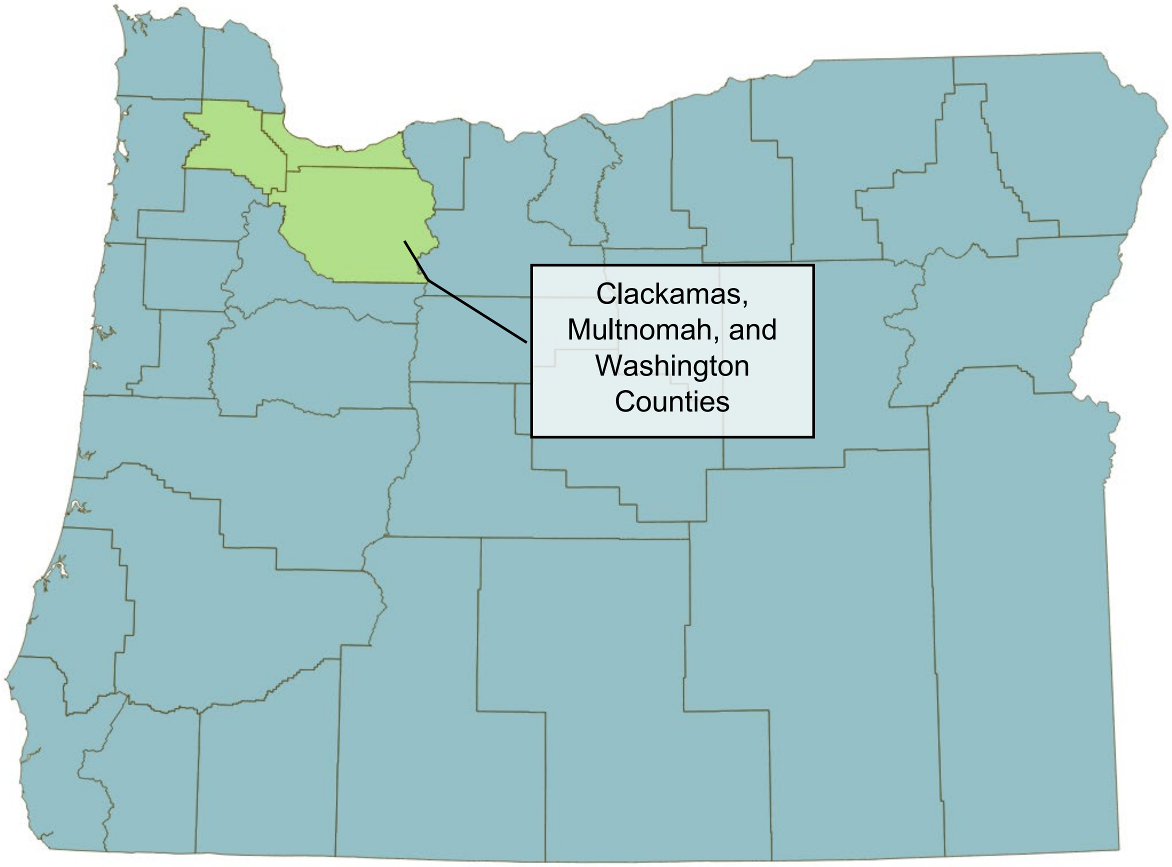


Table 2: GDF Stage II requirements

Area	General Permit: AQGP-023 Rule: OAR 340-242-0500 through OAR 340-242-0520	
	Rule	**Affected sources**
State-wide	NA	NA
Clackamas, Multnomah, and Washington Counties	OAR 340-242-0520	Annual throughputs: 600,000 gallons or more

Data Summary

In 2018, DEQ prepared a draft report on the Stage II VRS Impact Evaluation[1]. This evaluation was based on 2014 fleet data and showed that Stage II VRS controls prevented 13% of statewide VOC emissions. DEQ has begun updating the 2014 analysis to look at the 2020 and 2019 vapor emissions from gasoline stations in Oregon.

As of 2020, approximately 83 percent of Oregon registered vehicles were equipped with Onboard Vapor Recovery (ORVR). At the same time, approximately 46 percent of GDFs in Multnomah, Clackamas and Washington Counties equipped with Stage II VRS had systems that were incompatible with ORVR. This means that the Stage II system does not detect ORVR and consequently the systems counteract each other, leading to excess vapor emissions. Despite this, in 2020, Stage II VRS reduced approximately 38% of GDF VOC emissions that would have occurred if Stage II controls were not in place in Multnomah, Clackamas, and Washington Counties. The 2019 vapor emissions from gasoline stations in Oregon analysis update is in process.

Enhanced Vapor Recovery (EVR) controls further capture gasoline vapor emissions at GDFs. This rulemaking will include analysis of EVR controls and the emissions reductions from requiring these controls at GDFs in Oregon. Stage I EVR requires more durable and leak-tight components, along with an increased vapor collection efficiency.

Preliminary Analysis

In the technical advisory committee meeting, we will be discussing the current GDF control requirements and the various controls available that could further reduce VOC emissions from GDFs. DEQ provides preliminary data in Figures 3 through 6, about current throughputs and emissions from GDFs across Oregon. This data is not final and DEQ presents the data only to guide TAC discussion.

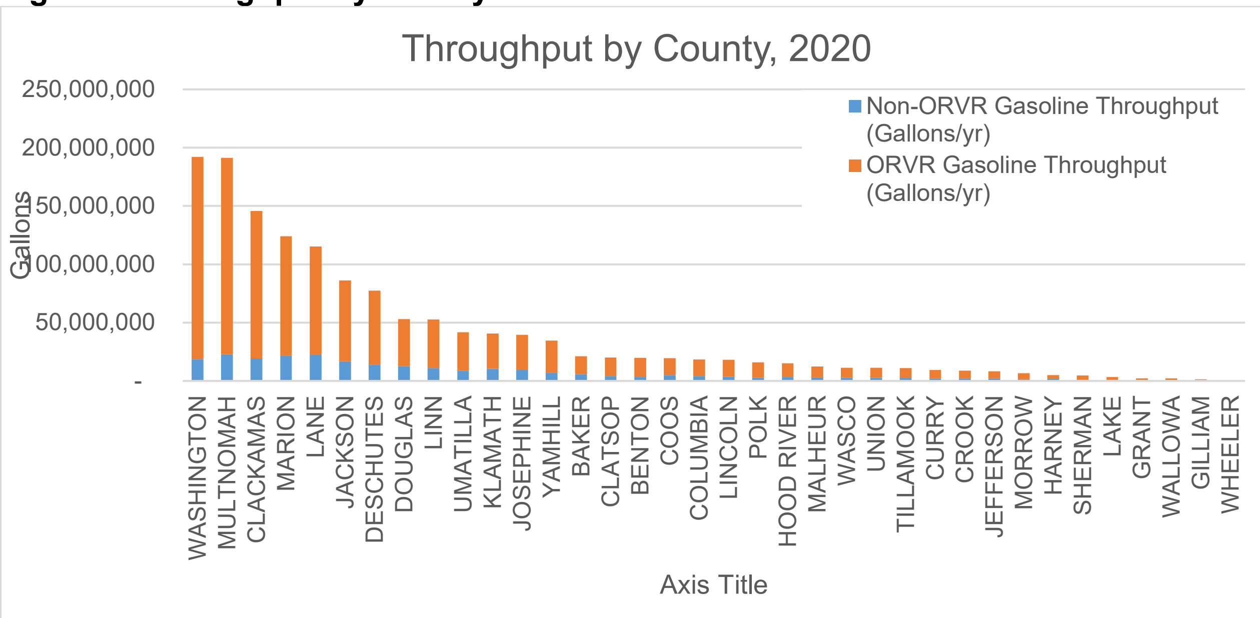
Figures 3 and 4 detail the gasoline throughputs in Oregon. Vapor emissions from a GDF are dependent on the throughput. Existing regulations are based on GDF throughput and potential changes to GDF regulations will likely be based on throughput.

Figures 5 and 6 detail calculated vapor emissions from GDFs in Oregon. Vapor emissions from GDFs contribute to ozone formation as well as toxics emissions. Benzene is a carcinogen that is found in gasoline and hence, reducing benzene emissions is important to protect public health. Benzene concentrations shown are for all sources and show that most counties in Oregon already exceed ambient benchmark concentrations (ABC) of benzene. An ambient benchmark concentration represents the concentration in outdoor air that would result in an excess lifetime cancer risk level of one in a million. ABCs are concentrations of toxic air contaminants that serve as goals in the Oregon Toxic Air Contaminants Program. They are based on human health risk and hazard levels considering sensitive populations.

[1] DEQ, May 2018, *2014 Gasoline Dispensing Facility (GDF) Stage II VRS Impact Evaluation for the Portland-Medford Multipollutant Analysis Project (PMMAP).*

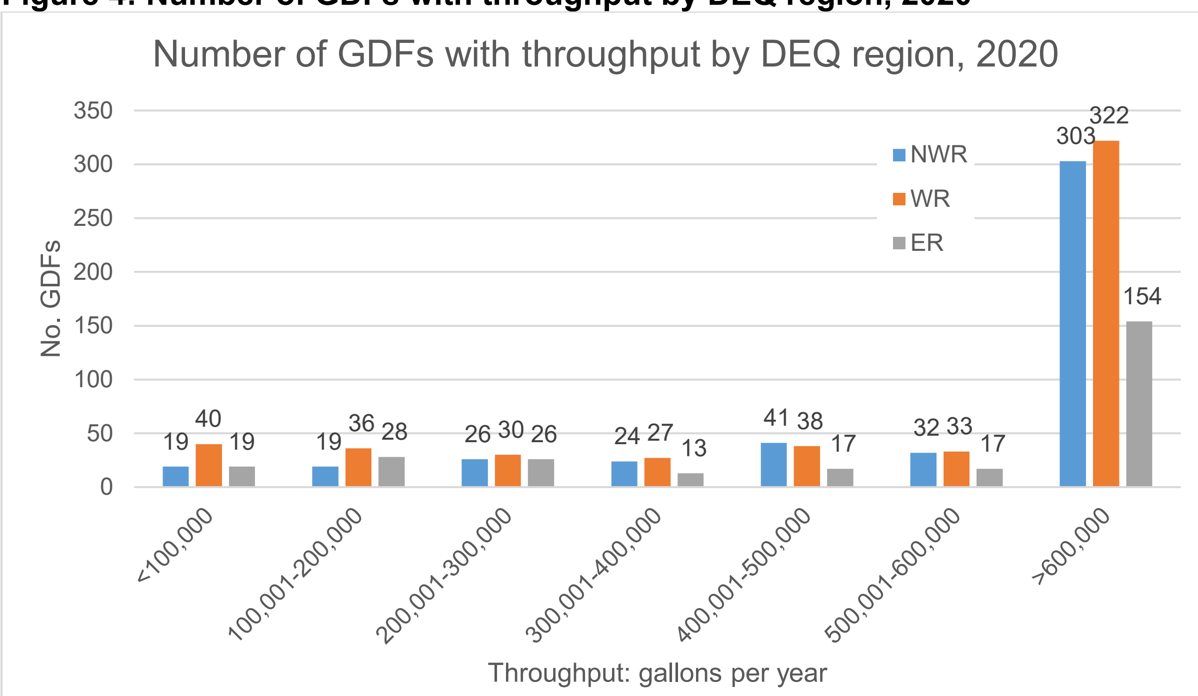
Throughput data, 2020

Figure 3: Throughput by County



Source: DEQ TRAACS data, 2020

Figure 4: Number of GDFs with throughput by DEQ region, 2020



Emissions data - 2020

Figure 5: VOC emissions by GDF source and county, 2020

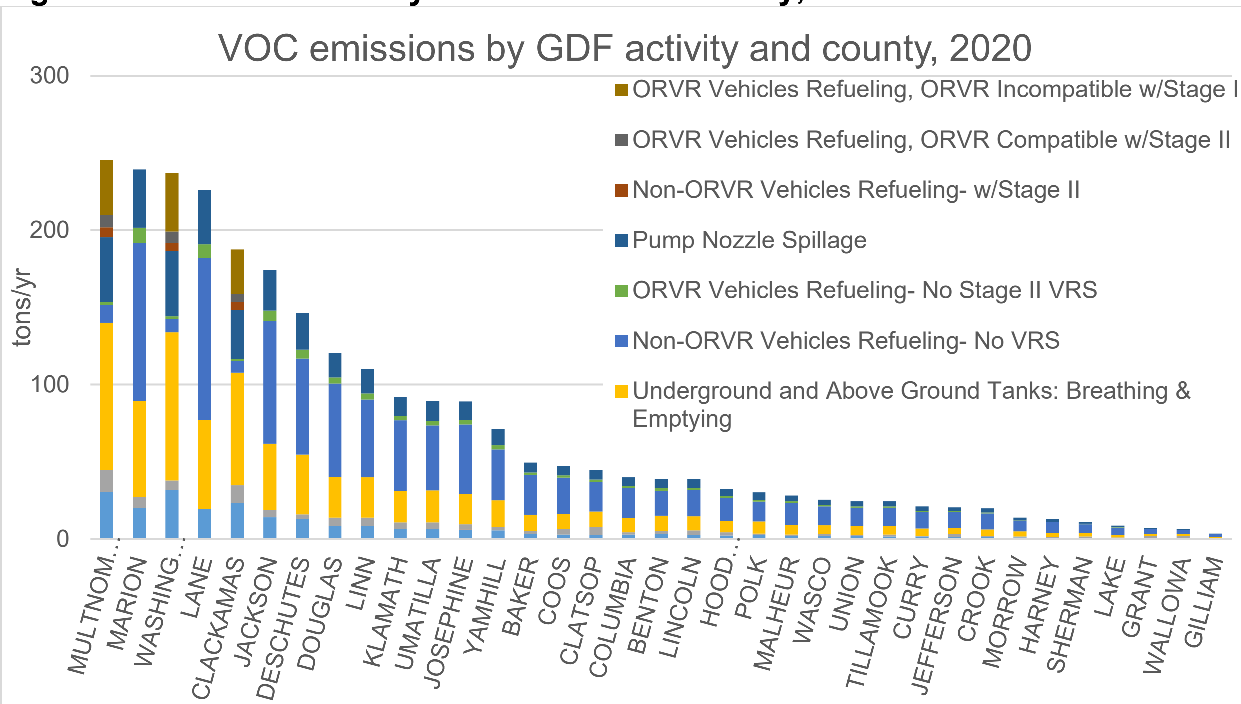
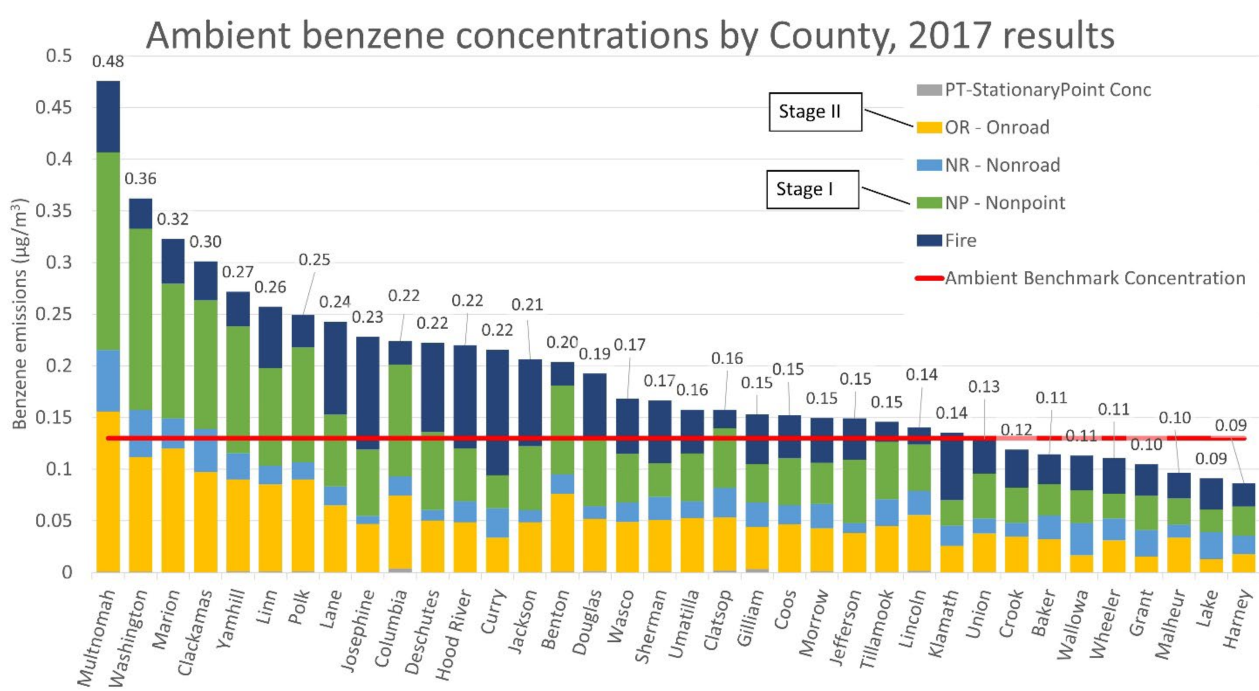


Figure 6: Ambient benzene concentrations, 2017



Source: EPA National Air Toxics Assessment data, 2017 Assessment Results

Gasoline Dispensing Facility Emissions

This rulemaking focuses on emissions from equipment located at gasoline dispensing facilities. These emission sources, and their potential controls, are described in Table 3, below. Table 4, below provides estimated emission factors for some of the vapor controls available for GDFs. The typical components of gasoline in Oregon are detailed in Table 5. The gasoline speciation data provided in Table 5 is used to translate the emissions of Total Organic Gases generated by using the emission factors in Table 4.

The California Air Resources Board (CARB) has approved various GDF EVR controls and systems. Vapor Recovery Certification Procedure CP - 201 Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities provides details on the performance standards and specifications of these controls. Tables 6 and 7 provide a summary of these requirements. For full requirements, refer to the Certification Procedures, available here: https://ww3.arb.ca.gov/testmeth/vol2/cp201.pdf

Table 3: Emissions Sources and Potential Controls at GDFs

Emission Source	Description	Potential Controls
Loading "Stage I"	Loading emissions occur when a fuel tanker truck makes a delivery to a gas station. During each delivery, gas is transferred from the fuel tanker truck into the underground storage tanks at a gas station. Gasoline vapors may be emitted as the liquid gasoline enters the underground storage tanks.	Stage I VRS, Stage I EVR
Breathing	Breathing emissions (or breathing losses) occur during periods of low activity or inactivity (e.g., after hours, station closed for repairs) at a gas station. During these periods, temperature changes inside the underground storage tank can cause gasoline vapor pressures to increase. If the vapor pressure rises above the pressure limit for the underground storage tank, excess pressure will be released from the gas station vent pipe in the form of gasoline vapor emissions. Breathing emissions are also called breathing losses or pressure-driven losses.	Stage II VRS, Stage II EVR
Fueling "Stage II"	Fueling emissions occur at the gas pump during vehicle fueling. During the fueling process, gasoline vapors are emitted from the space due to a poor seal between the nozzle and the vehicle.	ORVR, Stage II nozzles (Stage II and and EVR)
Spillage "Stage II"	Spillage emissions are generated from dispensing nozzle spillage of liquid gasoline during the act of vehicle fueling, including pre-fueling, fueling and post-fueling spillage.	Stage II Dripless Nozzles
Hose Permeation "Stage II"	Hose Permeation emissions occur from the fueling hoses at the gas pump. Gasoline vapors can pass through (or permeate) the fuel delivery hoses.	Low Permeation Hoses

Table 4: Emission Factors[1]

Emission Source Type	Emission Source	Total Organic Gases (TOG) Emission Factor (lb/1,000 gal)	
		AP-42[2]	CARB[3]
Filling storage tank (Stage I)			
Loading	Submerged filling w/out Stage II	7.3	7.7
Loading	Balanced submerged filling Stage II	0.3	0.38
Loading	Stage I EVR	--	0.15
Breathing	Underground tank breathing and emptying	1.0	--
Breathing	Pressure driven - w/out Stage II		0.76
Breathing	Pressure driven - Stage II		0.092
Breathing	Pressure driven - Stage II EVR		0.024
Vehicle refueling operations (Stage II)			
Fueling	No ORVR, w/out Stage II	11.0	8.4
Fueling	No ORVR with Stage II	1.1	2.4
Fueling	No ORVR with Stage II EVR	--	0.42
Fueling	ORVR w/out Stage II		0.42
Fueling	ORVR with Stage II	1.1	0.12
Fueling	ORVR with Stage II EVR	--	0.021
Spillage	Spillage - w/out Stage II		0.61
Spillage	Spillage - Stage II	0.7	0.42
Spillage	Spillage - Stage II EVR		0.24
Hose Permeation	Hose Permeation losses pre 2013 standards		0.062
Hose Permeation	Hose Permeation losses 2013 standards		0.009

1. Actual emission factors will vary depending on temperature.
2. U.S. Environmental Protection Agency, January 1995, *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Chapter 5, Petroleum Industry.*
3. California Environmental Protection Agency Air Resources Board, December 23, 2013, *Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities.*

Table 5: HAP Speciation of VOC for Gasoline Fugitive Emissions

CAS	NAME	VOCtoTOG	WEIGHT_PER	Weight Percent
95-63-6	1,2,4-trimethylbenzene	1	0.63	0.63%
108-67-8	1,3,5-trimethylbenzene	1	0.21	0.21%
141-93-5	1,3-diethylbenzene (meta)	1	0.04	0.04%
611-14-3	1-Methyl-2-ethylbenzene	1	0.15	0.15%
620-14-4	1-Methyl-3-ethylbenzene	1	0.43	0.43%
622-96-8	1-Methyl-4-ethylbenzene	1	0.19	0.19%
109-67-1	1-pentene	1	0.68	0.68%
540-84-1	2,2,4-trimethylpentane	1	0.89	0.89%
75-83-2	2,2-dimethylbutane	1	0.43	0.43%
565-75-3	2,3,4-trimethylpentane	1	0.29	0.29%
79-29-8	2,3-dimethylbutane	1	1.22	1.22%
565-59-3	2,3-dimethylpentane	1	0.75	0.75%
108-08-7	2,4-dimethylpentane	1	0.48	0.48%
592-27-8	2-methylheptane	1	0.15	0.15%
591-76-4	2-methylhexane	1	0.52	0.52%
107-83-5	2-methylpentane (isohexane)	1	3.54	3.54%
589-81-1	3-methylheptane	1	0.17	0.17%
589-34-4	3-methylhexane	1	0.63	0.63%
96-14-0	3-methylpentane	1	1.98	1.98%
71-43-2	Benzene	1	--	0.82% (1)
590-18-1	Cis-2-butene	1	0.49	0.49%
627-20-3	Cis-2-pentene	1	0.52	0.52%
110-82-7	Cyclohexane	1	0.25	0.25%
287-92-3	Cyclopentane	1	0.77	0.77%
100-41-4	Ethylbenzene	1	0.66	0.66%
75-28-5	Isobutane	1	2.71	2.71%
78-78-4	Isopentane (2-Methylbutane)	1	28.09	28.09%
78-79-5	Isoprene (2-methyl-1,3-butadiene)	1	0.05	0.05%
98-82-8	Isopropylbenzene (cumene)	1	0.04	0.04%
1330-20-7	M & p-xylene mixture	1	2.39	2.39%
108-87-2	Methylcyclohexane	1	0.09	0.09%
96-37-7	Methylcyclopentane	1	0.05	0.05%
106-97-8	N-butane	1	23.43	23.43%
142-82-5	N-heptane	1	0.46	0.46%
110-54-3	N-hexane	1	2.14	2.14%
111-84-2	N-nonane	1	0.05	0.05%
111-65-9	N-octane	1	0.13	0.13%
109-66-0	N-pentane	1	12.05	12.05%
103-65-1	N-propylbenzene	1	0.14	0.14%
1120-21-4	N-undecane	1	0.01	0.01%
95-47-6	O-xylene	1	0.9	0.90%
108-88-3	Toluene	1	4.36	4.36%
624-64-6	Trans-2-butene	1	0.39	0.39%
N/A	Other	1	4.36	4.36%
N/A	Unidentified	1	--	1.27% (2)

Total				100%

Table 6: CARB Stage I Performance Standards and Specifications

Performance Type	Requirement
Stage I Efficiency	≥ 98.0%
Stage I Emission Factor	HC ≤ 0.15 pounds/1,000 gallons
Static Pressure Performance	See CP-201
Pressure Integrity of Drop-Tube with Overfill Prevention	≤ 0.17 CFH at 2.0 inches H_2O
Stage I Product and Vapor Adaptor/Delivery Elbow Connections	Rotatable 360°, or equivalent
Stage I Product Adaptor Cam and Groove	See CP-201
Stage I Vapor Recovery Adaptor Cam and Groove	CID A-A-59326
Stage I Vapor Adaptor	Poppetted
Stage I Vapor Adaptor	No Indication of Leaks Using Liquid Leak Detection Solution (LDS) or Bagging
Stage I Product and Vapor Adaptors	≤ 108 pound-inch (9 pound-foot) Static Torque
UST Vent Pipe Pressure/Vacuum Valves	Pressure Settings 2.5 to 6.0 inches H_2O Positive Pressure 6.0 to 10.0 inches H_2O Negative Pressure Leakrate at +2.0 inches H_2O ≤ 0.17 CFH Leakrate at -4.0 inches H_2O ≤ 0.63 CFH
Spill Container Drain Valves	Leakrate ≤ 0.17 CFH at +2.0 inches H_2O
Vapor Connectors and Fittings	No Indication of Leaks Using Liquid Leak Detection Solution (LDS) or Bagging
Compatibility with Fuel Blends	Materials shall be compatible with approved fuel blends

Table 7: CARB Stage II Performance Standards and Specifications

Performance Type	Requirement
Stage II Emission Factor Includes: Refueling and Vent Emissions Pressure-Related Fugitives	Summer Fuel: 95% Efficiency and HC ≤ 0.38 pounds/1,000 gallons Winter Fuel: 95% Efficiency or HC ≤ 0.38 pounds/1,000 gallons
Static Pressure Performance	See CP-201
Spillage Including Drips from Spout	≤ 0.24 pounds/1,000 gallons
ORVR Compatibility	Applicant shall develop a test procedure to demonstrate ORVR compatibility
Liquid Retention Nozzle “Spitting”	≤ 100 ml/1,000 gallons ≤ 1.0 ml per nozzle per test
ISD	See CP-201

Performance Type	Requirement
Low Permeation Hoses	Permeation Rate ≤ 10.0 g/m^2/day as Determined by UL 330 (7^{th} ed.)
Stage II Compatibility with Stage I Systems	See CP-201
UST Pressure Criteria (30 day rolling average)	Daily Average Pressure ≤ +0.25 in. H_2O Daily High Pressure ≤ +1.50 in. H_2O
Nozzle Criteria: Each Stage II Nozzle Shall:	Post-Refueling Drips ≤ 3 Drops/Refueling Comply with spout assembly dimensions including nozzle bellows as specified in CP-201 Be capable of fueling any vehicle that can be fueled with a conventional nozzle
Nozzle/Dispenser Compatibility	Vapor Check Valve Closed When Hung Hold-open Latch Disengaged When Hung
Unihose MPD Configuration	One Hose/Nozzle per Dispenser Side

Alternate formats

DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email deqinfo@deq.oregon.gov.