Oregon Department of Environmental Quality

Controls Summary

Gasoline Dispensing Facility Emissions 2022 Rulemaking Advisory Committee Meeting #1

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Background

Gasoline vapors contain volatile organic compounds (VOCs) that include air toxics such as benzene, a known carcinogen; contribute to the formation of ozone; and contribute to regional impairment of scenic views.

Vapors are emitted during the storage and distribution of gasoline. Sources of vapor releases at gasoline dispensing facilities (gas stations) include leaks from storage tanks, releases from storage tank vents, leaks during refueling of storage tanks, leaky pipes and fittings, accidental spills from the nozzles of gas dispensers, releases from vehicle tanks during refueling, and leaky hoses.

Gas Station Vapor Controls Summary

As stated above, there are three main types of controls associated with vapor releases at gas stations. These are Stage I, Stage II, and Onboard Refueling Vapor Recovery.

Stage I Vapor Control is the control of gasoline vapor released when the GDF storage tanks are being filled. This equipment uses a combination of pipes and hoses to collect displaced gasoline vapors from the tank and route them back into the delivery truck so they can be returned to the terminal for processing.

Stage II Vapor Controls reduce gasoline vapors when gasoline is dispensed into vehicle fuel tanks. Stage II vapor recovery systems use special refueling nozzles, dispensing hoses, and a system that draws refueling vapors into the underground storage tank (UST). The vapors stored in the underground storage tanks are later routed back into the next delivery truck so they can be returned to the terminal for processing.

Onboard Refueling Vapor Recovery (ORVR) is a system that exists within newer vehicles. This system captures gasoline vapors from the vehicle gas tank during refueling. In vehicles with ORVR, fuel vapors travel to an activated carbon packed canister, which adsorbs the vapor. When the vehicle is running, it draws the gasoline vapors into the engine to be used as fuel.

Stage II and ORVR Systems both collect vapors during vehicle refueling. This makes Stage II systems largely redundant. In fact, use of some types of vacuum-assist Stage II systems with an ORVR vehicle can result in an increase in emissions from the UST vent pipe. This occurs when the vacuum assist system draws fresh air into the UST rather than vapors from the vehicle fuel tank. The fresh air drawn into the UST increases the pressure in the UST. When the pressure in the tank gets high enough, the pressure/vacuum valve will vent vapors to the atmosphere.

Analysis of the Stage II / ORVR incompatibility at GDFs in the Portland region show that Stage II incompatibility will cause a net increase in VOC emissions from gas stations starting as early as 2025.

Enhanced Vapor Recovery (EVR): The California Air Resources Board (CARB) certifies Stage I and Stage II enhanced vapor recovery (EVR) systems that meet stricter emission control standards compared to standard Stage I and Stage II systems.

Existing Requirements in Oregon

Gas stations and other dispensing facilities are subject to National Emission Standards for Hazardous Air Pollutants rules put into law by the U.S. EPA. The Oregon Environmental Quality Commission adopted more stringent rules, requiring smaller dispensing facilities to be included. The goal of this rule is to capture vapors while transferring gasoline from tanker trucks into storage tanks using Stage I vapor controls. These requirements are incorporated into air quality permits administered by DEQ.

Portland Metro area gas stations are subject to a second set of state rules. These requirements are incorporated into air quality permits administered by DEQ. The goal of these rules is to capture vapors while transferring gasoline from the pump to an individual vehicle using Stage II vapor controls. Most cars manufactured after 1998 have ORVR.

Stage I

Stage I vapor recovery systems work using a vapor balance system. This is a combination of pipes and hoses that create a closed system between the vapor spaces of an unloading gasoline cargo tank and a receiving storage tank so that vapors in the storage tank are transferred to the gasoline cargo tank being unloaded. There are two types of Stage I vapor balance systems, coaxial and dual-point.

- Stage I coaxial vapor balance system have a single product fill / vapor return connection where gasoline is delivered, and vapors are extracted.
- Stage I dual-point vapor balance system have two connections – one product fill connection for gasoline delivery and a separate connection for vapor extraction (Figure 1 shows a dual-point vapor balance system).

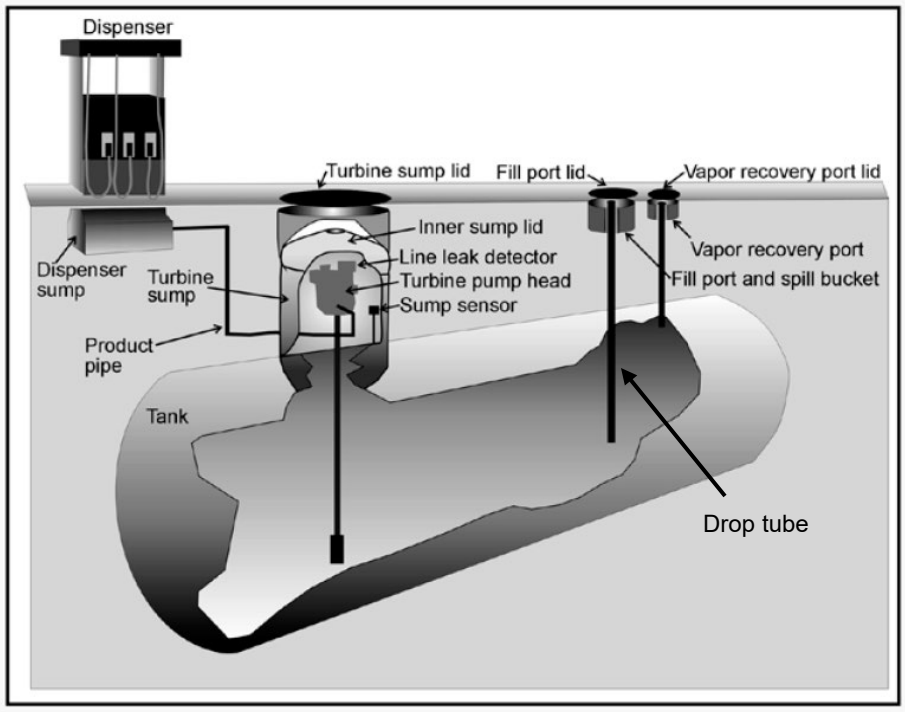


Figure 1: Diagram of a UST system. Source: EPA: UST Systems: Inspecting and Maintaining Sumps and Spill Buckets

Existing regulations regarding Stage I Vapor Controls in Oregon can be found at Oregon Administrative Rules (OAR) chapter 340 division 244. All gas stations across the state are required to comply with general work practices including filling tanks that are 250 gallons or greater using submerged fill (the fill pipe reaches to within 6 inches of the bottom of the tank). Storage tanks that are 250 gallons or greater and are located at a gas station with either 480,000 gallons per year throughput or 100,000 gallons per month throughput must have a vapor balance system. New gas stations with monthly throughput 100,000 gallons or more must install a dual-point vapor balance system.

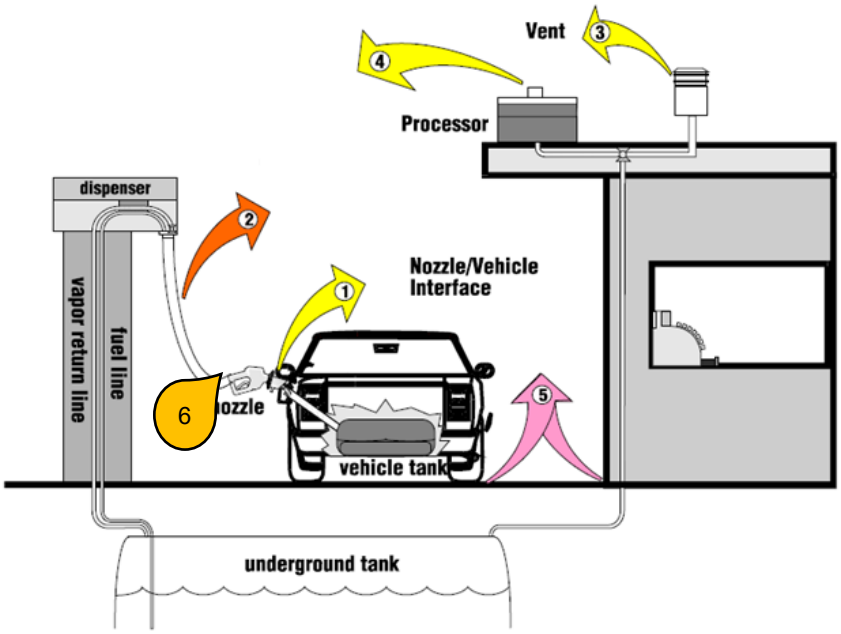
Stage II

Stage II vapor recovery systems work by capturing the gasoline vapors at the vehicle fill pipe and transferring this vapor to the gas station UST. Vapor emissions can occur at a number of points during vehicle refueling (Figure 2). There are two types of Stage II systems, vacuum assist and vapor balance.

- Stage II vapor balance systems work using pressure differential to move the gasoline vapors into the UST. Stage II vapor balance systems are compatible with motor vehicle ORVR systems.
- Stage II vacuum assist VRS systems work using a vacuum source to move the vapors into the UST. Some Stage II vacuum assist systems are incompatible with ORVR; however, there are ORVR-compatible nozzles available that make these systems compatible.

Existing regulations regarding Stage II Vapor Controls in Oregon can be found at OAR chapter 340 division 242. These regulations only apply to stations in the Portland Metro area

(Clackamas, Multnomah, and Washington Counties) whose annual throughput exceeds 600,000 gallons.



ID	Source
1	Vehicle fueling
2	Hose permeation
3	Vent line
4	Vapor Processor
5	Fugitive
6	Nozzle spillage

Figure 2: Sources of Stage II Vapor Emissions

Tipping Point

DEQ analyzed the incompatibility between ORVR and Stage II controls using EPA approved methodology. Based on this analysis, DEQ estimates that incompatible Stage II control systems in the Portland Metro area could result in increased emissions, over no Stage II controls, by the end of 2024.

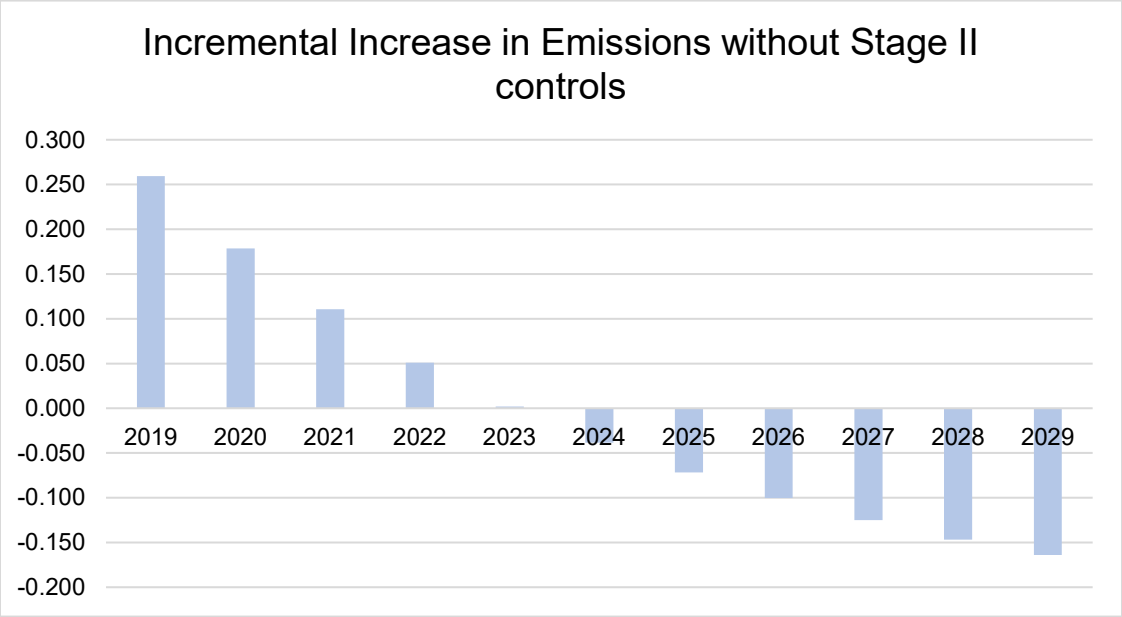


Figure 3: Stage II controls tipping point.

Potential Modifications

As stated above, Stage II incompatibility issues will cause a net increase in VOC emissions from gas stations in the Portland Metro area by 2025. Additionally, vapor emissions from gas stations across the state are a concern due to releases of toxic constituents including benzene, ozone precursors, and contribution to regional haze. There have been many advancements in vapor controls from gasoline stations. Potential changes to control requirements at GDFs are discussed below. In the Scenarios fact sheet, DEQ has analyzed various combinations of these control requirements, their anticipated cost and potential emissions reductions.

Stage I EVR

In 2000, the CARB approved Stage I EVR systems that meet stricter emission control standards. Specifically, regular Stage I systems are expected to be 90% efficient while Stage I EVR systems are required to be 98% efficient. There are Aboveground Storage Tank (AST) and UST Stage I EVR systems.

Additionally, CARB approval is for the entire Stage I EVR system, including each component. Some states have allowed “mix-and-match” of components in CARB approved Stage I EVR systems. Stage I EVR components vary depending on if the storage tank is above ground or below ground. Additionally, coaxial Stage I Systems are not CARB approved.

- For USTs, Stage I EVR controls include P/V valve, spill containment, drop tube and overfill prevention device, and rotatable adaptors on all underground storage tanks.
- For ASTs, Stage I EVR controls include emergency vent, spill container, overfill prevention device with drop tube, non-rotatable product adaptor, product adaptor dust caps, and product couplers on all above ground storage tanks.

Tanks that are not compatible with Stage I EVR would need to be upgraded to Stage I EVR upon tank replacement. The average ‘life’ of a gasoline storage tank is 30 years.

Remove some or all Stage II Systems

Incompatible Stage II controls do not detect vehicle ORVR systems and consequently the systems counteract each other, leading to excess vapor emissions. When an area has a sufficient percentage of ORVR equipped vehicles, Stage II systems can result in overall increased vapor emissions. At this time, removal of all Stage II systems, or just incompatible Stage II systems, can lead to decreased emissions from the gas station.

Some Stage II controls are compatible with ORVR and provide an extra level of vapor recovery. Maintaining the compatible Stage II controls while removing incompatible Stage II controls can lead to additional emissions reductions over removing all Stage II controls.

Convert incompatible Stage II controls to compatible Stage II controls

Converting all stations with incompatible Stage II controls to compatible Stage II controls would result in additional reduction of VOC emissions.

Low Permeability hoses and ECO nozzles

A low permeation conventional hose is one that is made from specific materials that will limit the release of gasoline vapor emissions. This is typically through thermoplastic or rubber materials that are used for hose construction.

An ECO nozzle is a conventional nozzle CARB-certified per CP-207 that is equipped with features to limit excess liquid releases. Examples include spillage, spitting, post fueling drips, and liquid retention. ECO nozzles also differ from conventional nozzles in appearance because they are equipped with a mini boot device that serves as an interlock to prevent gasoline flow when the boot is uncompressed.

In-Station Diagnostics

In-Station Diagnostics (ISD) continuously monitors the performance of the vapor collection and vapor containment systems at GDFs. The ISD system notifies the GDF operator of possible problems in the systems through a series of warning and failure alarms. This reduces gasoline vapor emissions by detecting, and therefore fixing, any equipment problems sooner. Some states have adopted regulations that require gas stations to have either an ISD system or perform frequent (monthly) inspections for potential equipment failures.

Stage II EVR

Stage II EVR systems recover at least 95% of the emissions at gasoline dispensing facilities during vehicle refueling. Regular Stage II systems are expected to be 90% efficient.

As with Stage I EVR, CARB approves entire Stage II EVR systems including all the components. Stage II EVR components include: enhanced conventional (ECO) nozzles, In-Station Diagnostics (ISD), low permeation hoses, UST pressure criteria, one hose/nozzle per dispenser side, vapor return piping, and liquid condensate traps.

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.