

# Transportation and Marketing of Gasoline

There are approximately 2,842 gasoline stations in Washington. Approximately 2,305 have Stage I controls, and 955 have Stage II controls. In Western Washington, there are 2,110 gasoline stations, 88% of which have Stage I controls, and 45% have Stage II controls. Based on throughput, 98% of the throughput is controlled by Stage I and 78% of the throughput is controlled by Stage II.<sup>1</sup>

Based upon estimate by the Washington State of Transportation, more than 2.4 billion gallons of gasoline were consumed in 1994.

## Description of Process

The gasoline marketing network consists of the storage and transfer facilities that move gasoline from production to end consumption. However, this report only addresses the receipt and distribution of gasoline from retail service stations. Typically, service stations receive gasoline from 8,000 gallon tanker trucks.

Loading losses occur as organic vapors in empty tanks are displaced by the liquid being loaded into the tank.

Breathing loss is the expulsion of the vapor from the tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure. Breathing loss emissions occur in the absence of any liquid level change in the tank.

## Methods of Determining Emissions

Loading losses can be controlled somewhat by using a vapor balance system (stage I vapor controls). Stage I vapor controls are simply the retrieval of the displaced vapors in the source tank by the delivery truck. The tank truck then returns the vapors to the loading terminal.

Chapter 173-491 of the Washington Administrative Code, Emission Standards and Controls for Sources Emitting Gasoline Vapors applies to sources that store, transport and dispense gasoline. This regulation defines stage I and stage II as follows:

Stage I means gasoline vapor recovery during all gasoline marketing transfer operations except motor vehicle refueling.

Stage II means gasoline vapor recovery during motor vehicle refueling operations from stationary tanks.

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<sup>1</sup> This is based on an informal survey conducted in 1998. Western Washington numbers are based on the 1995 emission inventory developed for Ecology's Stage II Vapor Recovery project. Eastern Washington numbers are based on regulating authority estimates for 1997. Note that some regulating authorities only reported registered sources, therefore numbers may be slightly higher.

Ecology proposed revising these state requirements for Stage 2 gasoline vapor recovery systems, and the rule was adopted on December 24, 1997, and took effect on January 24, 1998. Stage 2 is now required at the following gas stations (Ecology, December 1997):

<b>County</b>	<b>Annual Gasoline Throughout</b>	<b>Date Required</b>
Cowlitz/Thurston	Over 1.2 million gallons	Currently for all existing and new stations
Kitsap	Over 840,000 gallons	By December 31, 1998
Clark, King, Pierce, Snohomish	Over 600,000 gallons	By December 31, 1998
All Counties	Over 1.5 million gallons and is sufficiently close to a residence <sup>2</sup>	Currently

Eastern Washington stations dispensing less than 1.5 million gallons annually will not be required to submit a notice of construction and will not be required to install stage II recovery systems. New or modified stations dispensing more than 1.5 million gallons per year will be reviewed. Stations dispensing more than 1.5 million gallons that do not have environmental or health concerns are not required to install stage II vapor recovery systems.

For uncontrolled loading operations emissions, loading loss, can be estimated by the equation below. This equation is accurate to plus or minus 30 percent.

$$LL = (12.46)(S)(P)(M)/T$$

where LL = loading loss, lb/103 gal of liquid loaded

M = molecular weight of the vapors (lb/lb-mole)

P = true vapor pressure of liquid loaded (psia)

T = temperature of bulk liquid loaded (°R = °F + 460)

S = a saturation factor

EPA has estimated that vehicle refueling emissions account for as much as two percent of the overall VOC emissions inventory in urban areas. Refueling emissions at a given Reid vapor pressure (RVP) will vary with temperature from a minimum of 1.8 grams of VOC/gallon of gasoline (winter conditions) to a maximum of approximately 9 grams of VOC/gallon of gasoline (extreme summer conditions).

MOBILE5.0a is a model that uses a regression equation to estimate hydrocarbon, carbon monoxide, and nitrogen oxides for gasoline fueled and diesel highway motor vehicles. There are

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<sup>2</sup> Removal of a Stage 2 gasoline vapor system is a modification of an air emission control device. To remove Stage 2 equipment, gas station managers must file a notice of construction with the local air authority and gain agency approval prior to removing Stage 2. If the gas station is near a residential area, Stage 2 may be required to control air toxics.

two basic approaches to the control of vehicle refueling emissions, generally referred to as stage II (at the pump) and on-board (on the vehicle) vapor recovery systems (VRS). MOBILE5.0a can be used to model uncontrolled levels of vehicle emissions as well as both types of VRS.

The uncontrolled refueling emission factors in MOBILE5.0a are a function of RVP, temperature of dispensed fuel, and difference in temperatures of dispensed and residual tank fuel. The result of the model is an emission factor in terms of grams of vapor emitted per gallon of fuel dispensed (g/gal). EPA recommends that states and other use MOBILE5.0a to model refueling emissions for highway vehicle emissions inventory development.

## References

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