HHA-107

A New Approach to Modeling On-Road Vehicle Evaporative Emissions

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Submitted to
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June 2, 2005

ABSTRACT:

This paper suggests a new methodology for estimating vehicle evaporative emission rates during the range of temperatures where ozone is a problem, i.e., summer-time. The new concept partitions the vehicle's contribution to the evaporative emission inventory into three categories:

1. Permeation
2. Tank vapor venting
3. Leaks (two sub-sets - Liquid and Vapor)

Evaporative Emission Rate = Sum (Permeation + Tank Vapor Loss + Leaks)

The first two terms are strongly driven by fuel composition, ambient temperature, and ambient temperature change. Leaks are not strongly affected by normal summer temperatures. Liquid leaks have two components:

1. Static leaks occurring while the vehicle is inactive and,
2. Increase in leak rate caused by the system pressure increase during engine operation.

Vapor leaks also have two components:

1. Static vapor leaks that might occur at constant temperature by diffusion through a large opening (like a missing fuel cap), and
2. Dynamic leaks created by the ambient temperature increase that by-pass the carbon canister.

Evaporative emissions are more properly represented as a time rate, i.e., g/hour, rather than grams per mile. The analysis suggested in this report is focused on time rates.