

# Proposed Temperature and RVP Adjustments For Evaporative Running Losses

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## Evaporative Running Losses

- **Evaporative running losses are fuel vapor losses that occur while an engine is running.**
- **Vapor losses while an engine is running are affected by:**
  - Vapor generation as a function of:
    - Increasing fuel tank temperature.
    - Fuel volatility (RVP).
  - Vapor storage capacity (charcoal canister).
  - Purging of the canister as a function of:
    - Engine canister purging strategy.
    - Driving schedule.
  - Vapor leaks.

## Vapor Loss Mechanism

- Vapor is generated as the fuel tank is heated during driving.
- Vapors generated during driving are captured by the canister and stored.
- During particular engine operating modes, vapors are purged from the canister and burned.
- Vapor is vented to the air when:
  - Adequate purging does not occur.
    - Canister capacity is exceeded.
  - The system has vapor leaks.

## Running Loss Vapor Adjustments

- **MOVES2010b running loss rates do not vary by:**
  - Vehicle age.
  - Temperature.
  - Fuel properties.
  - Trip length.
  - Vapor leaks.
- **Permeation during engine operation is already adjusted for temperature and fuel properties.**
- **Liquid leaks during engine operation are handled as a separate process.**

## Running Loss Adjustment Proposal

- MOVES running loss rates based on an ambient 85 degrees Fahrenheit and 9 psi RVP gasoline.
- Recent tunnel studies suggest that running emissions in MOVES underestimate HC emissions, especially at high temperatures.
- Both temperature and RVP affect total vapor generation during driving.
- *The proposal is to add an adjustment of vapor running losses for ambient temperature and gasoline RVP to MOVES.*

## Available Adjustment Data

- Little data from running loss tests has been gathered since MOBILE6 was released.
- MOBILE6 data is based on a large number of vehicle tests on older model year vehicles.
- No recent running loss data includes both variation in temperature and gasoline RVP.
- *The proposal is to use the temperature and fuel property effects in MOBILE6 to adjust running loss rates in MOVES.*

## MOBILE6 Temperature and Fuel Effects

- MOBILE6 running loss emissions are calculated using a multi-variable regression equation that accounts for both temperature and fuel volatility.
- Emission regressions are based on a large number of in-use vehicle running loss measurements made in the 1980's and 1990's using multiple temperature and gasoline RVP levels.
- The effects of temperature and RVP on running losses are not separate from the emission rate estimate.

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MOBILE6 running loss emission rates are described in the report, "Estimating Running Loss Evaporative Emissions in MOBILE6" (EPA420-R-01-023, April 2001, M6.EVP.008).

## Using MOBILE6 Adjustments

- Vapor losses during running are due to vapor generation in excess of the ability to store and purge vapor during engine operation.
- The base vapor losses already account for differences in vehicle technology.
- *The proposal is that the base vapor generation (and losses) will be adjusted proportionally using temperature and RVP, regardless of vehicle technology.*



## Running Losses in MOBILE6

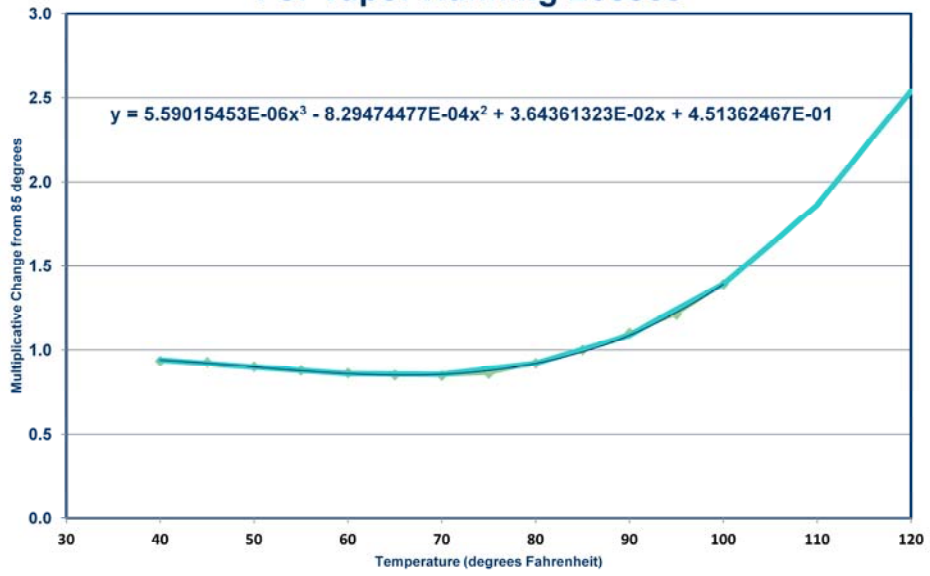
- Temperature and fuel property effects for running losses in MOBILE6 are embedded in the emission rate calculations.
- The resulting MOBILE6 effect can be obtained by running the model for:
  - Multiple temperatures.
  - Multiple RVP levels.
- Use the results to generate adjustments:
  - Fit statistical curves through the MOBILE6 results.
  - Calculate the adjustments from the curve fits.

## Adding the Adjustments to MOVES

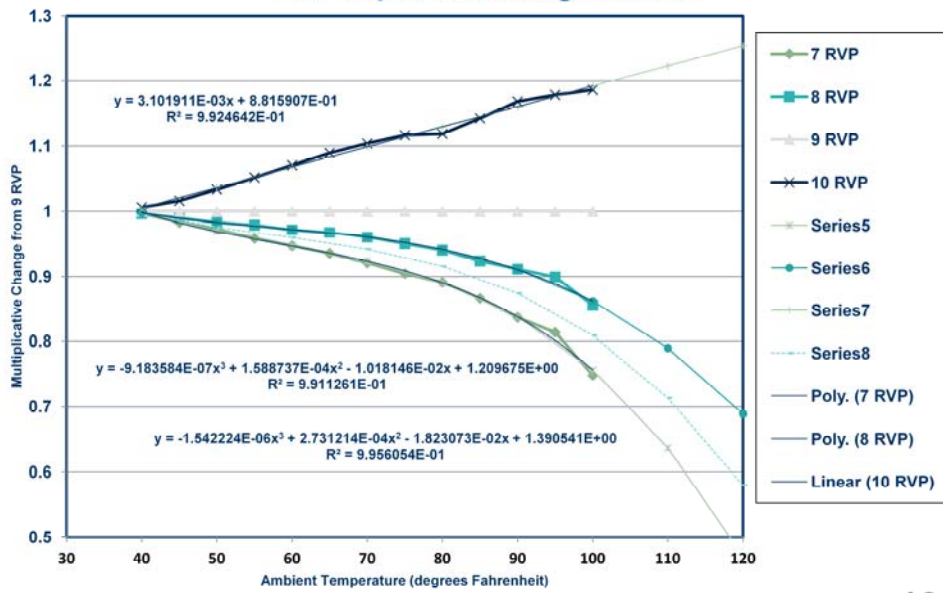
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**Adjusted Vapor Running Losses =**  
**Vapor Running Losses (85 degrees, 9 RVP)**  
**\* Temperature Adjustment**  
**\* RVP Adjustment (function of temperature)**

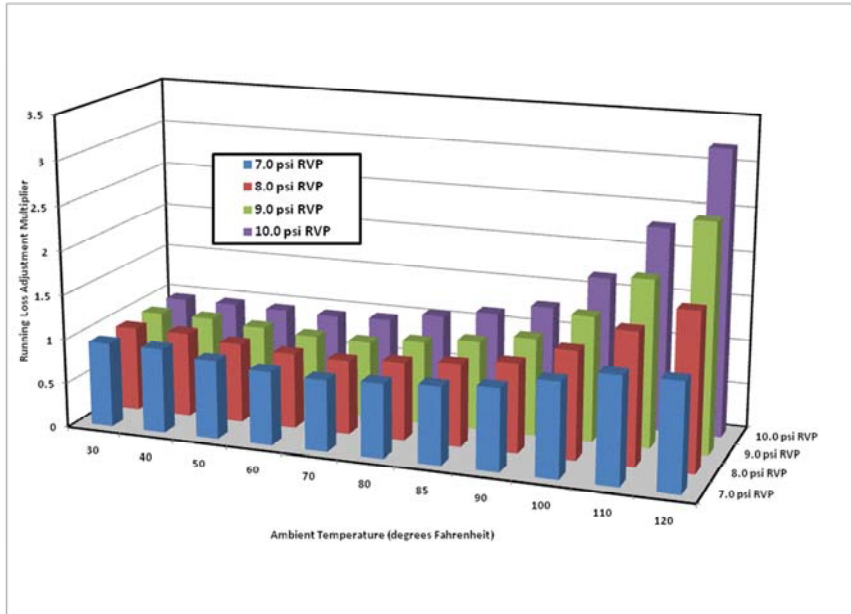
### Proposed Temperature Adjustment Factor For Vapor Running Losses



## Proposed RVP Adjustment Factor For Vapor Running Losses



## Proposed Combined Temperature and RVP Adjustment Factor For Running Losses



## Additional Assumptions

- The temperature adjustment at 40 degrees will be applied to all temperatures below 40 degrees.
- The RVP adjustment at 7 RVP will be applied to all RVP values below 7 RVP.
- The RVP adjustment at 10 RVP will be applied to all RVP values above 10 RVP.
- No RVP adjustment will be applied below 40 degrees.

## Effect on Inventories

- **The effect of the changes will depend on the scenario:**
  - Below 85 degrees F, running losses will be lower, if RVP is 9 psi or less. Running losses below 40 degrees will be lower at any RVP.
  - Running losses with RVP above 9 psi will likely see some increase, depending on the temperature. Low temperatures will offset some of the RVP increase.
- **Overall change is likely to be small.**

## Questions?

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