

Advanced Vehicles & Fuel Quality

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Advanced Vehicles

- EPA Regulations for Greenhouse Gases/Fuel Economy Standards
 - 2012-2016 MYs: 35.5 mpg
 - 2017-2025 MYs: 54.5 mpg
- EPA Regulations for Tier 3 Emissions Standards
 - More Stringent Tailpipe and Evaporative Emissions Standards Phased in Through 2025 MY

Standards Dictate New Vehicle Technologies

- Improvements to Traditional Powertrains
 - Downsized Engines
 - More Turbo-Charging
 - Improved Valve-Trains
 - Cylinder Deactivation
 - Improved Transmissions
- Other Advances
 - More Hybrid Electric Vehicles
 - Plug-in HEVs, Full EVs
 - Fuel Cell Vehicles
 - Start-Stop Technology

Advanced Vehicles Bring Fuel Changes

- More Plug-in HEVs and EVs - More Recharging Stations
 - Flexibility for Recharging Options
- Fuel Cell Vehicles – Complete New Network Needed to Support Hydrogen Refueling
- CNG Vehicles – Flexibility Needed
- Gasoline and Diesel Fuel Parameters to Support Emission Reductions

Gasoline Quality

- EPA Tier 3 Proposal Includes More Stringent Control of Gasoline Sulfur (S) Content
 - 10 ppm S Annual Refinery Average
 - Requested Comments on Per Gallon Cap Limit (currently 80 ppm S) and Retail Per Gallon Cap Limit (currently 95 ppm S)
- Lower S Gasoline Phase-In Would Begin 2017

Other Gasoline Quality Parameters

- Sub-Octane Gasoline (below 87 AKI) Should Be Eliminated
- Metallic Gasoline Additives Should Be Eliminated
- Detergent Requirements Should Be Increased
- Heavier Aromatics Should Be Controlled

Sub-Octane Gasoline

- Traditionally ASTM Recognized 85 AKI Gasoline in Certain High Altitude Areas Only
 - Based on Carbureted Vehicles Designed Prior to Mid 1980s
- All Light Duty Vehicles Built Since Mid 1980s are Fuel Injected and Computer Controlled
- All OEMs Specify Min 87 AKI Regardless of Altitude
- Working with ASTM Committee to Eliminate this Out-Of-Date Allowance
- Recommendation: EPA Regulations Should Specify 87 AKI Minimum for All U.S. Gasoline

Metallic Additives

- OEMs Have Long Opposed Metallic Additives
- Metallic Additives Increase Particulate Emissions During Combustion
- Results in Catalyst Plugging and Deposits in Engines and on Spark Plugs and Oxygen Sensors
- Deposits Cause Pre-Mature Spark Plug Failure, MIL Light Illumination, Higher Emissions and Loss of Fuel Economy
- Today's Catalysts Have High Cell Density (Grid 1000 per Square Inch or Higher); Fine Grid Susceptible to Plugging from Deposits
- Metallic Additives Banned in Federal Reformulated Gasoline and California Gasoline
- Metallic Additives Should be Banned in All U.S. Gasoline

Spark Plugs – No MMT



Spark Plugs With MMT



Catalyst Plugging

No MMT



With MMT



2001 MY; Close Coupled Catalyst; 600 Cell Density; 50,000 Miles (R) vs. 49,000 Miles (L)

Detergents

- Some Fuel Components (e.g. Olefins) Lead to Deposit Formation during Combustion
- Deposits Collect on Fuel Injectors, Valves, and Other Internal Engine Components and Can Lead to Higher Emissions
- The Clean Air Act of 1990 Provided for Gasoline Detergent Requirements
- EPA Adopted Detergent Regulations in Mid 1990s
- Detergency Levels Have Been Decreasing Over the Past Decade While the Stringency of Emissions Standards and Durability Periods Have Increased

Detergency Declining for Decade

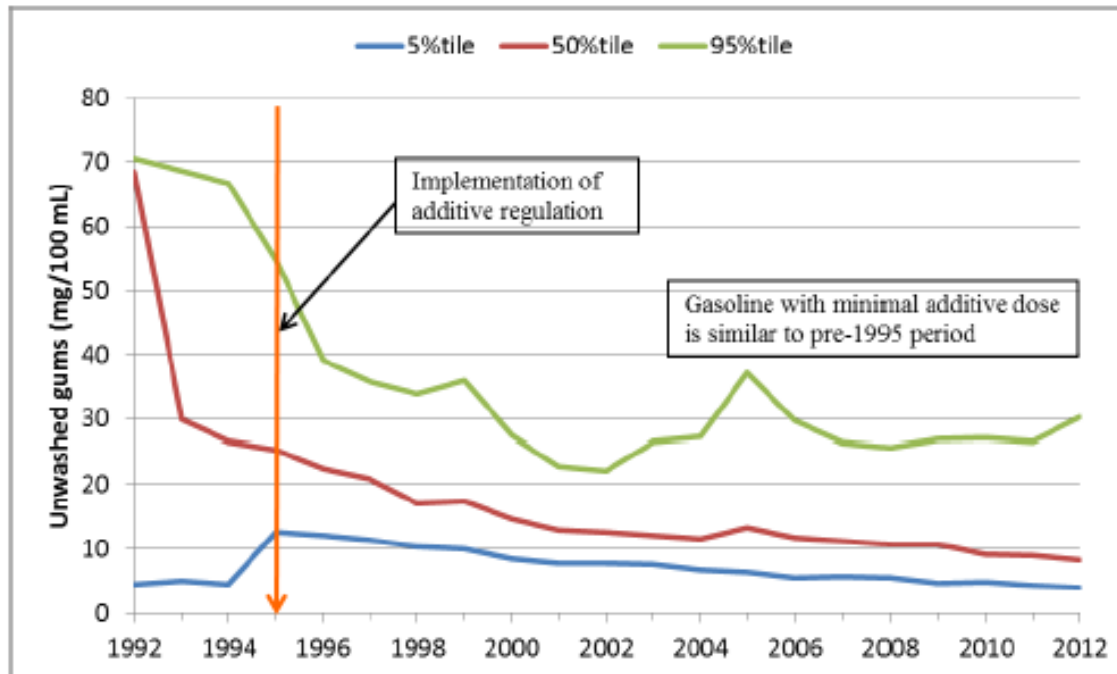


Figure 3: Trends in Unwashed Gum Levels (50-State)

(Source: Alliance of Automobile Manufacturer North American Surveys)

Heavy Aromatics

- Increasing Health Concerns for Fine Particles
- In Tier 3 EPA Proposes More Stringent PM Levels
- Studies Indicate that Heavy Aromatics Contribute Disproportionately to PM Emissions
- Heavy Aromatics (C10+) Content in U.S. Gasoline Averages about 5% (with FBP of 420°F)
- In Tier 3 EPA Lowering Certification Fuel Requirement to 4-5% C10+ (with FBP of 420°F)
- We Believe C10+ Content Should Be Capped at 2% with an FBP of 400°F

Renewable Fuels

- Energy Independence & Security Act of 2010
 - 36 Billion Gallons of Renewable Fuel by 2022
- Resulted in Increasing Volumes of Ethanol in Gasoline
- EPA Partial Waiver for E15 (2001+ MY Vehicles)
- Automaker Concerns
 - Legacy Fleet (pre 2013 MY) not Designed for E15
 - Misfueling of Older Vehicles
 - No Recourse for Manufacturers or Consumers
- Required Levels Could Force Further Changes in Fuel
- Fuel Changes Need to be Prospective, Not Retroactive, and Allow Sufficient Lead-Time for OEMs and Fuel Suppliers

Thank You