2009-2011 Compliance Report

Vehicle & Engine Compliance Activities











EPA

United States Environmental Protection Agency

EPA-420-R-13-006

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Vehicle & Engine Compliance Activities

United States Environmental Protection Agency
Office of Transportation and Air Quality
1200 Pennsylvania Avenue, NW
Washington, DC 20460

EPA-420-R-13-006
December 2013
www.epa.gov/otaq

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I. Forward by the Compliance Division Director

2009 – 2011 Compliance Report

This is the third in a series of vehicle and engine compliance reports issued by the U.S. Environmental Protection Agency (EPA) Office of Transportation and Air Quality (OTAQ). These reports offer a convenient reference to the data that OTAQ collects in implementing emissions regulations for vehicles, engines, and other motorized equipment. The environmental programs OTAQ implements apply to virtually every vehicle, engine and gallon of transportation fuel sold in the United States. It is our job to make sure that these regulated mobile sources comply with emissions and fuel economy requirements. OTAQ's role in ensuring comprehensive compliance is essential to realizing national air quality and public health goals.

This report updates and builds upon the data and information presented in the first two reports, the "2007 Progress Report on Vehicle and Engine Compliance Activities" (2007 Compliance Report) and the "2008 Progress Report on Vehicle and Engine Compliance Activities" (2008 Compliance Report). The 2009-2011 Progress Report on Vehicle and Engine Compliance Activities (2009-2011 Compliance Report) presents certification data and other types of information OTAQ collected for model years (MY) 2009 through 2011 and for calendar years 2009-2011[1].

OTAQ oversees a broad set of compliance activities to ensure that vehicle and engine manufacturers satisfy their regulatory obligations. These activities extend from pre- to post-production and range from issuing certificates of conformity before vehicles and engines enter commerce to monitoring in-use testing and reporting after they enter customer service. In addition to regulating vehicles and engines, EPA regulates motor vehicle fuels, including gasoline, diesel and renewable fuels such as ethanol and biodiesel. Please see EPA's fuels web site, http://epa.gov/otaq/fuels/, for further information about OTAQ's fuel compliance program.

We recommend that readers who are unfamiliar with EPA's mobile source emission control programs refer to the 2007 Compliance Report for additional background information, including descriptions of the vehicle, engine, and fuel categories EPA regulates.

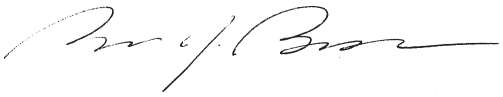
The 2009-2011 Compliance Report includes data from the following mobile source sectors: light-duty vehicles, highway motorcycles, heavy-duty highway engines, nonroad compression ignition engines, nonroad spark ignition engines and recreation vehicles.

[1] Some information is reported by model year while other types of information (e.g., recalls and defects) are reported by calendar year.

The purpose of the compliance reports is to offer a snapshot of compliance activity over a given time frame. The years covered by the 2009-2011 Compliance Report represent a period of significant transition in the mobile source program. Stringent new emission standards took effect for many vehicle and engine categories, including motorcycles, heavy-duty highway engines, nonroad compression-ignition and marine diesel engines, locomotives, small spark-ignition and marine spark-ignition engines, and recreational vehicles. In addition, EPA promulgated the first-ever mobile source greenhouse gas emission standards, beginning with a light-duty vehicle greenhouse gas rule in 2010. Heavy-duty highway greenhouse gas standards followed in 2011. The greenhouse gas regulations do not take effect until future years but manufacturers were already taking steps in the 2009-2011 timeframe to accrue early credits and to prepare for compliance mandates starting in the 2012 model year. The 2009-2011 time period was also notable for a rapid expansion of new certification and compliance activity in the recreational vehicle, and small nonroad and marine engines sectors, as well as an accelerating international dimension to EPA compliance oversight.

This report is also one of our deliverables on the President directives regarding the need for and importance of transparency. From the President's memo on Transparency and Open Government on www.whitehouse.gov: "Transparency promotes accountability and provides information for citizens about what their Government is doing. Information maintained by the Federal Government is a national asset." This report provides a broad range of partners and stakeholders access to the data collected and generated as part of the vehicle and engine certification and compliance program.

The highlights that follow provide additional examples of information that is available today and that is explained in more detail in the report.



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Highlight 1 – Certification

EPA issued nearly 4,000 certificates of conformity in each of model years 2009 - 2011. While it is typical for the number of certificates to fluctuate from year to year, the overall trend has been one of growth. EPA issued 2,520 certificates of conformity in 2000. Certification activity has increased significantly over the last decade.

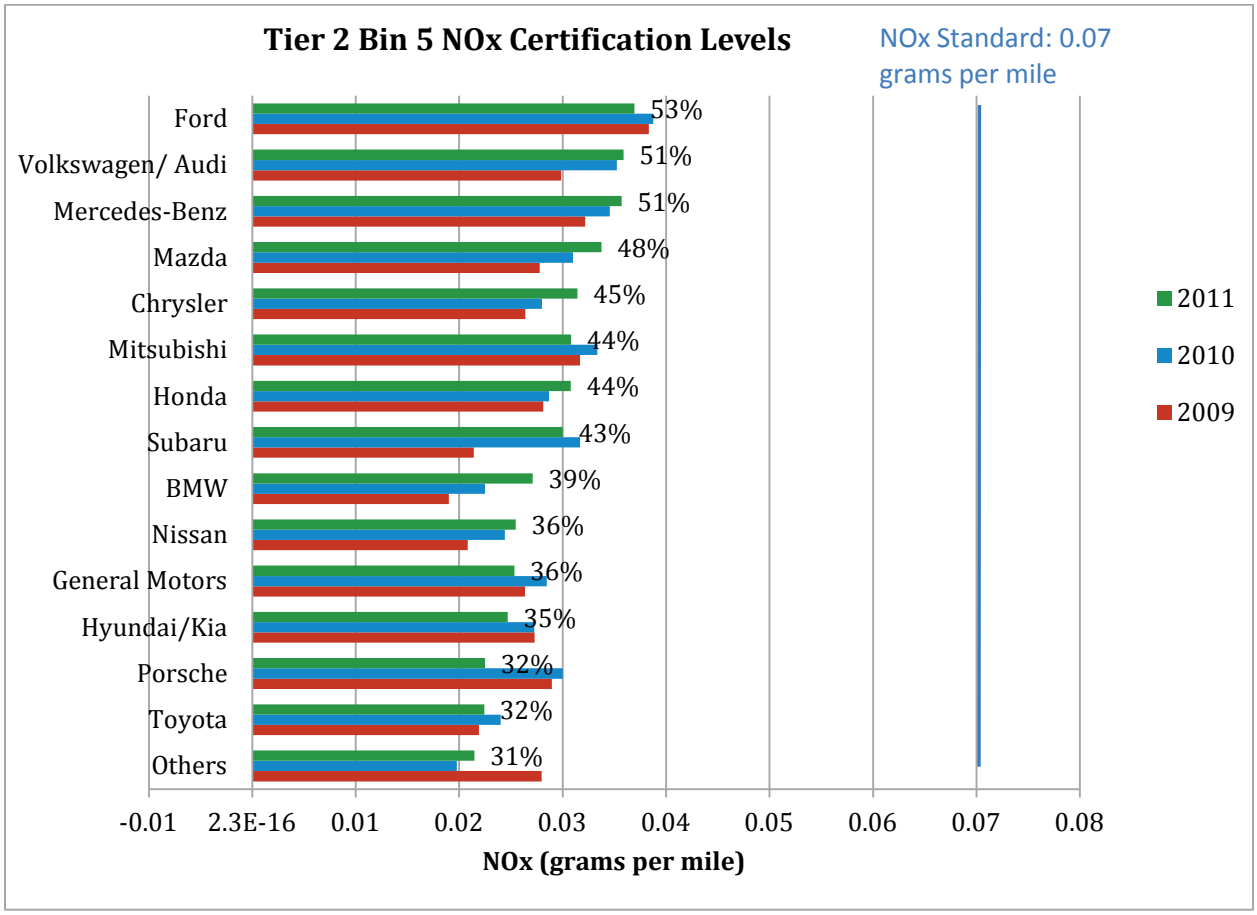
Figure F-1
Certificates of Conformity by Model Year

Industry Sector	Category	MY 2009	MY 2010	MY 2011
Light-Duty Vehicles	Passenger cars and trucks	507	489	464
	Independent commercial importers	21	15	11
	Alternative fuel conversions	74	55	227
Highway Motorcycles	On-highway motorcycles	460	399	337
Heavy-Duty Highway Engines	Compression ignition (mostly diesel)	90	44	52
	Spark ignition (mostly gasoline)	9	9	9
	Alternative fuel conversions	11	13	34
	Evaporative emissions	13	15	17
Nonroad Compression Ignition Engines	Diesel powered equipment, such as tractors, generators, construction equipment, forklifts, welders	616	648	568
	Diesel boats and ships	152	170	210
	Oceangoing vessels per International Maritime Organization requirements	28	37	53
	Locomotives	70	47	60
Nonroad Spark Ignition Engines	Small SI: Small nonroad gasoline powered equipment, such as lawnmowers, string trimmers, chain saws, small compressors, pumps, utility vehicles < 25 mph, snow blowers, rammers, and floor cleaners	1,160	1,020	985
	Marine SI: Gasoline boats and personal watercraft	124	117	124
	Large SI: Large nonroad gasoline powered equipment, such as forklifts, compressors, generators, and stationary equipment	89	124	140
	Evaporative components (mostly intended for small nonroad gasoline and marine gasoline equipment)	161	195	424
Recreational Vehicles	All-terrain vehicles	229	182	143
	Utility vehicles	13	15	23
	Off-highway motorcycles	62	58	46
	Snowmobiles	38	37	35
Total		**3,927**	**3,689**	**3,962**

Highlight 2 – Light-Duty Manufacturers Design to Exceed Standards

EPA confirmatory test results show high compliance margins among light-duty pre-production vehicles, meaning that their emission levels were significantly below the level the standards allow. For example, light-duty vehicle NOx emissions were about one half of the applicable 0.07 grams per mile NOx standard.

Figure F-2
MY 2009-2011 Tier 2 Bin 5 NOx Certification Levels and Compliance Margins by Manufacturer



Highlight 3 – In-Use Surveillance, Defect Reporting, and Recall Requirements Prevent Potential Problems in Millions of Vehicles and Engines

Manufacturers reported emission defects for a variety of components. The most prevalent defects reported involved onboard diagnostic systems, catalysts, particulate filters, turbochargers, and fuel delivery and exhaust systems. Manufacturers corrected a significant number of these defects through voluntary recalls.

From 2009 through 2011 manufacturers voluntarily recalled some 12 million cars (about 5% of registered light-duty vehicles) and, 900,000 heavy-duty highway engines (more than 20% of heavy-duty registered vehicles).

Highlight 4 - The Characteristics of Mobile Source Industries are Changing

The car and truck manufacturing sectors are dominated by relatively few very large companies. The more recently regulated nonroad, small engine, and recreational vehicle industries are different, with literally hundreds of very small manufacturers comprising the market. In the motorcycle industry, for example, about

one half of the model year 2009 - 2011 certificates were issued to manufacturers who produced a small number of engine families (grouped below as "Other").

Figure F-3
MY 2009-2011 Highway Motorcycle Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Piaggio Group Americas, Inc.	30	31	26
Yamaha Motor Corporation	31	27	28
American Suzuki Motor Corporation	30	23	14
American Honda Motor Co., Inc.	18	13	14
Kawasaki Motors Corp., U.S.A.	16	15	13
Carter Brothers Manufacture Co., Ltd.	9	12	9
Kymco USA	10	11	11
Harley-Davidson Motor Company	12	8	7
Ducati North America, Inc.	7	9	10
BMW	7	8	5
Qlink L.P.	7	7	4
Triumph Motorcycles America Ltd	6	6	7
Cobra Scooters	6	5	3
Big Bear American Made Choppers, Inc.	5	5	0
Xingyue USA, Inc	5	5	3
Other	261	214	183
Total	**460**	**399**	**337**

Furthermore, while the set of vehicle and engine manufacturers historically subject to EPA regulation had their headquarters and/or production facilities in the United States, today's manufacturers are based all over the world.

Figure F-4
MY 2009-2011 Construction and Agricultural Engine Families by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Japan	193	195	179
Germany	83	83	75
China	60	65	43
Italy	46	49	50
England	47	47	32
USA	43	47	21
Korea	31	36	27
India	23	25	22
Mexico	8	7	8
Sweden	8	2	9
Switzerland	7	11	3
France	8	7	2
Czech Republic	2	2	2
Austria	1	1	-

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Brazil	1	1	-
Belgium	0	0	-
Slovakia	-	4	4
Multiple countries[1]	50	59	43

Compliance Report Organization

This summary is followed by three chapters that cover the following topics:

- Chapter II, Scope of EPA's Vehicle, Engine, Equipment, and Fuel Compliance Programs, describes the laws that authorize EPA's mobile source compliance activity.
- Chapter III, Compliance Programs and Processes, describes the compliance programs and processes in more detail and provides compliance data and other information organized by industry sector. Please refer to Figure 1 for examples of the vehicles, engines, and equipment that are included in each industry sector.
- Chapter IV, Industry Statistics, presents some interesting statistics that are contained within the compliance information that EPA collects.

Figure 1 - Industry Sectors and Examples

Industry Sector	Examples	Key
Light-Duty Vehicles	Passenger cars, vans, SUVs, small trucks	
Highway Motorcycles	On-highway motorcycles, cruisers, choppers, scooters, touring bikes, mopeds, street bikes	
Heavy-Duty Highway Engines	Tractor-trailers (semi-trucks), buses, delivery and work trucks	

[1] "Multiple countries" means that engines within an engine family are manufactured in more than one country.

Nonroad Compression Ignition Engines (Nonroad CI)	Construction and agricultural equipment, such as tractors, generators, construction and road-work equipment, welders	
	Marine diesel boats and ships, oceangoing vessels	
	Locomotives	
Nonroad Spark Ignition Engines (Nonroad SI)	Small SI: lawnmowers, string trimmers, chain saws, small compressors, pumps, snow blowers	
	Marine SI: inboard and outboard motorboats, jet-skis	
	Large SI: forklifts, large compressors, generators	
	Evaporative components: hoses, fuel tanks	
Recreational Vehicles	All-terrain vehicles (ATVs), utility vehicles (UTVs), sand cars, dune buggies, go karts	
	Off-highway motorcycles	
	Snowmobiles	

II. Scope of EPA's Vehicle, Engine, Equipment, and Fuel Compliance Programs

A. Statutory Authority for EPA Regulation of Vehicles, Engines, Equipment, & Fuels

EPA derives authority to do its work through a variety of environmental statutes enacted by Congress. Figure 2 outlines the primary environmental statutes that give EPA the authority to develop and implement its mobile source clean air programs.

Figure 2 - Environmental Statutes

Statute	Authority
Clean Air Act (CAA)	Emission standards for highway & nonroad vehicles and their fuels
Energy Policy and Conservation Act (EPCA)	Fuel economy information programs for consumers, including vehicle fuel economy labels
Energy Policy Act (EPAct) Energy Independence and Security Act (EISA)	Annual volume standards for renewable fuel content

From locomotives to lawnmowers, EPA's Office of Transportation and Air Quality (OTAQ) has the authority to regulate nearly all engines and vehicles that emit pollutants into the environment. The statutory authority also covers the fuels that power these mobile sources, and includes responsibility for emissions compliance oversight that extends from initial product design to performance on the road or in the field.

B. Scope of EPA Vehicle, Engine, & Equipment Regulations

Compliance programs play an essential role in achieving the benefits of statutes and regulations. OTAQ oversees a comprehensive set of compliance activities to ensure that vehicle and engine manufacturers and fuel refiners and producers satisfy their regulatory obligations. EPA regulation of motor vehicles began in the 1970s; Figure 3 lists vehicle and engine regulations that were proposed or established since 2004. For a comprehensive list of EPA mobile source emission standards, refer to EPA's online Emission Standards Reference Guide, available at www.epa.gov/otaq/standards/index.htm. Please see Section II.C of this report for a list of regulations applicable to motor vehicle fuels.

Figure 3 - Vehicle and Engine Regulations and Implementation Dates

Affected Industry Sector/Category	Program/Rulemaking Description	Effective Model Year[2]
Light-Duty Vehicles	Tier 2 Emission Standards and Gasoline Sulfur Fuel Control – Strengthened emission standards for light-duty vehicles and significantly reduced sulfur levels in gasoline	2004
	On-Board Diagnostics (OBD) – Established new emissions system monitoring requirements for light-duty diesel vehicles	2005
	Revisions to Motor Vehicle Fuel Economy Labeling – Updated EPA method for determining fuel economy label values to better represent typical driving patterns and more accurately estimate actual consumer fuel economy	2008
	Mobile Source Air Toxics – Set standards to lower gasoline benzene content, reduce cold temperature exhaust emissions, and reduce evaporation and permeation from portable fuel containers	2010
	Clean Alternative Fuel Vehicle and Engine Conversions[3]– Updated anti-tampering provisions applicable to manufacturers of clean alternative fuel conversion systems for highway vehicles and engines	All[4]
	Light-Duty Greenhouse Gas (GHG) Emission Standards – Established the first mobile source emission standards for greenhouse gases including carbon dioxide, methane, and nitrous oxide	2012
	Revisions and Additions to Motor Vehicle Fuel Economy Label – Redesigned label provides new information on vehicle fuel economy, energy use, fuel costs, and environmental impacts for conventional and advanced technology vehicles	2013

[2] Effective model year refers to the first year of a new program. Many programs are phased in over multiple model years.
[3] This rule also applies to heavy-duty highway clean alternative fuel conversions.
[4] .Although the regulation took effect with its promulgation in 2011, because it applies to tampering, it applies to any model year that is subject to any emissions standard.

Affected Industry Sector/Category		Program/Rulemaking Description	Effective Model Year
Highway Motorcycles		Highway Motorcycle Exhaust Emissions- Class I and II: Established more stringent HC and added new optional hydrocarbons + oxides of nitrogen (HC+NOx) standards; Added Class 1a (<50cc) Class III: Established new Tier 1 HC+NOx standard Class III: More stringent Tier II HC+NOx standard Highway Motorcycle Permeation Emissions- Established new evaporative/permeation standards for fuel tank(s) and lines.	2006 2006 2010 2008
Heavy-Duty Highway Engines and Vehicles		Light Heavy-Duty OBD – Established OBD monitoring requirements for heavy-duty chassis certified vehicles, and for engines certified for use in heavy-duty vehicles between 8,500 and 14,000 pounds gross vehicle weight rating (GVWR) Heavy-Duty Highway Rule – Established more stringent exhaust emission standards for heavy-duty vehicles and engines; required Ultra Low Sulfur Diesel (ULSD) fuel (15 ppm sulfur maximum) Heavy-Duty Engines OBD Rule – New OBD monitoring requirements for engines certified for use in heavy-duty vehicles above 14,000 pounds GVWR Heavy-Duty GHG Standards – Established first emission standards for greenhouse gas pollutants from heavy-duty engines and heavy-duty vehicles	2004 2007 2010 2014
Nonroad Compression Ignition Engines & Equipment	Construction & Agricultural	Tier 3/Interim Tier 4 – Established more stringent emission standards for engines between 37 and 560 kilowatts (50 and 750 hp) Tier 4 Nonroad Diesel Rule – Established more stringent emissions standards for all engines greater than 19 kilowatts (25 hp) and lowered nonroad diesel fuel sulfur to 15 ppm maximum	2006 2010
	Marine Diesel Engines	Tier 3 and Tier 4 Emission Standards for Marine Diesel Engines – Established more stringent emission standards for newly built and remanufactured engines	2009
	Locomotives	Tier 3 and Tier 4 Emission Standards for Locomotive Diesel Engines – Established more stringent emission standards for newly built and remanufactured engines	2011

Affected Industry Sector/Category		Program/Rulemaking Description	Effective Model Year
Nonroad Spark Ignition Engines & Equipment	Small Spark Ignition Engines (Small SI)	Control of Emissions From Nonroad Spark Ignition Engines and Equipment – Established more stringent exhaust emission standards for Class I (MY2012) and Class II (MY2011) engines below 19 kilowatts and fuel permeation standards for all engines below 19 kilowatts	2011 2012
	Marine Spark Ignition Engines (Marine SI)	Control of Emissions From Nonroad Spark Ignition Engines and Equipment – Established first federal exhaust emission standards for sterndrive and inboard Marine SI engines and increased the stringency of exhaust emission standards for outboard and personal watercraft engines. Established new evaporative emission standards for all Marine SI engines	2010
	Large Spark Ignition Engines (Large SI)	New Emissions Standards for Large SI Engines – Established new emission standards, diagnostic capability and portable emission testing provisions Tier 1 Tier 2	 2004 2007
Recreational Vehicles		New Exhaust Emission Standards for RVs – Off-highway motorcycles, ATVs and UTVs Snowmobiles Tier 1 Tier 2 Tire 3 New permeation standards for fuel components	 2006 2006 2010 2012 2008
Aircraft[5]		Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures – Established more stringent NOx exhaust emission standards for aircraft engines NOx Emission Standards for Aircraft Gas Turbine Engines – Established new NOx emission standards for aircraft, engines consistent with international standards	2005 2012

[5] The Federal Aviation Administration has primary oversight responsibility for aircraft emissions compliance.

C. Scope of EPA Fuel Regulations

In addition to regulating vehicles and engines, EPA regulates motor vehicle fuels, including gasoline, diesel, and renewable fuels such as ethanol and biodiesel. Figure 4 describes both historical and current fuels programs and implementation dates. For a comprehensive list of ongoing fuels regulations, please visit http://www.epa.gov/otaq/fuels/publications.htm. Additional information can be found on the OTAQ website at http://www.epa.gov/otaq/fuels/index.htm. Please see Section II.B of this report for recent regulatory actions applicable to vehicles and engines.

Figure 4 - Fuels Regulations and Implementation Dates

Affected Fuel Type- *Applicable Fuel Producer or Importer*	**Program/Rulemaking Description**	**Effective Imple-mentation Date**
Motor vehicle fuels and fuel additives – *Gasoline and diesel refiners and importers, renewable fuel producers and importers, fuel additive producers and importers*	Fuels and Fuel Additives Registration System (FFARS) – Mandatory registration program for motor vehicle gasoline, diesel, and their additives sold in the U.S. Requires all fuel and fuel additive manufacturers to report the chemical composition of their products and other technical, sales and health effects information	1975
Gasoline – *Gasoline Refiners and Importers*	Volatility Standards – Limits the vapor pressure of gasoline sold at retail stations during the summer ozone season to reduce evaporative emissions from gasoline, which contribute to ground-level ozone formation	1989
	Oxygenated Fuel Requirements – Establishes fuel oxygen standards to reduce carbon monoxide emissions from motor vehicles during the winter season	1992
	Reformulated Gasoline (RFG) – Reduce smog-forming and toxic pollutants in U.S. cities with worst smog pollution	1995
	Tier 2 Emission Standards and Gasoline Sulfur Regulations Establishes stringent exhaust emission standards for all fuel types and limits fuel sulfur levels to an average of 30 ppm	2004
	Mobile Source Air Toxics Regulations – Limits the benzene content of gasoline and reduces toxic emissions from passenger vehicles and gas cans	2011
Diesel – *Diesel Producers and Importers*	Highway, Nonroad, Locomotive, and Marine Regulations – Suite of rules for highway, nonroad, locomotive, and marine diesel engines that requires ultra-low sulfur diesel (ULSD), 15 ppm maximum	2006

Affected Fuel Type- *Applicable Fuel Producer or Importer*	**Program/Rulemaking Description**	**Effective Imple-mentation Date**
Renewable Fuels (e.g. ethanol, biodiesel) – *Gasoline Refiners and Importers, Renewable Fuel Producers, Importers, Exporters, Marketers, and Blenders*	The Renewable Fuel Standard (RFS) – RFS1 – Regulations established under the Energy Policy Act (EPAct) of 2005 required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012. RFS2 – Regulations established under the Energy Independence and Security Act (EISA) of 2007 expanded upon RFS1. The RFS2 regulations require renewable fuel to be blended into both gasoline and diesel fuel, as well as jet fuel and heating oil in volumes that increase from 9 billion gallons in 2008 to 36 billion gallons in 2022.	2007 2010

III. Compliance Programs and Processes

A. Overview

EPA uses a variety of testing and reporting programs to monitor compliance with emissions regulations. The programs may apply to vehicles and engines before they are produced (preproduction), while they are in production and after they are in customer service (postproduction). EPA has the authority and flexibility to choose compliance strategies that best fit an industry sector at any given time. Factors that influence the use of a particular compliance approach include regulatory requirements affecting a given industry sector, the technology being used to meet the emission standards, industry-specific production processes and cycles and sector or manufacturer size. This report describes compliance programs and activities that OTAQ conducted in 2009 - 2011. Specifically, the report presents data we collected and analyzed pertaining to MY 2009 - 2011 vehicles and engines, as well as test results and other types of information OTAQ obtained during calendar years 2009-2011.[6]

EPA regulations typically give manufacturers some flexibility about how they will achieve emissions compliance. Examples include emissions standards phase-ins, averaging, banking and trading (ABT) programs and several types of exemptions. This regulatory flexibility enables manufacturers to align their business model with emissions requirements and sometimes allow manufacturers to earn credit for introducing new technologies early. At the same time, some regulatory flexibilities introduce challenges to compliance oversight because vehicles and engines subject to one regulation and set of standards may legally certify to different emissions levels. This report includes some discussion of flexibility provisions and presents data showing how manufacturers are using them.

[6] This report presents the data we have received and compiled as of the date of publication. In some cases data sets may be incomplete due to agency workload constraints, manufacturer under-reporting or error, and/or other issues. EPA continues to work with manufacturers to improve compliance with all requirements. Failure to comply with the applicable regulations, including failure to comply with all reporting requirements represents a violation of law that may result in enforcement action.

EPA mobile source compliance programs allow for vehicle and engine testing and other compliance activity that can generally be parsed into three life-cycle categories:

Preproduction activities include certification testing and reporting and other compliance processes conducted before vehicles and engines are produced.

Production activities include audits and other compliance testing conducted on vehicles and engines coming off the production line, but before they enter customer service.

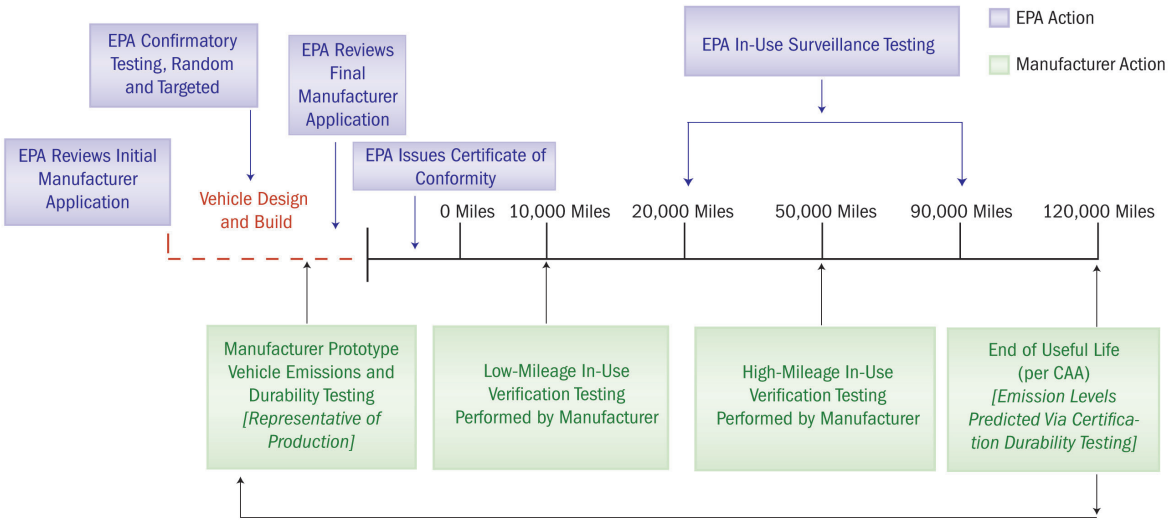
Postproduction activities include in-use testing and reporting and other compliance processes conducted after vehicles and engines enter customer service.

Figure 5 provides how EPA's compliance programs are related to one another.

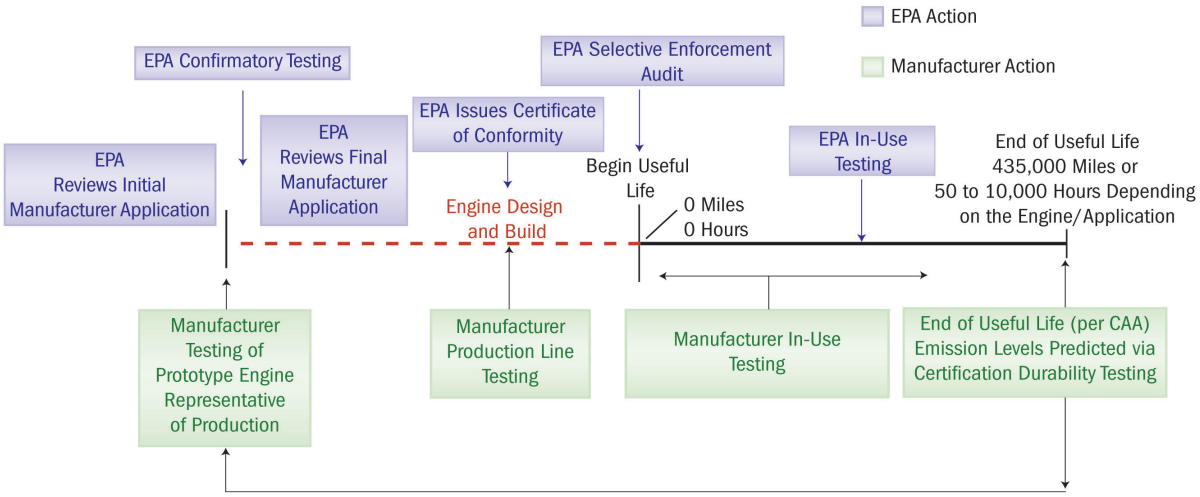
Figure 5 - Compliance Schedule Examples

EPA's mobile source compliance processes seek to ensure that the vehicles and engines are fully compliant with emissions standards throughout their full useful life. This is accomplished with a variety of testing programs and other requirements that occur over the life of vehicles and engines. This figure shows example compliance schedules for certain sectors. Other mobile source sectors may differ with regard to the timing but generally follow similar protocols.

Compliance Schedule for Light-Duty Vehicles



Compliance Schedule for Certain Heavy-Duty Highway and Nonroad Engines



1. Preproduction Programs

CERTIFICATES OF CONFORMITY

Section 206 of the Clean Air Act (CAA) requires all engines and vehicles to be covered by a certificate of conformity before they can enter commerce. A certificate of conformity is a license to produce products for one model year constant with the vehicle description and any terms of the certificate. Certificates of conformity are generally issued to a group of vehicles or engines having similar design and emission characteristics. For light-duty vehicles, certificates are issued for each unique combination of exhaust test group[7] and evaporative family. For heavy-duty vehicles and nonroad equipment subject to engine standards, the unit of certification is called an engine family. Test groups and engine families may include multiple models. Conversely, different versions within a given model may be included in different engine families or test groups.

Figure 6 shows the number of certificates that EPA issued in MY 2009 - 2011. It is typical for the number of certificates to fluctuate from year to year. The drop in total certificates in model year 2010 may have reflected the downturn in the global economy at that time. Overall the trend has been one of growth: certification activity has increased significantly over the last decade. (In 2000 EPA issued 2,520 certificates of conformity.)

[7] An exhaust test group is a group of vehicle models with similar engines, drive trains and emission control systems. It represents a group of vehicles or engines that have a similar design and emission characteristics.

Figure 6 - Certificates of Conformity by Model Year

Industry Sector	Category	MY 2009	MY 2010	MY 2011
Light-Duty Vehicles	Passenger cars and trucks	507	489	464
	Independent commercial importers	21	15	11
	Alternative fuel conversions	74	55	227
Highway Motorcycles	On-highway motorcycles	460	399	337
Heavy-Duty Highway Engines	Compression ignition (mostly diesel)	90	44	52
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	Large SI: Large nonroad gasoline powered equipment, such as forklifts, compressors, generators, and stationary equipment	89	124	140
	Evaporative components (mostly intended for small nonroad gasoline and marine gasoline equipment)	161	195	424
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Total		**3,927**	**3,689**	**3,962**

STATIONARY SOURCES-

OTAQ assists EPA's Office of Air Quality Planning and Standards with certification procedures for stationary engines. Stationary engines are used either in a fixed application or in a portable (or transportable) application where the engine resides at a single site for at least one year. A given engine may be certified as a mobile engine, stationary engine, or both. In 2009, of the 89 certificates of conformity for the nonroad large spark ignition engine sector, 16 were for mobile-stationary applications and 17 were for stationary-only applications. The remaining 56 certificates were for mobile-only applications. In 2010, of the 124 certificates of conformity for the nonroad large spark ignition engine sector, 21 were for mobile-stationary applications and 56 were for stationary-only applications. The remaining 47 certificates were for mobile-only applications. In 2011, of the 140 certificates of conformity for the nonroad large spark ignition engine sector, 37 were for mobile-stationary applications and 64 were for stationary-only applications. The remaining 39 certificates were for mobile-only applications. Of the certificates of conformity issued for engines in the nonroad compression ignition diesel powered equipment sector (616 in MY 2009, 648 in MY 2010 and 461 in MY 2011), 128 in MY 2009, 209 in MY 2010 and 189 in MY 2011 were for mobile-stationary engines. In both 2009 and 2010 only 5 engines were certified as stationary-only engine families while 43 engines were certified as stationary-only engine families in 2011.

APPLICATION FOR CERTIFICATION

The certification process begins when a manufacturer submits an application for certification to EPA. Applications cover an exhaust test group or engine family that represents a group of vehicles or engines having similar design and emission characteristics. EPA requires manufacturers to provide detailed information in the certification application to show that the vehicles or engines meet all of the applicable emissions requirements and to describe the vehicles or engines to be covered by the certificate of conformity. Each certificate covers only those vehicles or engines specifically described in the application. The list below summarizes the general types of information and data that manufacturers submit to begin the application process:

- A description of the basic engine design and list of distinguishable configurations to be covered by the certification application.
- An explanation of how the emission control system operates
- A description of the vehicle or engine being used to represent the group for certification testing.
- A description of the test procedures and equipment used to test the vehicle or engine
- All emission data obtained on each test vehicle or engine
- The emission deterioration characteristics for each regulated pollutant over the useful life of the vehicles and engines covered by the certification application
- The predicted production volumes of each configuration to be covered by the certificate

• An unconditional statement attesting that vehicles or engines covered by the certification application comply with all requirements of the applicable regulation and the CAA

• Manufacturer representative and official company contact information

• Durability groupings (i.e., groups of vehicles/engines with similar emission deterioration and emission component durability)

• Durability test procedures

• Description of each test group or engine family which is represented by the durability test vehicle or engine

• Description of vehicles or engines used to demonstrate emissions and emission control component durability

• List of all test results, official certification levels, and the applicable emission standards for each vehicle or engine tested

• Statement of compliance with the applicable emission standards for all other configurations not tested but represented by the test vehicles or engine and covered by the certification application

• Evaporative emissions system information

• Description of the evaporative, permeation or refueling families covered by the certification application and test results demonstrating compliance with the applicable standards

• Information on emission control diagnostic systems, where applicable

CONFIRMATORY CERTIFICATION TESTING

Manufacturers conduct the initial testing to support an application for a certificate of conformity and report the results to EPA. Subsequent certification testing, called confirmatory testing, occurs after an application has been submitted. Confirmatory tests are performed by either the manufacturer or by EPA and serve to validate the manufacturer's initial emissions or fuel economy test results.

2. Production Programs

The objective of compliance activities that occur during production is to confirm that vehicles and engines coming off production lines match specifications set forth in the certificate of conformity. In other words, production programs are designed to verify that manufacturers are actually producing the same vehicle or engine that they certified. Some mobile source regulations call for routine production line testing. EPA may also audit production vehicles and engines without prior notice using selective enforcement audits.

3. Postproduction Programs

IN-USE COMPLIANCE PROGRAMS

In-use compliance programs track emissions performance of production vehicles or engines after they enter customer service. In-use testing programs are conducted by both EPA and manufacturers.

DEFECT REPORTING PROGRAMS

Manufacturers are required to report emission-related defects to EPA. An emission-related defect is a defect in design, materials or workmanship in a device, system or assembly, as described in the approved application for certification. Manufacturers must report a defect even if it does not increase emission levels. EPA regulations generally establish minimum numbers of confirmed defects that trigger defect information reporting requirements. An emission-related defect does not necessarily lead to an emission recall because not all defects in emission-related parts increase emissions.

RECALL PROGRAMS

An emissions recall is a repair, adjustment or modification program conducted by a manufacturer to remedy an emission-related problem. Vehicle and engine manufacturers are required to design and build their products to meet emission standards for the useful life of the vehicle or engine specified by law. Under Section 207(c)(1) of the CAA, if EPA determines that a substantial number of vehicles or engines in a category or class do not meet emission standards in actual use, even though they are properly maintained and used, EPA can require the manufacturer to recall and fix the affected vehicles and engines. EPA may use a variety of data sources including EPA and manufacturer test results to determine that a recall is necessary. The purpose of a recall is to make sure the problem gets fixed and thereby prevent excessive pollution from vehicles or engines that are already in customer service. When an emissions recall occurs, the manufacturer must notify vehicle owners and provide instructions about how to have their vehicle repaired. Most recalls are initiated voluntarily by manufacturers once potential noncompliance is discovered; however, EPA also has the authority to order the manufacturer to recall and fix noncompliant vehicles or engines if the manufacturer declines to implement a voluntary recall.

4. Regulatory Flexibility Programs

EPA builds flexibility into its emissions regulations to increase compliance efficiency, decrease costs and encourage manufacturers to introduce new technologies.

AVERAGE BANKING AND TRADING (ABT) PROGRAMS

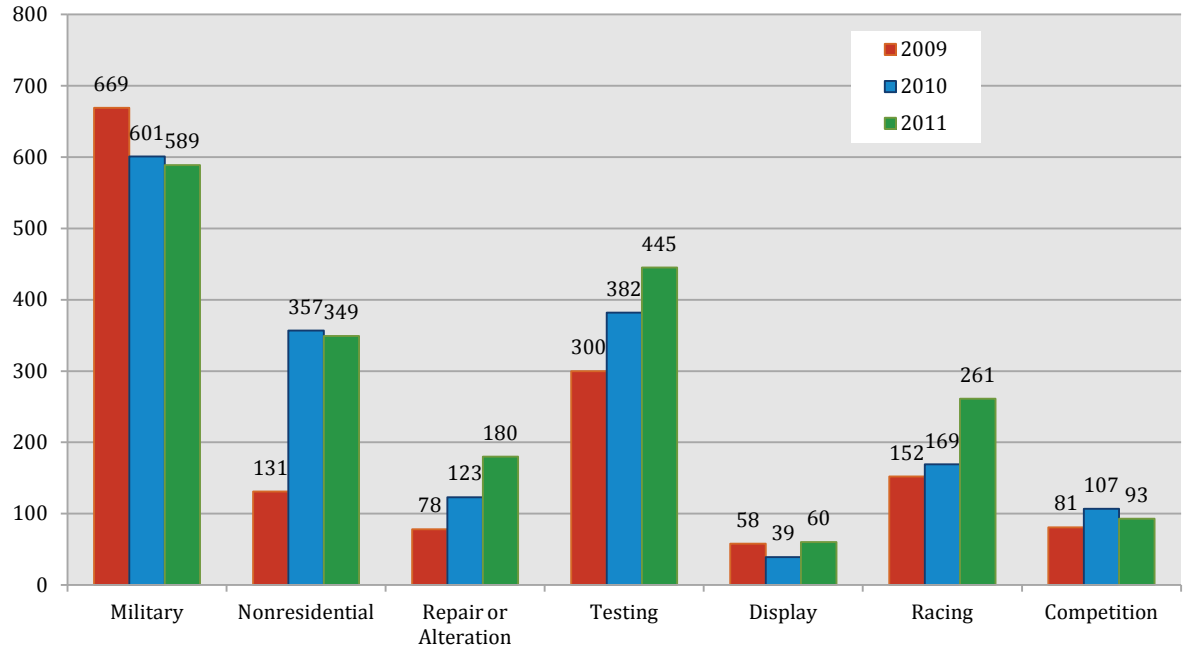
Average Banking and Trading (ABT) provisions allow manufacturers to meet an overall fleet average standard instead of an individual vehicle or engine standard. Manufacturers may comply with ABT provisions by certifying some vehicles and engines at levels above the emission standard, provided that these emission “deficits” are offset by positive credits from vehicles and engines certified below the standard. Compliance is determined by calculating the manufacturer’s fleet-wide average of each exhaust test group’s production or sales volume and emission level. The flexibility to meet fleet average emission standards by ABT credits can facilitate earlier introduction of clean technology into the market.

The Transition Program for Equipment Manufacturers (TPEM) recognizes a potential challenge that can face equipment manufacturers when new emission standards take effect. If engines, of which there are relatively few designs, must be redesigned to achieve the required emission reductions, equipment powered by those engines, of which there could be 10,000 or more designs, may also need to be redesigned. TPEM permits equipment manufacturers a transition period during which they may continue to use a limited number of engines meeting previous standards while they update product designs to accommodate engines meeting the new standards.

5. Exemption Programs

Vehicles and engines imported into the United States may be eligible for an exemption from federal emission requirements. For example, vehicles belonging to military personnel or nonresidents may be eligible for exemption. Vehicles that are being imported for testing or display may also be exempt. Depending on the type of exemption, importers must request written EPA approval in advance. EPA works with the Department of Homeland Security U.S. Customs and Border Protection to ensure that proper approvals have been issued before vehicles and engines may enter the United States. The majority of the 1,469 import exemptions EPA issued in 2009, the 1,778 exemptions issued in 2010 and the 1,732 exemptions issued in 2011 were for light-duty vehicles (less than 0.02%). The majority of exemptions EPA issued for heavy-duty highway and nonroad engines or equipment were for test programs. EPA issued 90 heavy-duty or nonroad exemptions in 2009, 158 in 2010 and 245 in 2011 (less than 0.05%). An exemption may cover multiple vehicles and/or engines. Figure 7 summarizes the exemptions that EPA issued in calendar years 2009 – 2011.

Figure 7 - Vehicle and Engine Exemptions



B. Light-Duty Vehicles

SECTOR PROFILE:

- The light-duty vehicle sector includes passenger vehicles such as cars, vans, SUVs, and light-trucks
- Light-duty vehicles have been subject to increasingly stringent emissions and fuel economy standards since the 1970s
- Primary emission standards in effect for MY 2009-2011 are Tier 2 emission standards for HC, CO, NOx, and PM

PRIMARY COMPLIANCE ACTIVITIES IN 2009 -2011:

- Certification and fuel economy
- EPA and manufacturer confirmatory and in-use testing
- Defect reporting
- Recall
- Early credit for reducing greenhouse gas emissions described here.

CERTIFICATION

EPA issued about 500 certificates to light-duty vehicle[8] original equipment manufacturers (OEMs) each year in MY 2009 - 2011 (see Figure 6). Figure 8 shows the number of certified test groups for MY 2009 - 2011 by manufacturer.[9]

PRODUCTION VOLUME

Figure 9 presents by manufacturer the number of MY 2009-2011 cars and light-duty trucks produced for sale in the United States.[10] A comparison of Figures 8 and 9 shows that there is not always a correlation between the number of test groups a manufacturer certifies and the number of vehicles the manufacturer produces. Manufacturers with the most certified test groups do not necessarily produce the most vehicles.

[8] Some heavy-duty vehicles that are between 8,500-14,000 pounds GVWR are chassis-certified and are included in the light-duty vehicle certificate count.

[9] Each light-duty vehicle certificate covers a unique combination of exhaust test group and evaporative emissions family. Therefore the number of light-duty certificates and test groups is usually different. Manufacturers may create test groups that include both cars and trucks.

[10] These production data only include vehicles subject to Corporate Average Fuel Economy standards.

Figure 8 - MY 2009-2011 Light-Duty Vehicle Test Groups by Manufacturer[11]

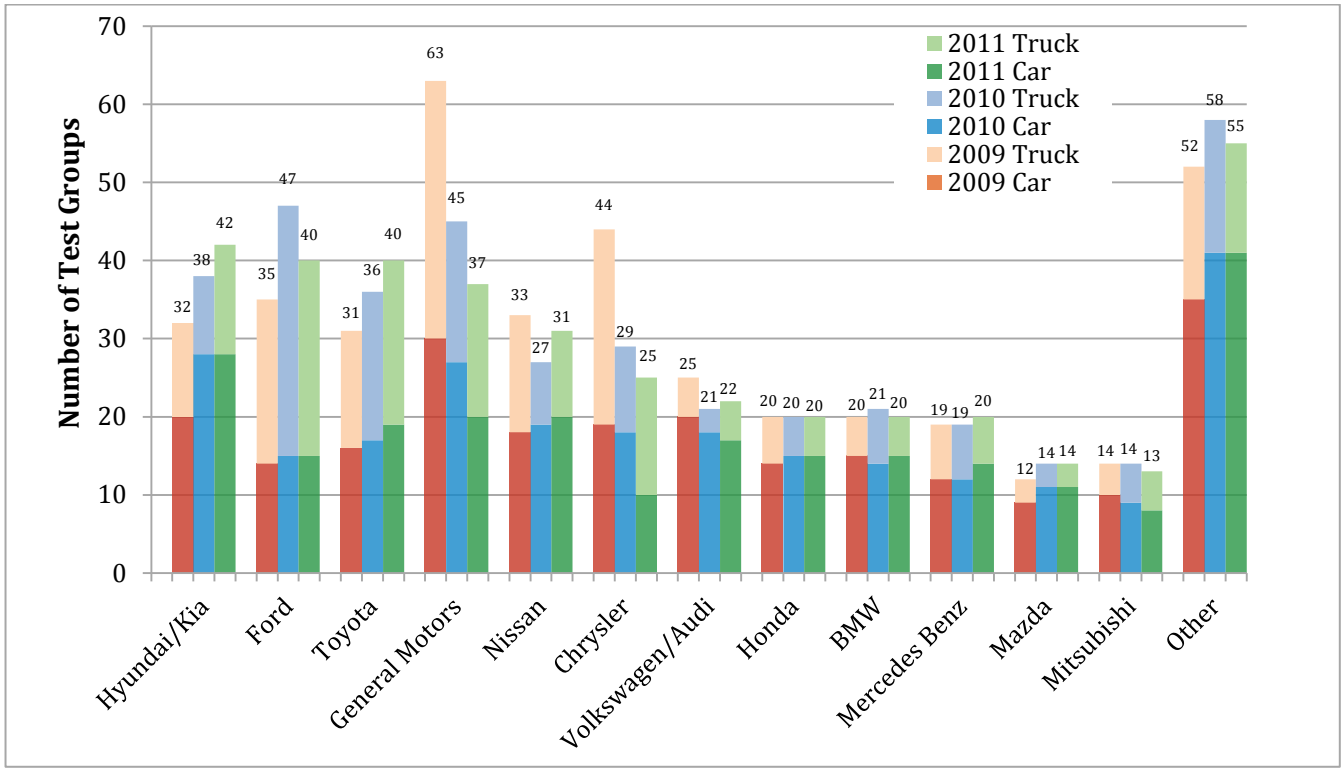
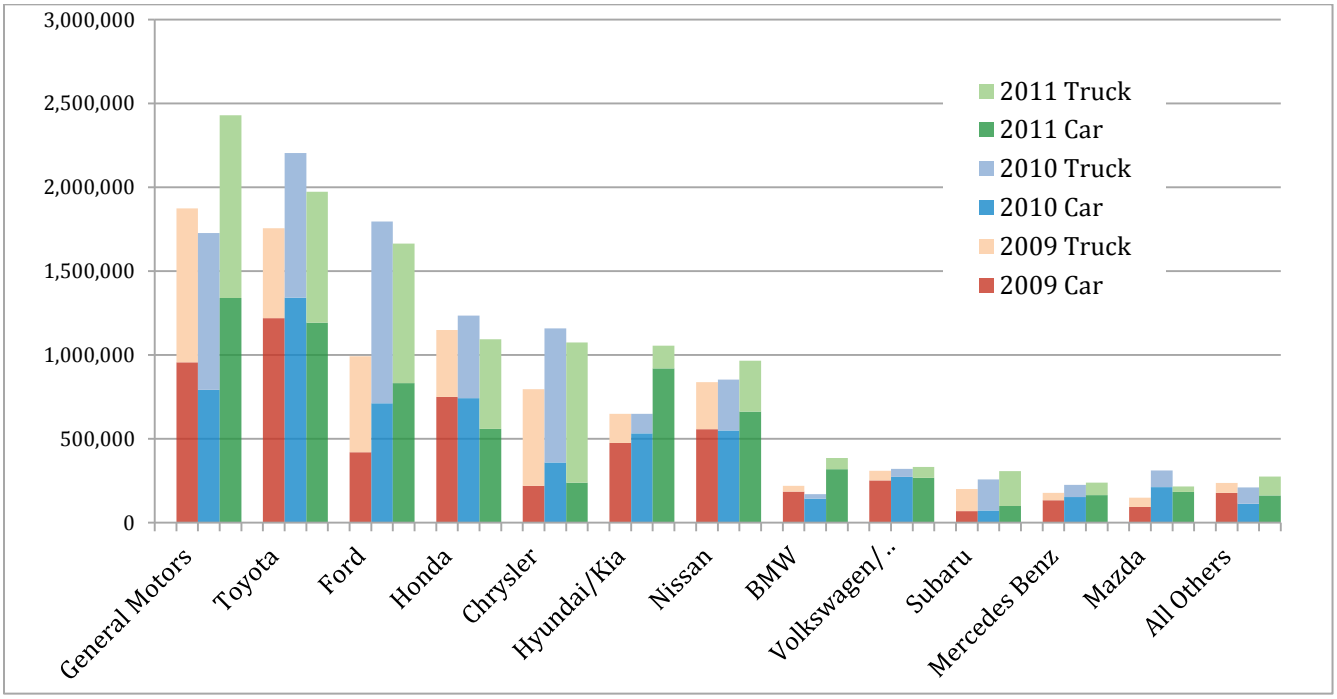


Figure 9 - MY 2009-2011 Light-Duty Production Volume by Manufacturer



[11] In MY 2010, two manufacturers created test groups that included both cars and trucks. One General Motors car/truck test group and two BMW car/truck test groups are counted under the "MY 2010 Car" category in Figure 8.

CONFIRMATORY TESTING

EPA and manufacturers test pre-production vehicles and engines prior to their introduction into commerce to confirm initial manufacturer emission test results. When a vehicle fails a confirmatory test, the manufacturer is allowed one retest to confirm or refute the failure. If the vehicle passes on retest, the retest is deemed the official certification test and the results from the retest stand as the official emission levels for that vehicle. Sometimes a confirmatory test failure can be attributed to problems that render the test vehicle unrepresentative of production vehicles. In those situations, the manufacturer corrects the problem in the test vehicle and retests. In still other cases, failures over the confirmatory test reflect actual engineering problems. These types of failures usually result in manufacturer action to change the vehicle calibration and update the certification application accordingly, resulting in a quantifiable emissions reduction for the vehicles that are ultimately produced. Regardless of whether a confirmatory test failure is due to problems with the test vehicle or problems with the calibration, the problems must be corrected and the vehicle must pass confirmatory testing before EPA will issue a certificate.

FUEL ECONOMY TESTING

EPA and manufacturers perform confirmatory testing for both emissions and fuel economy validation purposes. Fuel economy test results are the source for information that appears on new vehicle fuel economy labels and that EPA and the U.S. Department of Transportation use to assess compliance with corporate average fuel economy (CAFE) standards.

On May 7, 2010, EPA and the National Highway Safety Administration (NHTSA) published a final rule to regulate carbon dioxide (CO_2) and other GHG emissions from light-duty vehicles. The greenhouse gas and fuel economy standards apply to passenger cars, light-duty trucks and medium-duty passenger vehicles, covering model years 2012 through 2016. The program design enables manufacturers to use a single data set to satisfy both greenhouse gas and CAFE compliance requirements. EPA has been working with manufacturers to implement these regulations and expects to begin reporting greenhouse gas data as the program matures.

EPA reports fuel economy test data in an annual Fuel Economy Trends Report[12] which includes both laboratory test value results and results adjusted for real-world driving conditions.

[12] See http://www.epa.gov/oms/fetrends.htm for the latest Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends Report.

DURABILITY TESTING

The CAA requires EPA emission standards to apply for the full useful life of the vehicle. Since emissions may degrade as vehicles age and accrue miles, manufacturers must perform durability testing to demonstrate that a vehicle will remain compliant for its full useful life, despite any deterioration that may occur over time. EPA regulations establish processes by which manufacturers may demonstrate durability using standard or custom methods. All the other manufacturers chose to use proprietary methods to estimate. Manufacturers who use their own durability aging procedures must provide EPA with an "equivalency factor" that enables comparison between the proprietary method and the published, standard EPA method. This allows a third party who relies on the EPA method to replicate the manufacturer's method.

IN-USE COMPLIANCE TESTING

Both EPA and manufacturers conduct testing to monitor in-use vehicle emissions. EPA conducts in-use vehicle surveillance testing at the National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan. The purpose of the EPA surveillance program is to assess emissions performance a few years after vehicles enter the fleet. EPA typically recruits two- or three-year-old vehicles from volunteers in southeast Michigan. EPA selects vehicles for surveillance both randomly and based on certification data, manufacturer in-use verification data, vehicle production volume, new technology, and public complaints and inquiries. In both 2009 and 2010, EPA selected about 45 classes per year for surveillance and generally tested three vehicles from each selected class. In 2011 EPA selected 50 classes and tested two vehicles per class. If any of the initial vehicles within a class failed a test, EPA recruited additional vehicles from that class for follow-up testing to determine whether an emissions problem was likely to exist and was not an artifact of the small sample size (or even a single defective vehicle).

EPA also conducts an in-use confirmatory testing program for vehicle classes that merit closer scrutiny. These classes may be indentified through failures in either EPA in-use surveillance or manufacturer in-use testing programs.

Figure 10 on the next page shows the vehicle model year, manufacturer, and carline selected for EPA surveillance testing in 2009 - 2011.

Figure 10 - Vehicles Tested in EPA's In-Use Testing Program in 2009-2011

Model Year	Manufacturer	Model
Surveillance Classes		
2005	Hyundai	Elantra (2.0)
2005	Volkswagen	Touareg (3.2)
2006	BMW	M3, M3 CONVERTIBLE (3.2)
2006	Chrysler	Jeep Liberty 2WD/4WD (3.7)
2006	Ford	Freestar Wagon FWD (4.2); F150 2WD (5.4)
2006	General Motors	Trailblazer, Rainier, Envoy (6.0); Chevrolet Colorado, Canyon, Isuzu I280 (2.8)
2006	Honda	Pilot 2WD (3.5)
2006	Mercedes Benz	E320 CDI (3.2)
2006	Porsche	Carrera (3.8)
2006	Toyota	Scion XB (1.5)
2006	Volkswagen	Jetta (1.9)
2007	Audi	Audi Q7 and Touareg (4.2)
2007	BMW	328i, 328xi (3.0); Mini Cooper (1.6)
2007	DaimlerChrysler	Dodge Caliber (2.4); Pacifica (4.0); Wrangler 2WD,4WD (3.8); Nitro 2WD (3.7)
2007	Ford	Expedition 2WD, Navigator 2WD (5.4); Lincoln-Mercury, MKZ AWD/FWD (3.5); 500 FWD (3.0)
2007	GM-Daewoo	Aveo (1.6)
2007	General Motors	Saturn Outlook 4WD & AWD (3.6); Several 5.3L vehicles; Chevrolet Malibu (2.4); Chevy Impala (3.5); Saab 9-3 (2.3);
2007	Honda	Fit (1.5)
2007	Hyundai	Tucson (2.7)
2007	Jaguar	Jaguar S-type, VDP, XJ8, XK (4.2)
2007	Kia	Sedona, Hyundai Entourage (3.8)
2007	Mazda	CX-7 (2.3); Mazda 3 (2.3);
2007	Mercedes Benz	HL450 4Matic (4.6)
2007	Mitsubishi	Outlander 2WD 4WD (3.0); Galant (2.4)
2007	Nissan	Altima (2.5); Frontier 2WD & 4WD (4.0); Versa (1.8); Frontier (2.5)
2007	Subaru (Fuji)	Impreza AWD, Wagon/Outback (2.5)
2007	Toyota	Camry Hybrid (2.4); Corolla (1.8); Lexus: LS 460, LS 460L (4.6); Sienna (3.5)
2007	Volvo	XD 90 AWD, XC 90 FWD (3.2)
2008	Audi	Audi A6 (3.1); Passat, Gtt, Jetta Passat (2.0)
2008	BMW	335 (3.0)
2008	Chrysler	Jeep Liberty 4WD (3.7); Dodge Dakota 2WD & 4WD (3.7); Charger (5.7)
2008	Ford	F150 (5.4); Focus (2.0); Escape Hybrid (2.3); F150 XL FFV (5.4); Explorer 4WD (4.0)
2008	General Motors	GM Chevrolet Cobalt (2.4); C15 Silverado 2WD (4.3); Saturn Astro (1.8); Yukon Denali + XL (6.2);
2008	GM-Daewoo	Suzuki Forenza Reno (2.0)
2008	Honda	Accord (2.4); Civic Hybrid (1.3); Odyssey (3.5)
2008	Hyundai	Tucson 2WD, 4WD (2.7)
2008	Kia	Kia Rondo (2.4)

Model Year	Manufacturer	Model
Surveillance Classes		
2008	Land Rover	LR2 (3.2)
2008	Mazda	CX-9 2WD, 4WD (3.7)
2008	Mercedes Benz	C300,C350,CLK350,E350 (3.5)
2008	Mitsubishi	Lancer (2.0)
2008	Nissan	Versa (1.8)
2008	Subaru (Fuji)	Impreza (2.5)
2008	Toyota	Toyota Lexus GX470 (4.7); Lexus IS 250 (2.5); Camry (2.4)
2009	Audi	A4, A5, Quattro (2.0)
2009	BMW	335 CI, 335 I (3.0)
2009	Chrysler	Dodge Caravan (3.8); Dodge Ram 1500 (5.7); Dodge Journey (4.0); Dodge Charger (3.5); Dodge Ram 1500 (4.7)
2009	Ford	F150 FFV (5.4); Escape Hybrid (2.5); Escape (2.5); Focus (2.0); Fusion (3.0); F150 (5.4)
2009	General Motors	Saab 9-3 (2.3); Chevrolet Malibu (2.4); Saturn Vue Hybrid (2.4); Chevrolet HHR (2.4); Chevrolet C15 Silverado (5.3); Envoy, Trailblazer (4.2)
2009	Honda	Pilot (3.7); CR-V (2.4); Civic (1.8); Accord (2.4)
2009	Hyundai	Sonata (2.4); Santa Fe (2.7)
2009	Kia	Optima (2.4); Rio (1.6); Sportage (2.0)
2009	Land Rover	LR3, Range Rover Sport (4.4)
2009	Mazda	Mazda 5 (2.3)
2009	Mercedes Benz	Smart for 2 (1.0)
2009	Mitsubishi	Galant (2.4); Eclipse and Eclipse Spyder (2.4)
2009	Nissan	350Z (3.5); Murano (3.5); Versa (1.8)
2009	Subaru (Fuji)	Subaru Forester (2.5); Outback Wagon (3.0)
2009	Suzuki	SX4 (1.9)
2009	Toyota	Sienna (3.5); Highlander Hybrid (303); Yaris (1.5); Corolla (1.8); Camry Hybrid (2.4)
2009	Volkswagen	Jetta (2.5)
2009	Volvo	C30, C70, S40, V50 (2.4)

In addition to its own in-use testing, EPA uses data from the mandatory manufacturer run In-Use Verification Program (IUVP) to monitor in-use light-duty vehicle emissions performance. IUVP tests are required at low mileage (between 10,000 and 50,000 miles) and high mileage (greater than 50,000 miles). Manufacturers must complete low mileage IUVP testing one year after the end of production and complete high mileage IUVP testing five years after the end of production. Figure 11 on the next page shows a sample IUVP test schedule for a MY2010 vehicle.

Figure 11 - Example of IUVP Testing Process for a MY 2010 Vehicle

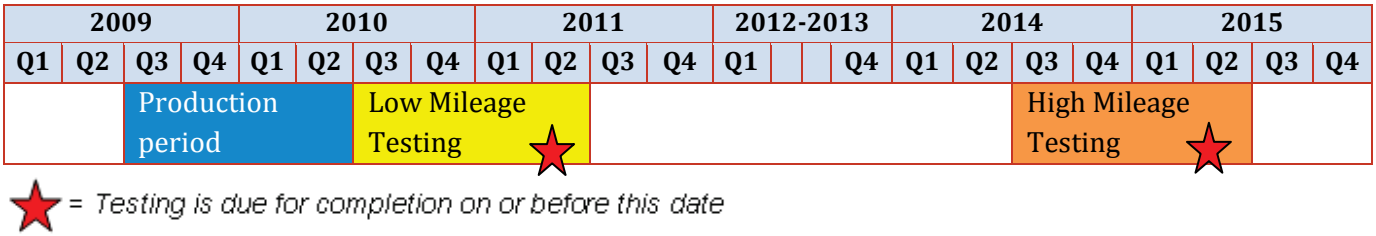


Figure 12 shows the total number of vehicles tested over each test procedure and their corresponding failure rates by vehicle model year for all IUVP testing conducted and reported through January 2011.

Figure 12
Light-Duty Vehicle In-Use Verification Program Test Volumes and Failure Rates

Model Year	FTP		US06		2-Day Evap		ORVR[13]	
	Vehicles Tested	Failure Rate	Vehicles Tested	Failure Rate	Vehicles Tested	Failure Rate	Vehicles Tested	Failure Rate
High-Mileage Testing								
2000	481	6.4%	0	N/A	38	0.0%	20	10%
2001	1147	4.2%	18	5.6%	103	3.9%	76	6.6%
2002	1135	5.2%	91	3.3%	105	3.8%	77	9.1%
2003	1185	4.2%	254	2.0%	121	5.0%	101	7.9%
2004	1173	3.8%	819	1.5%	158	4.4%	142	4.9%
2005	1103	3.5%	782	1.2%	142	4.2%	140	5.7%
2006	935	4.9%	671	0.8%	114	1.8%	121	0.8%
2007	1115	2.9%	781	1.9%	120	4.2%	127	6.3%
2008	264	8.0%	209	0.0%	43	7.0%	53	7.6%
2009	23	0.0%	16	6.3%	6	0.0%	7	14.3%
Low-Mileage Testing								
2004	670	4.8%	621	1.5%	167	5.4%	150	7.3%
2005	654	4.6%	589	0.9%	156	3.9%	145	3.5%
2006	654	3.8%	569	0.9%	152	2.0%	154	5.2%
2007	724	3.9%	602	0.3%	143	1.4%	149	4.0%
2008	649	4.3%	557	0.2%	128	1.6%	130	4.6%
2009	530	3.8%	479	0.4%	116	6.9%	127	0.8%
2010	556	3.1%	489	0.0%	141	2.1%	149	0.7%
2011	480	2.5%	425	1.2%	125	0.8%	130	2.3%

Overall, the test results from this program show that the majority of the in-use fleet continues to comply with the emission standards. However, when IUVP testing identifies potential emissions concerns, EPA and manufacturers work together to implement solutions which may involve voluntary manufacturer action to fix the problem, or, if necessary, an EPA-ordered emissions recall. This process is described in greater detail in the 2007 Compliance Report.

[13] Onboard refueling vapor recovery (ORVR) is a vehicle emission control system that captures fuel vapors from the vehicle gas tank during refueling. This requirement was phased-in from 1998 through 2006. It appears that the failure rate is generally decreasing.

Figures 13 and 14 present 2009 - 2011 *calendar year* light-duty vehicle emission defect report information. Defects reported in 2009 -2011 potentially affected more than 57 million vehicles. A single defect incidence may affect multiple *model years* of a given vehicle.

Light-duty vehicle manufacturers are required to notify EPA when they learn of emission-related defects in 25 or more vehicles of the same class (e.g., exhaust test group) and category (e.g., manufacturer, model year).

Figure 13 - 2009-2011 CY Light-Duty Vehicle Defect Reports by Manufacturer

	Reported in CY2009		Reported in CY2010		Reported in CY2011	
Manufacturer	**Number of Defect Reports**	**Number of Affected Vehicles**	**Number of Defect Reports**	**Number of Affected Vehicles**	**Number of Defect Reports**	**Number of Affected Vehicles**
Bentley	5	22,109	-	-	2	2,369
BMW	10	184,143	17	342,059	21	497,010
Chrysler	33	2,647,013	18	2,170,741	16	2,109,506
Cummins	1	157	2	211,305	-	-
Ford	12	2,936,701	11	1,816,928	14	2,123,801
General Motors	10	849,594	11	684,655	12	2,091,073
Honda/Acura	21	5,488,140	9	3,711,978	20	2,871,321
Hyundai	8	963,385	12	469,805	14	1,435,048
Jaguar	3	18,619	4	70,828	4	131,357
Kia	9	572,562	10	620,411	9	475,043
Lamborghini	1	139	-	-	-	0
Land Rover	2	53,237	4	208,491	8	371,850
Mazda	8	761,000	13	807,700	12	1,180,484
Mercedes-Benz	5	954,611	7	292,246	12	936,202
Mitsubishi	5	45,386	1	157,314	3	1,661
Nissan/Infiniti	23	2,576,199	21	3,341,602	15	2,255,282
Porsche	53	253,990	17	56,220	5	62,550
Rolls Royce	-	-	2	595	-	-
Rousch	-	-	-	-	2	1,415
Subaru	5	454,814	1	384,984	4	478,217
Suzuki	-	-	1	11,819	1	4,174
Toyota/Lexus	3	1,705,800	4	892,300	3	668,680
Volkswagen/Audi	28	1,024,318	13	619,951	26	762,073
Volvo	2	231,355	1	6,971	5	737,627
Total	**247**	**21,743,272**	**179**	**16,878,903**	**208**	**19,196,743**

Figure 13 shows the number of defect reports submitted for each manufacturer in 2009 - 2011 *calendar year* and the number of affected vehicles. The vehicle *model years* that are covered by the defect reports

submitted in 2009 - 2011 *calendar years* range from MY 2001 through 2011.[14] Manufacturers are required to report defects up to five years after the end of production.

Figure 14 shows the number of defects by defect category for all the vehicles covered by defect reports in 2009 - 2011 *calendar years*.

Figure 14 - 2009 - 2011 CY Light-Duty Vehicle Defect Reports by Problem Category

	Reported in CY2009		Reported in CY2010		Reported in CY2011	
Problem Category	Number of Defect Reports	Number of Affected Vehicles[15]	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles
Air Inlet/Intake System					6	752,695
Catalyst System	25	1,651,327	11	1,643,927	7	267,647
Computer Related (other than OBD)	21	4,615,410	19	2,473,670	22	2,754,463
Crankcase Ventilation System	3	187,429	1	1,991,813	3	97557
Drivability Problem	2	2,116,987	1	88,063	0	0
EGR System	2	485,755	2	621,929	3	480,845
Electrical, Mechanical & Cooling Systems	19	2,878,703	13	1,540,914	29	3,188,305
Emission Control Information	3	13,606	3	36,619	4	2,936
Evap Emissions System	14	1,033,398	12	968,646	20	2,252,586
Exhaust System	6	309,888	3	123,221	4	409,419
Fuel Delivery System	23	1,861,491	18	1,529,698	10	185,005
Fuel Tank System	14	2,177,608	11	2,235,022	22	3,150,623
Hybrid Vehicle System	2	25,840	1	25,810	0	0
Ignition System	11	378,428	7	1,876,995	6	575,421
Intake/Exhaust Manifold	10	1,362,544	3	155,205	3	204,248
Internal Engine Component					1	612,518
Monitoring/Measuring Sensor/System	24	6,460,405	27	3,415,266	15	1,086,995
OBD System	58	5,566,516	36	2,500,612	40	2,330,438
Other	1	157	-	-	1	8,314
Oxygen Sensor	9	3,238,400	11	511,651	7	608,779
Selective Catalytic Reduction					2	18,219
Turbocharger/Supercharger					3	209,730
Total	**247**	**34,363,892**	**179**	**21,739,061**	**208**	**19,196,743**

[14] Defect and recall reports can be submitted in the calendar year *prior to* the designated model year because vehicles can be certified and introduced into commerce starting January 2 of the prior year. For example, MY 2014 vehicles can be certified and introduced into commerce starting January 2, 2013.

[15] Vehicles that have defects in more than one category are counted in each problem category. Thus, the total number of affected vehicles can be higher in Figure 16 than the total number of affected vehicles in Figure 15.

Figure 15 shows the number of light-duty vehicle recalls by vehicle manufacturer in 2009 - 2011 *calendar years*. Because a recall usually covers a single, specific condition, a vehicle with multiple emissions problems may be subject to multiple recalls. Thus the total number of affected vehicles includes vehicles that have been recalled more than once. Similarly, there is no direct correlation between the number of defect reports, recalls, and the number of vehicles that are recalled. A manufacturer may identify a lot of defects that are not significant enough to warrant a recall. On the other hand, a manufacturer could have a few major defects that evolve into major recalls affecting large portions of their product line. Historically, emissions recalls affect about three million vehicles annually although the number may vary in any given year.

Figure 15 - 2009-2011 CY Light-Duty Vehicle Recalls by Manufacturer

	Recalls in CY2009		Recalls in CY2010		Recalls in CY2011	
Manufacturer	Number of Recalls	Number of Affected Vehicles[18]	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles
Aston Martin	-	-	-	-	1	3,977
Bentley	1	11,800	-	-	-	-
BMW	5	354,935	2	47,534	7	348,305
Chrysler	11	212,363	1	31,797	2	112,076
Cummins	-	-	2	160,582	1	28,978
Ford	-	-	1	215,764	2	4,632
General Motors	4	89,312	10	543,308	8	1,497,203
Honda/Acura	2	518,181	1	95,611	7	1,304,845
Hyundai	1	65,614	-	-	-	-
Jaguar	1	98,581	1	3,122	-	-
Kia	1	6,680	-	-	1	45,635
Land Rover	1	6,615	-	-	2	10,316
Lamborghini		-	-	-	-	-
Mazda	-	-	1	16,200	1	52,000
Mercedes-Benz	1	16,623	1	65,444	-	-
Mitsubishi	1	6,882	2	56,113	-	-
Nissan/Infiniti	3	379,688	7	1,454,813	3	41,523
Porsche	-	-	1	71,792	1	226
Rolls Royce		-	-	-	-	-
Rousch		-	-	-	2	1,415
Subaru	4	428,578	2	28,156	1	834,045
Suzuki	-	-	1	11,692	1	311
Toyota/Lexus	2	265,600	2	962,661	3	1,581,700
Volkswagen/Audi	4	520,657	3	561,433	9	1,046,881
Volvo	-	-	1	6,971	1	1,597
Total	**42**	**2,982,109**	**39**	**4,332,993**	**53**	**6,915,665**

Figure 16 lists categories of defects that were corrected by recalls in 2009 – 2011. EPA established the defect categories primarily for internal tracking purposes to identify potential, industry-wide problems with a particular component or technology. Recalls in 2009 -2011 *calendar years* affected vehicles spanning 2001 through 2011 *model years*.

Figure 16 - 2009-2011 CY Light-Duty Vehicle Recalls by Problem Category

	Recalls in CY2009		Recalls in CY2010		Recalls in CY2011	
Problem Category	**Number of Recalls**	**Number of Affected Vehicles**	**Number of Recalls**	**Number of Affected Vehicles**	**Number of Recalls**	**Number of Affected Vehicles**
Catalyst System	7	392,664	7	241,617	3	178,701
Computer Related (other than OBD)	7	638,641	5	22,807	8	2,413,259
Crankcase Ventilation System	1	2,470	-	-	1	115,829
Drivability Problem	1	51,000	-	-	-	-
Electrical, Mechanical & Cooling Systems	-	-	-	-	4	330,740
Emission Control Information Label	2	737	2	231,964	2	1,735
Evap Emissions System	-	-	1	643	3	96,935
Exhaust System	-	-	1	4,156	1	135,740
Fuel Delivery System	8	674,363	4	723,103	8	363,507
Fuel Tank System	3	30,175	5	1,330,691	6	1,158,906
Hybrid Vehicle System	1	18,353	1	566,745	1	46,400
Ignition System	3	501,739	2	572,864	1	237,610
Intake/Exhaust Manifold	1	359,665	-	-	2	129,015
Monitoring/Measuring Sensor/System	2	26,069	3	117,362	6	1,549,407
OBD System	5	156,033	6	412,669	7	157,881
Other	-	-	1	36,580	-	-
Oxygen Sensor	1	130,200	1	71,792	-	-
Total	**42**	**2,982,109**	**39**	**4,332,993**	**53**	**6,915,665**

AVERAGING, BANKING AND TRADING (ABT) PROGRAMS

The 2007 Compliance Report provided an overview of EPA's Tier 2 program. The Tier 2 standards are the current set of emission standards that apply to cars and light-duty trucks. The Tier 2 regulations offer manufacturers a choice of eight emission bins to which they can certify. Lower bin numbers reflect more stringent emission standards. The Tier 2 ABT program allows manufacturers to use sales-weighted averaging to certify groups of vehicles to different bin levels, as long as the fleet as a whole on average meets Bin 5 standards each year.

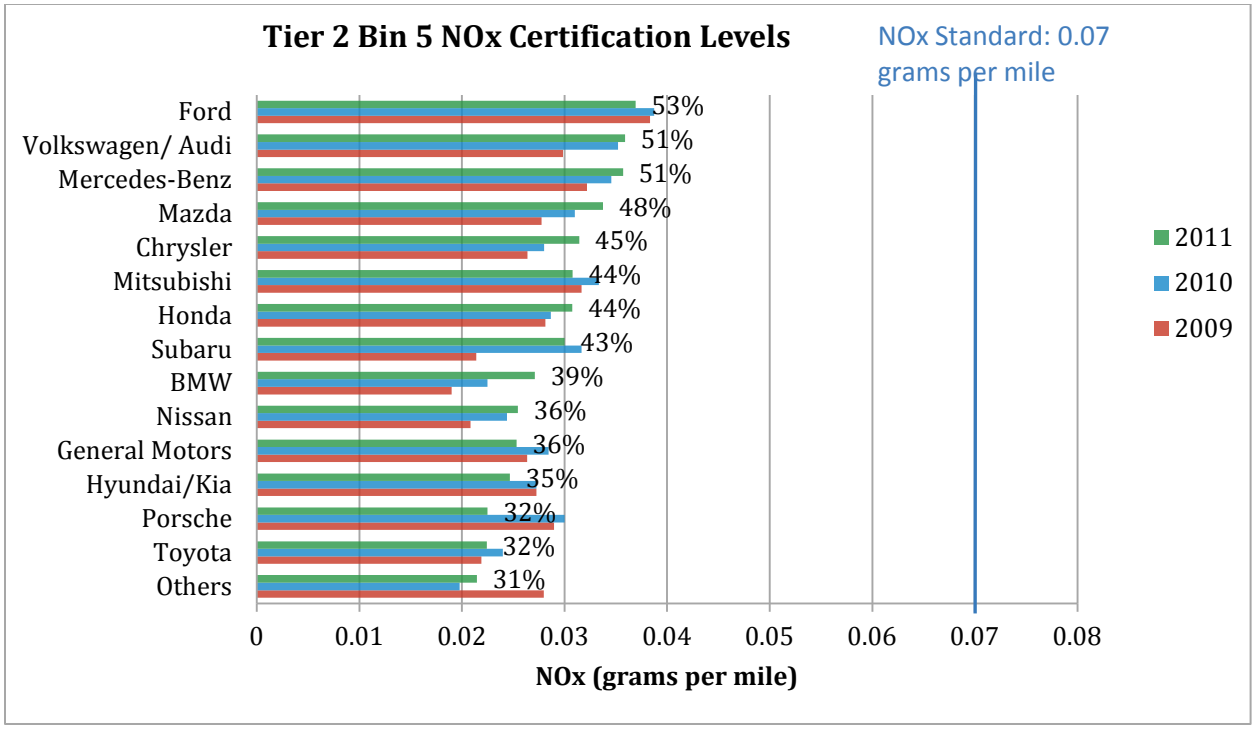
Figure 17 shows the percentage of exhaust test groups by emission certification bin for MY 2009 - 2011. For MY 2009, about 97 percent of test groups were certified to Bin 5 or better. For MY 2010 about 95 percent of test groups were certified to Bin 5 or better. And for MY 2011 about 90 percent of test groups were certified to Bin 5 or better.

Figure 17
MY 2009-2011 Light-Duty Test Group Distribution by Tier 2 Emissions Bins

	Percentage of Light-Duty Test Groups[16]		
Tier 2 Bin	MY 2009	MY 2010	MY 2011
1	0.3%	0.3%	1.9%
2	1.8%	2.6%	3.9%
3	2.4%	5.7%	4.6%
4	10.6%	15.4%	18.0%
5	82.2%	71.5%	61.5%
6	-	0.3%	0.8%
7	-	0.3%	0.2%
8	2.7%	3.9%	9.1%

Figures 18–20 present the average certification levels for NOx, NMOG, and CO respectively along with the standards for Tier 2 Bin 5 for each major manufacturer for 2009 - 2011. The lower the certification levels relative to the standard, the greater the compliance margin.[17]

Figure 18
MY 2009-2011 Tier 2 Bin 5 NOx Certification Levels and Compliance Margins by Manufacturer



[16] Sum of rounded values may not equal 100 percent.

[17] In Figures 20-22, the order from left to right is determined by the 2011 compliance margin, from lowest to highest.

Figure 19
MY 2009-2011 Tier 2 Bin 5 NMOG Certification Levels and Compliance Margins by Manufacturer

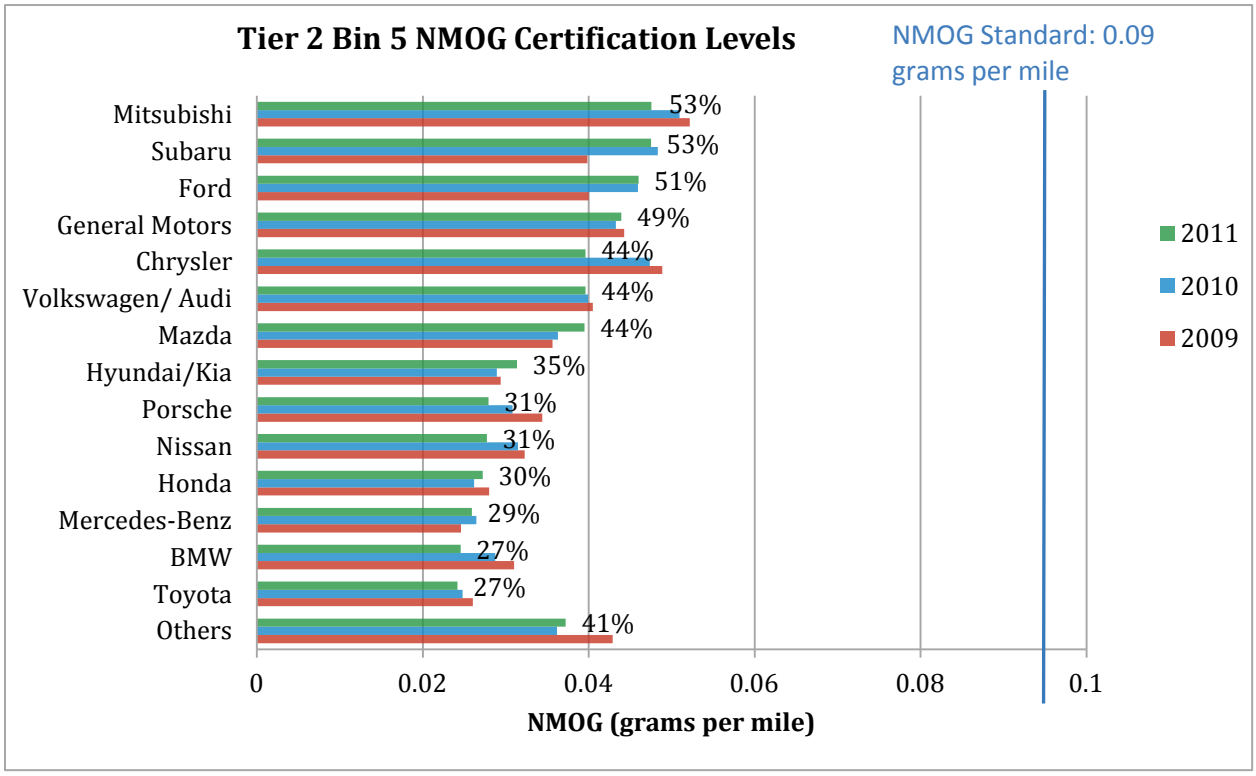
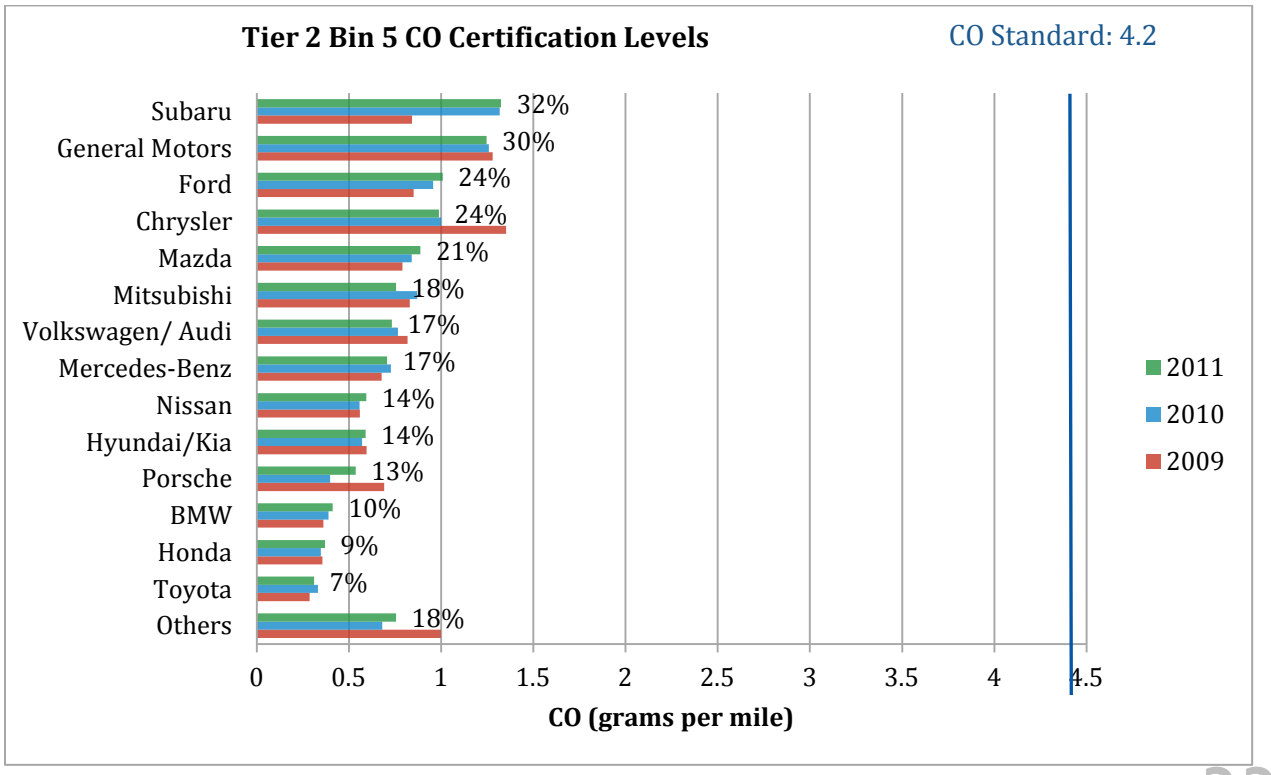


Figure 20
MY 2009-2011 Tier 2 Bin 5 CO Certification Levels and Compliance Margins by Manufacturer



C. HIGHWAY MOTORCYCLES

SECTOR PROFILE:

- Highway and off-highway motorcycles are subject to different sets of regulations and emission standards. This section covers the highway motorcycles. Information about off-highway motorcycles is reported in the Recreational Vehicles section, starting on page 55
- Highway motorcycles have been subject to HC and CO emissions standards since 1978
- A second set of more stringent emission standards took effect in MY2006. Although the CO emission standard remained unchanged at 12.0 g/km, the HC emission standard was reduced from 5 g/km to 1.0 g/km for Class 1 and 2 motorcycles. In addition, an optional HC + NOx 1.4 g/km standard was added.

PRIMARY COMPLIANCE ACTIVITIES IN 2009 – 2011:

- Certification
- Production vehicle testing
- Defect reporting

CERTIFICATION

Figure 21 presents the number of certified highway motorcycle engine families by class.

Figure 21 - MY 2009-2011 Highway Motorcycle Engine Families by Class

Highway Motorcycle Category	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Class Ia (<50cc)	91	77	48
Class Ib (50 -169cc)	96	80	55
Class II (170-279cc)	73	68	44
Class III (>279cc)	196	167	135
Battery electric motorcycles	4	7	8
Total	**460**	**399**	**290**

For MY 2009, 141 manufacturers certified highway motorcycles and 115 manufacturers certified highway motorcycles in MY 2010. For MY 2011, 89 manufacturers certified highway motorcycles. Figure 22 on the next page presents the number of motorcycle manufacturers in MY 2009 - 2011 for each highway motorcycle class.

Figure 22 - MY 2009-2011 Highway Motorcycle Manufacturers by Class

Highway Motorcycle Category	Number of Manufacturers Holding Certificates		
	MY 2009	MY 2010	MY 2011
Class Ia (<50cc)	68	52	47
Class Ib (50 -169cc)	69	51	44
Class II (170-279cc)	41	37	39
Class III (>279cc)	52	44	41
Battery electric motorcycles	4	5	6

Figure 23 presents the number of certified highway motorcycle engine families by manufacturer for MY 2009 - 2011. The manufacturers that certified a small number of engine families across the three model years are grouped together as "Other".

Figure 23 - MY 2009-2011 Highway Motorcycle Engine Families by Manufacturer

MY 2009		MY 2010		MY 2011	
Manufacturer	Number of Engine Families	Manufacturer	Number of Engine Families	Manufacturer	Number of Engine Families
Yamaha	31	Piaggio	30	Yamaha	28
Suzuki	30	Yamaha	27	Piaggio	26
Piaggio	30	Suzuki	23	Honda	14
Honda	18	Kawasaki	15	Suzuki	14
Kawasaki	16	Honda	13	Kawasaki	13
Harley-Davidson	12	KYMCO	11	KYMCO	11
		Carter Brothers	10	Ducati	10
KYMCO	10			Carter Brothers	9
Carter Brothers	9	Ducati	9	Harley-Davidson	7
BMW	7	BMW	8	Triumph	7
Other	297	Other	253	Other	199
Total	460	Total	399	Total	338
Top Manufacturers	35.4%	Top Manufacturers	36.6%	Top Manufacturers	41.1%

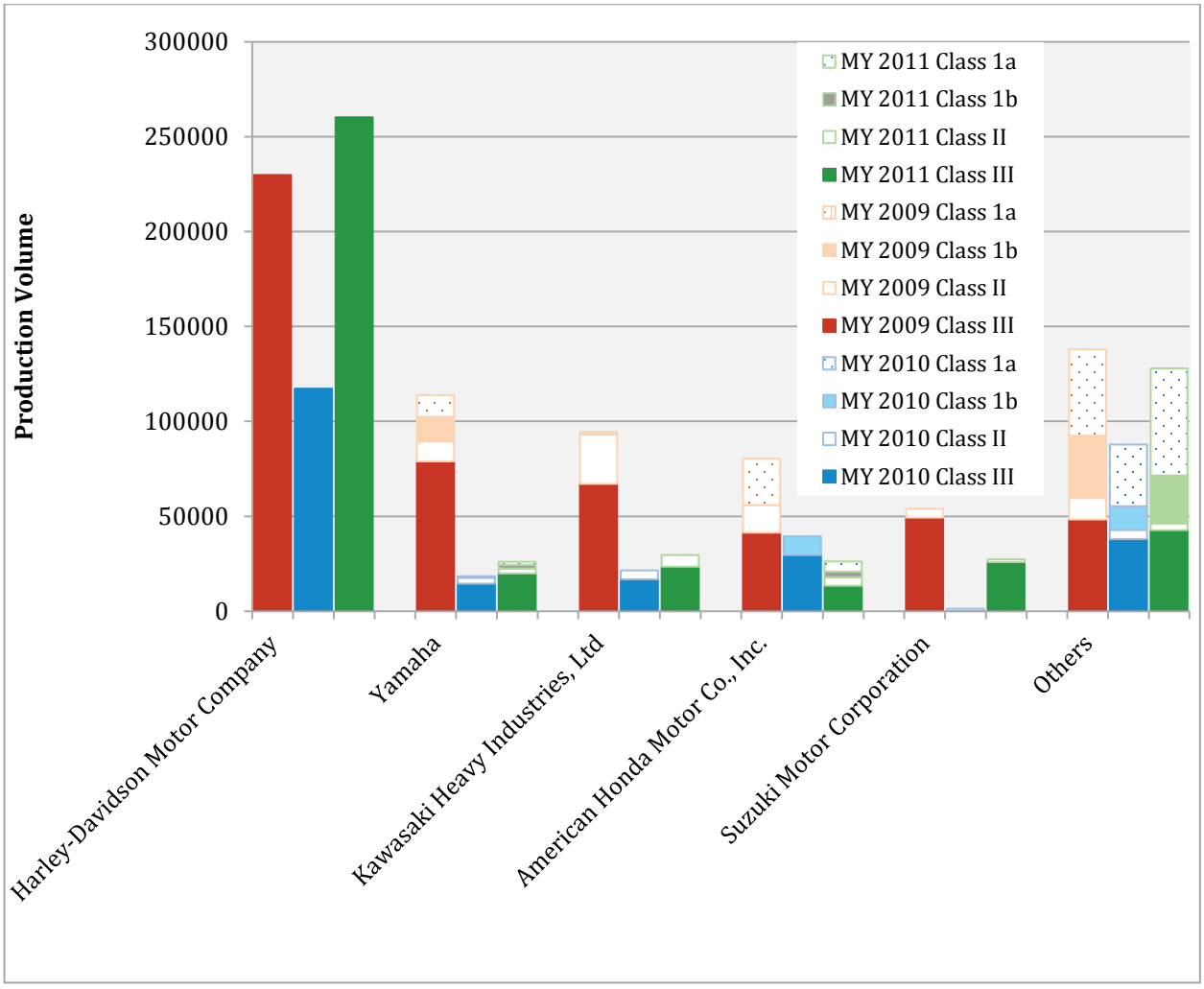
PRODUCTION VOLUME

More than 150 highway motorcycle manufacturers certified products in MY 2009 – 2011, but the vast majority of bikes sold in the United States were produced by just a few companies. Figure 24 shows reported production volumes for the five highest sales volume motorcycle manufacturers in model years 2009 - 2011.[25] The production volume for lower-volume manufacturers is shown in aggregate. The aggregated volume is based on available data manufacturers have reported to EPA. As with light-duty vehicles, a comparison of Figures 23 and 24 show that there is not always a correlation between the number of engine families a manufacturer certifies and the number of vehicles the manufacturer

[18] For MY 2009 Kawasaki Heavy Industries produced 1,555 Class 1b motorcycles; For MY 2010 Suzuki Motor Corporation produced 1,033 Class II and 245 Class III motorcycles; for MY 2010, Yamaha produced 516 Class 1a and 228 Class 1b motorcycles. . These low volumes are difficult to discern on the scale of this chart.

produces.[19] Manufacturers with the most certified engine families do not necessarily produce the most vehicles.

Figure 24 - MY 2009-2011 Highway Motorcycle Production Volumes by Manufacturer



PRODUCTION VEHICLE TESTING

EPA may require a manufacturer to supply production vehicles for emissions testing on demand. EPA has found, via inspections at ports and other enforcement related activities, that some imported production motorcycles are not built to the certified configurations. To follow up on this concern, EPA is collaborating with Environment Canada to test production motorcycles at an Environment Canada emissions testing facility. Through July 2011, the agencies had tested or were in the process of testing 29 MY 2008-2010 EPA certified engine families and have identified several engine families that may potentially exceed applicable standards. So far, one manufacturer has initiated a voluntary recall for thousands of motorcycles sold in both the United States and Canada based on this testing. EPA is continuing to follow up with other manufacturers.

[19] The economic slowdown may have contributed to the MY 2010 drop in production volume.

DEFECT REPORTING

Figure 25 presents 2009 - 2011 emission defect report information for highway motorcycles. These reports can include multiple model years of a given vehicle and can span more than one problem category. Highway motorcycle manufacturers are required to notify EPA when they learn of the existence of emission-related defects in 25 or more vehicles of the same class (e.g., engine family) and category (e.g., manufacturer, model year).

Figure 25 - 2009-2011 Highway Motorcycle Defect Reports by Problem Category

	Reported in 2009		Reported in 2010		Reported in 2011	
Problem Category	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles
Oxygen sensor	1	12,015	-	-	-	-
Electrical, mechanical & cooling systems	-	-	1	2,782	-	-
OBD system	1	2,447	-	-	-	-
Crankcase ventilation component/system	1	2,447	-	-	-	-
Computer related (other than OBD)	-	-	1	1,452	-	
Carburetor	-	-	-	-	1	16,856
Fuel Delivery Component	-	-	-	-	1	314
Other	-	-	1	59	-	
Total	**3**	**16,909**	**3**	**4,293**	**2**	**17,170**

In calendar years 2009 - 2011, manufacturers submitted defect reports that affected highway motorcycles in model years ranging from MY 2008-2011.

RECALL REPORTING

There was one highway motorcycle recall in 2009 for 5,858 MY 2010 Honda motorcycles with a problem categorized as “defective/incorrect crankcase ventilation component/system.” There were no highway motorcycle recalls in calendar year 2010. There was one highway motorcycle recall in 2011 for 314 MY 2011 Bombardier motorcycles with a problem categorized as “defective/incorrect intake/exhaust manifold”.

AVERAGE BANKING AND TRADING (ABT) PROGRAMS

The 2006 regulations added provisions allowing highway motorcycle manufacturers to use an EPA specified emission averaging approach to show compliance with the applicable HC+NOx standards. For MY 2009 – 2011 about 6-9 percent of manufacturers availed themselves of this provision.

Class III motorcycles (>279cc) represent the majority of motorcycle sales, and many Class III manufacturers with large sales volumes take advantage of the fleet averaging flexibility for HC+NOx. For model year 2009 about 13 percent of Class III manufacturers used this fleet averaging flexibility. For model year 2010 about 21 percent of Class III manufacturers used the fleet averaging flexibility. And for model year 2011 about 17 percent of Class III manufacturers used the fleet averaging flexibility.

D. Heavy-Duty Highway Engines

SECTOR PROFILE:

- Heavy-duty highway engines are used in highway vehicles such as trucks and buses that are more than 8,500 pounds GVWR
- EPA has regulated heavy-duty highway engine emissions since 1982
- Primary emission standards in effect for MY 2009-2011 were NMHC, CO, NOx, and PM, with final phase-in of a more stringent NOx standard starting in MY2010. Reductions in diesel sulfur content prior to 2007 enabled significant advances in emission controls.

PRIMARY COMPLIANCE ACTIVITIES IN 2009 - 2011:

- Certification
- In-use testing
- Defect reporting

CERTIFICATION

As shown in Figure 6, EPA issued 123 heavy-duty highway certificates for MY 2009, 81 heavy-duty highway certificates for MY 2010 and 112 heavy-duty certificates for MY 2011.[20] These include alternative fuel conversion and evaporative emissions certificates. Most certificates were for diesel engines.

Figures 26 and 27 on the next page present the number of MY 2009 - 2011 engine families certified in each intended service class for compression ignition and spark ignition heavy-duty highway engines. [21]

[20] Some vehicles that are between 8,500-14,000 pounds GVWR are chassis-certified and are included in the light-duty vehicles data.
[21] The number of engine families has is not directly correlated to engine production volumes.

Figure 26
MY 2009-2011 Heavy-Duty Highway Compression Ignition Engine Families by Service Class

Service Class	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Light heavy-duty diesel	14	3	8
Medium heavy-duty diesel	31	12	12
CA only medium-duty	2	-	1
Heavy heavy-duty diesel	39	25	28
Urban Bus	4	3	3
CA only urban bus	-	1	-

Figure 27
MY 2009-2011 Heavy-Duty Highway Spark Ignition Engine Families by Service Class

Service Class	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Heavy-duty gasoline 1 (<=14k lbs)	5	5	5
Heavy-duty gasoline 2 (>14k lbs)	3	3	4
Urban bus	1	1	-

Figures 28 and 29 present the number of MY 2009 - 2011 compression ignition and spark ignition engine families by each heavy-duty highway manufacturer.

Figure 28
MY 2009-2011 Heavy-Duty Highway Compression Ignition Engine Families by Manufacturer

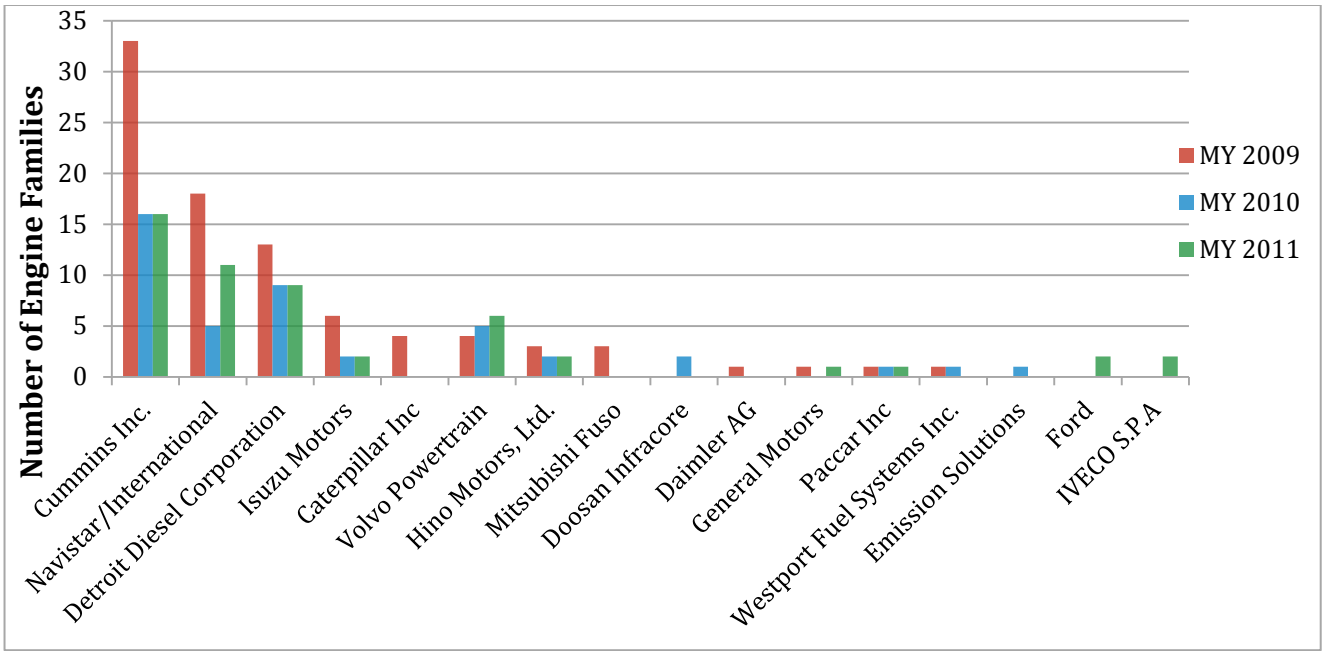
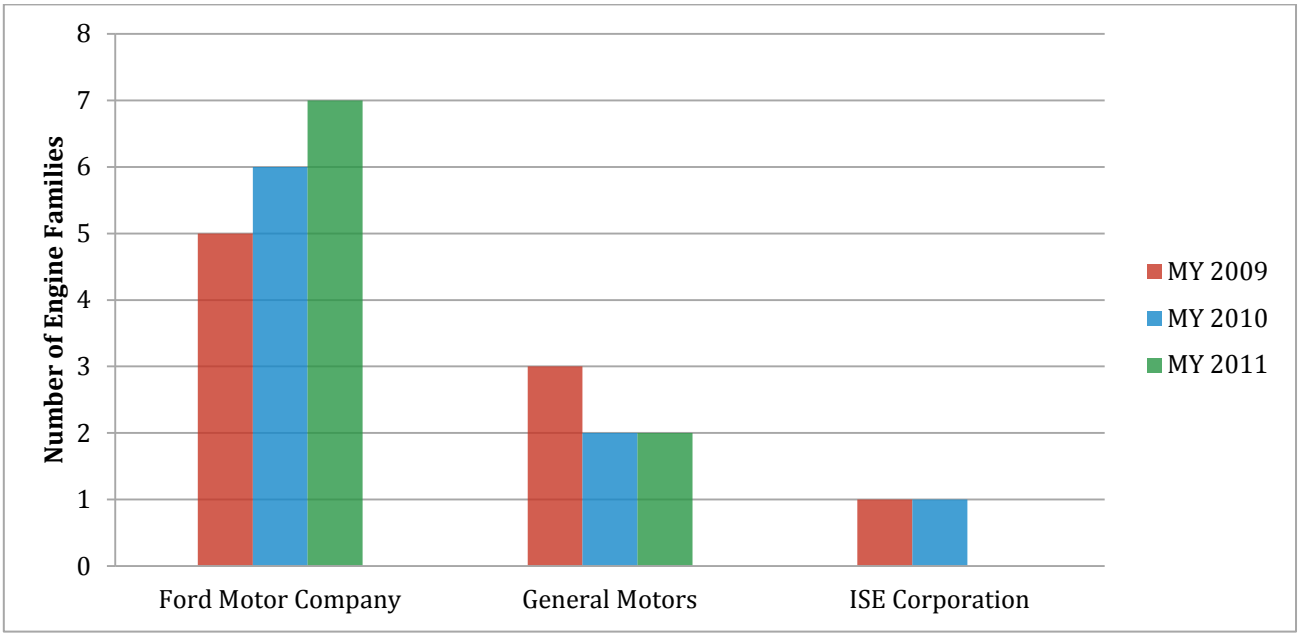


Figure 29
MY 2009-2011 Heavy-Duty Highway Spark Ignition Engine Families by Manufacturer



IN-USE COMPLIANCE TESTING

As is the case for light-duty vehicles, EPA relies on both internal and manufacturer testing programs to assess heavy-duty vehicle compliance with in-use emission standards. Heavy-duty in-use testing differs significantly from light-duty in-use testing. For light-duty vehicles, identical test procedures are used to measure emissions in both certification and in-use testing. The heavy-duty vehicle regulations do not require manufacturers to test in-use engines on a laboratory dynamometer, as they must for certification. Heavy-duty manufacturers may use portable equipment to measure in-use emissions while a vehicle is being driven over the road, instead of removing the engine from an in-use vehicle for laboratory testing. The regulations require manufacturers to measure the percentage of time that a vehicle exceeds certain emission thresholds under real-world driving conditions using devices that monitor emissions of hydrocarbons, carbon monoxide, nitrogen oxides, and particulate matter.

EPA also conducts its own heavy-duty in-use surveillance program, currently focusing on engines with 2010-level emission control systems. Beginning in late 2011 and lasting through 2012, this program focused on testing the most common engines currently used in heavy-duty line-haul tractors and vocational vehicles. This testing included engines from all of the major heavy-duty on-highway diesel engine manufacturers and the engine families tested represent 84% of the estimated large heavy-duty on-highway diesel engine production volume (MY2012 estimate).

All of the engines tested in this program were found to be in compliance with in-use emission standards when evaluated using the prescribed procedures. Emissions performance over non-prescribed conditions, such as extended idle and cold-starting, differed significantly by manufacturer, revealing key differences in calibration philosophy and limitations of current emission control technologies. These findings have been shared with the affected manufacturers and are driving system improvements for future model years.

Currently this testing program is focusing on small and medium sized heavy-duty diesel engine segments.[22]

DEFECT REPORTING

Figure 30 shows the number of defect information reports heavy-duty highway engine manufacturers submitted in 2009 - 2011 *calendar years*. Figure 31 shows the number of defect reports manufacturers submitted for each problem category reported in 2009 - 2011 *calendar years*. Defect reports can include multiple model years of a given engine.

Figure 30 - 2009-2011 Heavy-Duty Highway Engine Defect Reports by Manufacturer

Manufacturer	Number of Defect Reports		
	Reported in CY2009	Reported in CY2010	Reported in CY2011
Caterpillar	21	14	11
Cummins	1	10	2
Detroit Diesel Corporation	2	4	4
Ford	1	-	4
FTP Industrial S.p.A			1
General Motors	2	2	2
Hino	-	1	-
Isuzu	1	3	1
John Deere	-	1	-
Navistar	1	8	18
Paccar	-	3	6
Roush Industries, Inc.			2
UD Trucks Corporation			1
Volvo	3	5	15

Figure 31 - 2009-2011 Heavy-Duty Highway Engine Defect Reports by Problem Category

Problem Category	Number of Defect Reports		
	Reported in CY2009	Reported in CY2010	Reported in CY2011
Fuel delivery component / system	9	4	8
Turbocharger/supercharger	5	6	7
Passive diesel particulate filter (DPF)	5	5	5
Active diesel particulate filter (DPF)	4	4	1
Electrical, mechanical & cooling systems	4	2	-
VECI label	2	4	5
EGR system	2	2	12
Exhaust system	2	1	2
Crankcase ventilation component/system	2	-	1
NOx absorber system		-	1
NOx sensor	1	1	1
OBD system	-	6	2

[22] Smith, J., Greuel, J., Ratkos, B., and Schauer, E., "In-Situ Emissions Performance of EPA2010-Compliant On-Highway Heavy-Duty Diesel Engines,"SAE Int. J. Engines 6(3):1490-1499, 2013, doi: 10.4271/2013-01-2430.

Problem Category	Number of Defect Reports		
	Reported in CY2009	Reported in CY2010	Reported in CY2011
Selective catalytic reduction (SCR) system	-	5	8
Monitoring/measuring sensor/system	-	4	2
Computer related (other than OBD)	-	3	5
Diesel oxidation catalyst (DOC)	-	1	-
Ignition component	-	1	1
Defective / Incorrect Catalyst System (non-diesel engine)	-		3
Oxygen sensor	-		1

RECALL REPORTING

Figure 32 shows the number of heavy-duty highway engine recalls issued in 2009 - 2011 *calendar years*. Figure 33 shows the number of recalls for each problem category reported in 2009 - 2011 *calendar years*. Recalls can include multiple model years of a given engine. Recalls in the 2009 *calendar year* affected engines from 2004 – 2009 *model years*, while recalls in the 2010 *calendar year* affected 2006 – 2010 *model years*. Recalls in 2011 affected 2006 – 2012 *model year* engines.

Figure 32 - 2009-2011 Heavy-Duty Highway Engine Recalls by Manufacturer

Manufacturer	Recalls in CY2009		Recalls in CY2010		Recalls in CY2011	
	Number of Recalls	Number of Affected Engines	Number of Recalls	Number of Affected Engines	Number of Recalls	Number of Affected Engines
Caterpillar	4	153,771	1	7,488	2	25,719
Cummins	1	182	6	101,072	1	1,197
Detroit Diesel					1	3,531
Ford	3	47,639	1	868		
FPT Industrial S.p.A.						
General Motors	1	29,909			2	88,794
Hino	1	7,065				
Isuzu			2	21,679		
International-Navistar	1	128,514				
IVECO S.p.A.					1	1,800
Mitsubishi Fuso Truck	1	616				
PACCAR Inc.					1	31
Roush Industries, Inc.						
Volvo			1	1,065		
Total	**12**	**367,696**	**11**	**132,172**	**8**	**121,072**

Figure 33 - 2009-2011 Heavy-Duty Highway Engine Recalls by Problem Category

	Recalls in CY2009		Recalls in CY2010		Recalls in CY2011	
Problem Category	**Number of Recalls**	**Number of Affected Engines**	**Number of Recalls**	**Number of Affected Engines**	**Number of Recalls**	**Number of Affected Engines**
Crankcase ventilation component/system	1	147,245				
Active diesel particulate filter (DPF)	2	133,964			2	25,719
EGR system	1	29,909				
Electrical, mechanical & cooling systems	1	19,954				
Turbocharger/supercharger	1	19,954				
Fuel delivery component	2	14,796	1	7,488		
Exhaust system	2	965	1	1,117		
OBD system	1	616	5	95,439		
VECI label	1	293	1	21,006	1	31
Selective catalytic reduction (SCR) system			2	6,254	3	82,446
Computer related (other than OBD)			1	868		
NOx Sensor						
Monitoring/measuring sensor/system					1	3,531
Catalyst system					1	9,345
Total	**12**	**367,696**	**11**	**132,172**	**8**	**121,072**

AVERAGE BANKING AND TRADING (ABT) PROGRAMS

In MY 2009, 100 percent of heavy-duty highway compression ignition engine manufacturers participated in ABT programs. Approximately 25 and 45 percent of heavy-duty highway compression ignition engine manufacturers participated in ABT programs in MY 2010 and 2011, respectively.[23]

[23] In MY 2010 a regulatory change took effect that eliminated split engine family accounting.

E. Nonroad Compression Ignition (NRCI) Engines

SECTOR PROFILE-

- EPA regulates several categories of nonroad compression ignition engines including marine diesel engines, locomotives, and compression ignition engines used in construction and agricultural equipment.
- EPA has regulated emissions from nonroad compression ignition engines since 1996
- Primary emission standards in effect for MY 2009-2011 were NMHC, CO, NOx, and PM

PRIMARY COMPLIANCE ACTIVITIES IN 2009 - 2011:

- Certification
- Compliance programs

CERTIFICATION

Figure 34 presents the number of marine diesel certificates issued by certification Tier and classification. Figure 35 presents the number of marine diesel certificates by manufacturer. Marine diesel engine manufacturers applying for engine certification may request an International Maritime Organization (IMO) certificate in addition to an EPA certificate of conformity for the same engine family. The IMO program, in general, is different from EPA's program, but certain jurisdictions require operators to display an EPA-issued IMO certificate. For the purposes of this compliance report, only one certificate for each engine family was included in the counts listed below.

New marine diesel standards were phased in at different times for different engine sizes. In general, Tier 2 began to take effect around 2005; Tier 3 began in about 2009. Tier 3 will not be in place for all engines until 2018.

Figure 34 - MY 2009-2011 Marine Diesel Engine Certificates by Tier

Certification Tier	Number of Certificates		
	MY 2009	MY 2010	MY 2011
Tier 1	8	4	0
Tier 2	116	131	164
Tier 3	26	26	27
Remanufacture	2	9	19
IMO	28	38	53
Total	**180**	**208**	**263**

Figure 35 - MY 2009-2011 Marine Diesel Engine EPA and IMO Certificates by Manufacturer

Manufacturer[24]	Number of Certificates		
	MY 2009	MY 2010	MY 2011
AB Volvo Penta	16	28	17
Alaska Diesel Electric	5	4	5
Caterpillar Inc.	32	41	29
Cummins Inc.	22	23	18
Detroit Diesel Corporation	3	3	6
Electro-Motive Diesel, Inc.	3	9	15
IHI Shibaura Machinery Corporation	10	11	11
Iveco N.V.	10	10	11
John Deere Power Systems Group	3	7	46
MAN Nutzfahrzeuge AG	3	3	4
Mitsubishi Heavy Industries, Ltd.	5	6	6
MTU Detroit Diesel, INC.	7	6	9
Perkins Engines Co Ltd	2	4	11
Transportation Systems Business Operations of GE	5	5	6
VM Motori S.P.A.	4	3	3
Yanmar CO., Ltd	19	17	25
Other	31	28	41
Total	**180**	**208**	**263**

Figure 36 shows locomotive certificates. Some engine manufacturers obtain a locomotive certificate of conformity, if a locomotive uses its engine.

Figure 36 - MY 2009-2011 Locomotive and Engine Certificates by Manufacturer

Manufacturer	MY 2009			MY 2010			MY 2011		
	Locomotive Certificates	Engine Manufacturer	Total	Locomotive Certificates	Engine Manufacturer	Total	Locomotive Certificates	Engine Manufacturers	Total
EMD	23	2	23	10	2	12	11	2	13
GE	19	-	19	5	-	5	10	-	10
CSX	6	-	6	2	-	2	8	-	8
Advanced Global Engineering	4	-	4	8	-	8	11	-	11
National Railway Equipment Co.	2	2	4	2	2	4	2	2	4
Motive Power	3	-	3	3	-	3	2	-	2
Kansas City Southern	3	-	3				-	-	0

[24] Manufacturers that certified only a few Marine CI engine families in MY 2009 2011 are aggregated under "Other". For MY 2009 "Other" represents 13 manufacturers; for MY 2010 "Other" represents 15 manufacturers; and for MY 2011 "Other" represents 30 manufacturers.

Manufacturer	MY 2009			MY 2010			MY 2011		
	Locomotive Certificates	Engine Manufacturer	Total	Locomotive Certificates	Engine Manufacturer	Total	Locomotive Certificates	Engine Manufacturers	Total
Cummins	-	2	2	-	4	4	-	4	4
Burlington North Santa Fe	2	-	2	-	-	-	-	-	0
HK Engine Components	2	-	2	-	-	-	1	-	1
OceanAir	1	-	1	3	-	3	3	-	3
Haynes	-	1	1	-	1	1	-	-	0
Progressive Rail	-	-	-	3	-	3	3	-	3
Brookeville Equipment Corp.	-	-	-	1	-	1	-	-	0
RJ Corman Railpower	-	-	-	1	-	1	-	-	0
Bombardier Transport							1	-	1
Total	**65**	**7**	**70**	**38**	**9**	**47**	**52**	**8**	**60**

Nonroad compression ignition engines intended for use in construction and agricultural equipment can be certified for use in one or multiple service classes. Figure 37 presents the number of certificates that were issued covering each power category. There were more than 100 different nonroad compression ignition engine families certified in both the 19-37 kW and the 37-75 kW power ranges. Figure 38 shows the number of engine families certified by each manufacturer for MY 2009 – 2011. There were approximately 90 different manufacturers that certified nonroad compression ignition engines intended for use in construction and agricultural equipment in MY 2009 2011.

Figure 37 - MY 2009-2011 Construction and Agricultural Engine Families by Service Class

Service Class (Power Category)	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
0-8 kW	60	59	41
<130 kW	-	2	2
8-19 kW	73	74	70
8-37 kW	2	-	-
19-37 kW	120	121	111
37-56 kW	20	27	27
37-75 kW	107	107	106
56-75 kW	9	11	14
75-130 kW	52	59	67
75-225 kW			1
75-450 kW	2	2	-
130-225 kW	27	31	9
130-450 kW	5	4	1
130-560 kW	11	13	23
>=130 kW	2	6	-
225-450 kW	49	48	23
225-560 kW	2	2	2
450-560 kW	9	11	2
560-900 kW			2
>560 kW	61	64	19

Service Class (Power Category)	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Total[25]	**611**	**641**	**520**

Figure 38 - MY 2009-2011 Construction and Agricultural Engine Families by Manufacturer

Manufacturer[26]	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Kubota Corporation	49	51	50
Cummins Inc.	46	45	16
Deutz AG	46	45	40
Yanmar Co., Ltd.	42	41	40
Caterpillar Inc.	26	34	16
John Deere Power Systems	27	32	29
Motornfabrik Hatz	28	28	28
Mitsubishi Heavy Industries, Ltd	25	25	25
Iveco NV	22	28	22
Komatsu Ltd.	23	25	15
IHI Shibaura Machinery Corporation	22	22	22
Isuzu Motors Limited	20	20	18
Perkins Engines Co. Ltd.	18	17	13
Lombardini	14	14	13
Mahindra & Mahindra Ltd.	12	13	11
Kukje Machinery Co.	9	12	12
CNH UK LTD	10	10	10
Liebherr Machines Bulle SA	8	12	3
Daedong Industrial Co. Ltd.	9	10	8
Iseki Matsuyama Mfg. Co., Ltd.	9	9	9
AGCO Sisu Power Inc.	7	7	5
Hino Motors, Ltd.	6	5	5
AB Volvo Penta	7		8
Shandong Huayuan Laidong Engine Co.	6	6	6
Other	120	130	96
Total[27]	**611**	**641**	**520**

AVERAGE BANKING AND TRADING (ABT) PROGRAMS

About 10 percent of construction and agricultural engine manufacturers participated in ABT programs in MY 2009 - 2011.

[25] This figure does not include stationary-only engine families.
[26] Manufacturers that certified only a few engine families in MY 2009 - 2011 are aggregated under "Other".
[27] This figure does not include stationary-only engine families.

F. Nonroad Spark Ignition Engines

SECTOR PROFILE:

- Nonroad spark ignition (Nonroad SI) engines are generally divided into three categories for purposes of exhaust emission compliance:
  - Small spark ignition engines (Small SI) are rated below 25 horsepower (19 kW) and are generally used in household and commercial applications, including lawn and garden equipment, utility vehicles, generators, and a variety of other construction, farm, and industrial equipment
  - Marine spark ignition (Marine SI) engines are used in marine vessels, including outboard engines, personal watercraft, and sterndrive/inboard engines
  - Large spark ignition (Large SI) engines are generally rated above 19 kW and used in forklifts, compressors, generators, stationary equipment
- Equipment with NRSI engines installed is also subject to evaporative emissions standards.
- Nonroad SI engines have been subject to emissions regulations since 1997

PRIMARY COMPLIANCE ACTIVITIES IN 2009 - 2011:

- Certification
- Compliance programs

CERTIFICATION

As shown in Figure 6, for the 2009 – 2011 model years EPA certified around1,000 Small SI engine families , around 100 engine emissions families each for Marine SI and Large SI, and between 150 and 425 Evaporative Component families. There are seven classes of Small SI engines. Figure 39 presents the number of families certified in each Small SI class.[28] Figures 40-43 present the number of engine families certified by Small SI, Marine SI, Large SI and Evaporative Component manufacturers.

Figure 39 - MY 2009-2011 Small Spark Ignition Engine Families by Class

Small SI Class	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Class I	247	231	247
Class II	358	344	287
Class IA	39	16	8
Class IB	59	47	47
Class III	2	3	2

[28] Classes are defined by whether or not the engine in applied in a hand held piece of equipment and by power rating. Classes I through IB describe non hand held equipment whereas classes IV and V are in hand held equipment.

Class IV	307	268	275
Class V	148	111	119
Total	**1,160**	**1,020**	**985**

Figure 40 - MY 2009-2011 Small Spark Ignition Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Briggs & Stratton Corporation	69	65	57
Andreas Stihl AG & Co KG	62	58	59
Kawasaki Heavy Industries, Ltd.	50	47	37
Husqvarna AB	44	38	42
Echo Incorporated/Kioritz Corporation	37	52	56
Fuji Heavy Industries Ltd.	32	32	29
Husqvarna Consumer Outdoor Products N.A. Inc.	32	32	30
Generac Power Systems Inc.	31	-	17
Honda Motor Co., Ltd.	29	29	33
Kohler Co.	23	28	28
Loncin Industrial Co., Ltd.	-	31	29
Jiangsu Jiangdong Group Co. Ltd.	-	28	27
Other[29]	751	580	541
Total	**1,160**	**1,020**	**985**

Figure 41 - MY 2009-2011 Marine Spark Ignition Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Yamaha Motor Company Ltd.	38	24	23
Mercury Marine	28	31	30
Honda Motor Co., Ltd.	12	11	10
BRP US Inc.	11	14	13
Suzuki Motor Corporation	11	12	11
Tohatsu Corporation	9	8	8
Suzhou Parsun Power Machine Co., Ltd.	5	5	5
Hangzhou Hidea Power Machinery Co., Ltd	4	4	5
Kawasaki Heavy Industries, Ltd.	3	3	3
Weber Automotive GmbH	2	-	-
Volvo Penta of the Americas, Inc.	-	2	5
Zhejiang Shunfeng Power Machinery Manufacturer	-	2	-
Zhejiang Shengqi Motion Apparatus Co.	1	1	1
Flagship Marine Engine Company Inc	-	-	1
Ilmor Engineering, Inc	-	-	1

[29] For MY 2009 "Other" represents 168 manufacturers that collectively produced 751 engine families. For MY 2010 "Other" represents 100 manufacturers that collectively produced 580 engine families. For MY 2011 "Other" represents 93 manufacturers that collectively produced 541 engine families.

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Indmar Products Company, Inc	-	-	2
KEM Equipment, Inc	-	-	3
Pleasurecraft Marine Engine Company	-	-	3
Total	**124**	**117**	**124**

Figure 42 - MY 2009-2011 Large Spark Ignition Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
KEM Equipment, Inc.	15	18	19
Generac Power Systems, Inc.	9	32	34
Bucks Engine Company	8	-	7
NGVI, Inc.	8	2	-
Woodward Governor Company	8	6	7
IMPCO Technologies	7	8	8
Zenith Power Products LLC	6	7	7
Nissan Motor Co., Ltd.	5	3	3
Power Solutions, Inc.	6	11	12
TeleflexGFI Control Systems	4	-	-
Engine Distributors, Inc	3	5	4
Cummins Inc.	2	3	8
Linde Material Handling N.A. Corp.	2	2	2
Wisconsin Motors, LLC	2	3	3
GE Jenbacher	1	1	1
John Deere Power Systems of Deere & Comp	1	1	1
Toyota Industrial Equipment	1	1	1
Westerbeke Corporation	1	1	1
PSI International	-	5	8
Deutz Corporation	-	4	5
GFI Control systems	-	4	-
AFI	-	1	1
Don Hardy Race Cars, Inc.	-	1	1
EControls, Inc.	-	1	-
Industrial Engines Ltd	-	1	2
Juniper Engines, Inc.	-	1	1
KaChing, LLC	-	1	-
SRC Automotive, Inc.	-	1	1
Kohler Company	-	-	1
Kubota Corporation	-	-	1
Vantage Vehicle International, Inc.	-	-	1
Total	**89**	**124**	**140**

Figure 43
MY 2009-2011 Nonroad Spark Ignition Evaporative Component Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Honda Motor Co., Ltd.	22	7	4
Husqvarna Zenoah Co., Ltd.	16	16	8
MTD Southwest Inc.	15	12	5
Andreas Stihl AG & Co KG	10	18	36
Hitachi Koki USA, Ltd.	10	17	17
Kawasaki Heavy Industries, Ltd	7	8	6
Maruyama Mfg. Co., Inc.	7	11	11
Husqvarna AB, Sweden	5	5	1
ECHO Incorporated/Yamabiko Corporation	-	6	8
Husqvarna Consumer Outdoor Products N.A., Inc.	-	5	10
Sichuan Chuanhuan Technology Co. Inc	-	5	5
Other[30]	69	85	313
Total[31]	**161**	**195**	**424**

PRODUCTION LINE TESTING (PLT)

Production line testing requires manufacturers to routinely test engines as they leave the assembly line to demonstrate that production engines meet emission standards. In the Small SI and Marine SI sectors, most engine manufacturers had at least one engine family subject to PLT.[32] All engine families met the PLT test requirements. In the Large SI sector, many engine families are not subject to PLT requirements because the projected sales volume is less than 150 units. These engine families are only required to submit production reports. Large SI manufacturers satisfied all requirements for families with high enough volumes to require PLT testing and data submission in 2009 - 2011.

IN-USE COMPLIANCE TESTING

Marine SI and Large SI manufacturers are required to conduct in-use testing on up to 25 percent of engine families at 50 percent or more of their useful life. The Marine SI program has been in place since 2007.

[30] For MY 2009 “Other" represents 38 manufacturers that collectively produced 69 evaporative families. For MY 2010 “Other" represents 48 manufacturers that collectively produced 85 evaporative families. For MY 2011 “Other" represents 165 manufacturers that collectively produced 313 evaporative families.

[31] The evaporative emissions rule for nonroad spark ignition manufacturers started to phase in for model year 2009. The number of engine families affected by the rule should level off after the 2012 model year.

[32] PLT requirements do not apply to small volume engine manufacturers.

AVERAGE BANKING AND TRADING (ABT) PROGRAMS

In MY 2009 about 15 percent of Small SI manufacturers participated in ABT programs. In MY 2010 and in MY 2011about 21 percent of Small SI manufacturers participated. Prior to MY 2010 all types of Small SI engines were averaged together. However, beginning in MY 2010, handheld and non-handheld engines were averaged separately.

G. RECREATIONAL VEHICLES

SECTOR PROFILE:

- Emissions from recreational vehicles (RVs) were unregulated prior to MY 2006
- The regulations in 40 CFR part 1051 set the first emissions standards for RV categories, including all terrain vehicles (ATVs); certain off-road utility vehicles (UTVs) (less than 30 kW, less than 1, 000 cc, and maximum speed more than 25 mph); off-highway motorcycles; and snowmobiles. Each recreational vehicle category is subject to an individual set of exhaust emission standards which phase in over several years. Regulated pollutants are HC+NOx and CO
- All RVs became subject to the same fuel component based permeation emission standards beginning in MY 2008. The regulated pollutant is HC

PRIMARY COMPLIANCE ACTIVITIES IN 2009 - 2011:

- Certification
- Defect Reporting
- Recall
- ABT

CERTIFICATION

There were 100 different recreational vehicle manufacturers that certified products in MY 2009 - 2011. Figure 44 presents RV manufacturers that certified at least four engine families in one or more RV sectors in MY 2009, 2010 and/or 2011.[33] There were about 100 different recreational vehicle manufacturers that

[33]The number of engine families has no bearing on vehicle production volumes.

certified products each model year 2009 – 2011. Figures 45 - 47 present data for manufacturers that certified at least one MY 2009, MY 2010 and/or 2011 engine families in the ATV and UTV, off-highway motorcycle, or snowmobile sectors

Figure 44 - MY 2009-2011 Recreational Vehicle Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Yamaha Motor Corporation	28	27	26
Arctic Cat inc	22	21	21
Polaris Industries Inc.	22	21	22
Bombardier Recreational Products, Inc	19	17	18
American Honda Motor Co., Inc.	22	6	12
Kawasaki Motors Corp., U.S.A.	13	12	12
American Suzuki Motor Corporation	11	13	3
Tomoto Industries, Inc.	10	11	4
Kymco USA	9	9	4
Taotao USA Inc.	6	6	6
Xingyue USA, INC	6	6	6
Loncin (USA) Inc.	7	4	2
Baja Inc.	-	11	8
JCL Powersports LLC.	6	4	3
Other	161	124	100
Total	**342**	**292**	**247**

Figure 45 - MY 2009-2011 ATV and UTV Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Yamaha Motor Corporation	15	14	13
Arctic Cat	13	11	12
Polaris Industries Inc.	11	11	12
American Honda Motor Co., Inc.	13	6	8
Kawasaki Motors Corp., U.S.A.	10	9	9
Tomoto Industries, Inc.	10	9	5
American Suzuki Motor Corporation	9	10	3
Kymco USA	9	9	10
Bombardier Recreational Products, Inc	8	7	9
Taotao USA Inc.	5	5	5
Loncin (USA) Inc.	6	3	2
Kandi USA, Inc.	4	4	5
Xingyue USA, INC	4	4	4
High Rev Motorsports, LLC	3	5	3
Linhai USA, Inc.	2	6	6
Asian Ventures Inc.	4	3	3
Hammerhead Off-Road, Inc.	4	3	-
JCL Powersports LLC.	4	3	3
Team Joyner USA	6	-	2
Deere & Company	3	3	4
Easy Vehicle, Inc.	3	3	2
Eton America LLC	3	3	1
XY-Xinyang Motor, Inc.	2	3	-

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Baja Inc.	-	5	-
Other	91	58	45
Total	**242**	**197**	**166**

Figure 46 - MY 2009-2011 Off-Highway Motorcycle Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Yamaha Motor Corporation	7	7	7
American Honda Motor Co., Inc.	9	-	4
Apollo Motorsports, Inc.	4	4	3
Kawasaki Motors Corp., U.S.A.	3	3	3
Pride Enterprise, LLC	1	5	-
Baja Inc.	-	6	8
Xmotos Worldwide, Inc.	3	2	-
American Suzuki Motor Corporation	2	3	-
KTM North America, Inc.	2	3	3
Other	31	25	18
Total	**62**	**58**	**46**

Figure 47 - MY 2009-2011 Snowmobile Engine Families by Manufacturer

Manufacturer	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Bombardier Recreational Products, Inc.	11	10	9
Polaris Industries Inc.	11	10	10
Arctic Cat Inc	9	10	9
Yamaha Motor Co., LTD.	6	6	6
HJR	1	1	1
Total	**38**	**37**	**35**

As shown in Figure 48, in model years 2009 - 2011 very few ATV/UTV and off-highway motorcycle manufacturers produced two-stroke engines. However, more than 50% of the snowmobile engine families were two-stroke engines. This represents a technology shift. When the current RV regulations were written, a majority of ATVs sold in the United States and almost all snowmobiles used two-stroke engines (see 67 FR 68262).

Figure 48 - MY 2009-2011 Recreational Vehicle Two-Stroke Engine Families

Category	Percentage of Two Stroke Engine Families		
	MY 2009	MY 2010	MY 2011
ATV/UTV	0%	1%	1%
Off-Highway Motorcycles	2%	10%	17%
Snowmobiles	63%	62%	53%

In addition, in MY 2009-2011 over 50 percent of ATVs and UTV engine families either employed catalyst or fuel injection technologies, or both, to meet the emission standards.

RV CERTIFICATES VOIDED

In 2010 EPA withdrew emissions approval for the import and sale of approximately 200,000 MY 2006 and 2007 gasoline-powered off-road motorcycles and all terrain vehicles. The finding was the first case of its kind. The action to void emissions certificates affects the companies that manufactured and imported these vehicles. Consumers who own models covered by the voided certificates are not responsible for the wrongdoing and can continue to use their vehicles.

In 2013 EPA withdrew its approval of the import and sale of over 70,000 gas-powered on- and off-road motorcycles and all-terrain vehicles because the agency believes that it received either incomplete or falsified certification information. EPA issued the vehicle certificates from 2006 to 2012 to two companies which operate as Snyder Technology, Inc. and Snyder Computer Systems, Inc. (doing business as Wildfire Motors Corporation). As a result of a lengthy investigation, the agency believes that the applications for the certificates contained fallacious information and must be voided. These actions affected between four and nine percent of the highway motorcycles and recreational vehicles produced annually between 2006 and 2012. All vehicles imported into or manufactured in the United States are required to have certificates of conformity.

DEFECT REPORTING

Recreational vehicle manufacturers are required to notify EPA when they learn of the existence of emission-related defects in about 10 percent of the vehicles in an engine family.

Figures 49 and 50 present the 2009 - 2011 emission defect reports submitted by recreational vehicle manufacturers. These reports can include multiple model years of a given vehicle and can span more than one problem category. In calendar years 2009 - 2011, manufacturers submitted defect reports that affected recreational vehicles in model years ranging from MY 2006-2010.

Figure 49 - 2009-2011 Recreational Vehicle Defect Reports by Manufacturer

	Reported in 2009		Reported in 2010		Reported in 2011	
Manufacturer	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles
Arctic Cat	5	9,825	3	4,519	1	5,247
BRP	1	9,425	-	-	2	12,972
Honda					1	8,760
Polaris	2	6,077	2	25,146	-	-
Suzuki	-	-	1	25,458	-	-
Yamaha	1	2,020	-	-	-	-
Total	**9**	**27,347**	**6**	**55,123**	**4**	**26,979**

Figure 50 - 2009-2011 Recreational Vehicle Defect Reports by Problem Category

Problem Category	Reported in 2009		Reported in 2010		Reported in 2011	
	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles	Number of Defect Reports	Number of Affected Vehicles
Crankcase Vent System					1	8,656
PCV System					1	4,316
Fuel delivery component	2	11,445	-		-	-
OBD system	2	7,396	2	26,289	-	-
Internal engine component (piston, etc)	1	4,696	-	-	1	5,247
VECI label	1	2,285	-	-	-	-
Drivability problem	2	1,381	-	-	-	-
Miscellaneous	1	144	-	-	-	-
Computer related (other than OBD)	-	-	1	12,573	-	-
Exhaust system	-	-	1	12,573	-	-
Monitoring/measuring sensor/system	-	-	1	2,033	1	8,760
Intake/exhaust manifold	-	-	1	1,655	-	-
Total	**9**	**27,347**	**6**	**55,123**	**4**	**26,979**

RECALL REPORTING

Figures 51 and 52 summarize the recreational vehicle recall actions in 2009 - 2011. The recalls in 2009 - 2011 affected vehicles in model years 2007-2010.

Figure 51 - 2009-2011 Recreational Vehicle Recall Reports by Manufacturer

Manufacturer	Recalls in 2009		Recalls in 2010		Recalls in 2011	
	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles
Arctic Cat	5	9,932	3	4,519	1	5,247
BRP	1	4,530	-	-	2	12,404
Polaris	1	1,381	-	-	-	-
Total	**7**	**15,843**	**3**	**4,519**	**3**	**17,651**

Figure 52 - 2009-2011 Recreational Vehicle Recall Reports by Problem Category

Problem Category	Recalls in 2009		Recalls in 2010		Recalls in 2011	
	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles
Crankcase Vent System					1	8,729
PCV System					1	3,675
Internal engine component (piston, etc)					1	5,247
OBD system	2	7,503	-	831	-	-
Fuel delivery component	1	4,530	-	-	-	-
VECI Label	2	2,285	-	-	-	-

Problem Category	Recalls in 2009		Recalls in 2010		Recalls in 2011	
	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles	Number of Recalls	Number of Affected Vehicles
Drivability problem	1	1,381	-	-	-	-
Miscellaneous	1	144	-	-	-	-
Monitoring/measuring sensor/system	-	-	1	2,033	-	-
Intake/exhaust manifold	-	-	1	1,655	-	-
Total	**7**	**15,843**	**2**	**4,519**	**3**	**17,651**

AVERAGE BANKING AND TRADING (ABT) PROGRAMS

Only a few of the larger ATV, utility vehicle, and off-highway motorcycle manufacturers took advantage of the ABT and emission averaging. On the other hand, almost all snowmobile manufacturers participated in ABT.

IV. Industry Statistics

This section presents additional information that EPA collects in the course of implementing compliance programs.

ALTERNATIVE FUEL AND ALTERNATIVE FUEL CONVERSIONS[34]

Some vehicles and engines are designed to operate on fuels other than gasoline and diesel. Some are manufactured by the OEM to operate on alternative fuels, while others are certified by the OEM to operate on gasoline or diesel fuel and later converted by an aftermarket manufacturer to operate on an alternative fuel. Generally, the CAA prohibits any aftermarket changes to a certified vehicle or engine configuration that could affect emissions, but a regulatory exemption to the prohibition is available in the case of alternative fuel conversions. Each sector has different criteria under which vehicles and engines can be converted to operate on a new fuel. In some sectors fuel conversions are certified using OEM certification provisions.

LIGHT-DUTY VEHICLE ALTERNATIVE FUEL DATA

Figures 53 - 55 present the production of MY 2009 - 2011 OEM light-duty vehicles by fuel type. Gasoline vehicles comprise the dominant fuel type, followed by flexible fuel vehicles. After gasoline and ethanol, diesel is the next most prevalent fuel, but still represents less than one percent of passenger car and light-

[34] While alternative fuels are generally understood to mean non-petroleum alternatives to gasoline and diesel, this section of the report also presents data for diesel-fueled vehicles and engines in the light-duty, motorcycle, and recreational vehicle sectors, sectors that have historically been dominated by gasoline.

duty truck production. Compressed natural gas (CNG) vehicles make up an even smaller fraction of MY 2009 - 2011 vehicle production.

Figure 53 - MY 2009 Light-Duty Vehicle Production Volume by Fuel Type

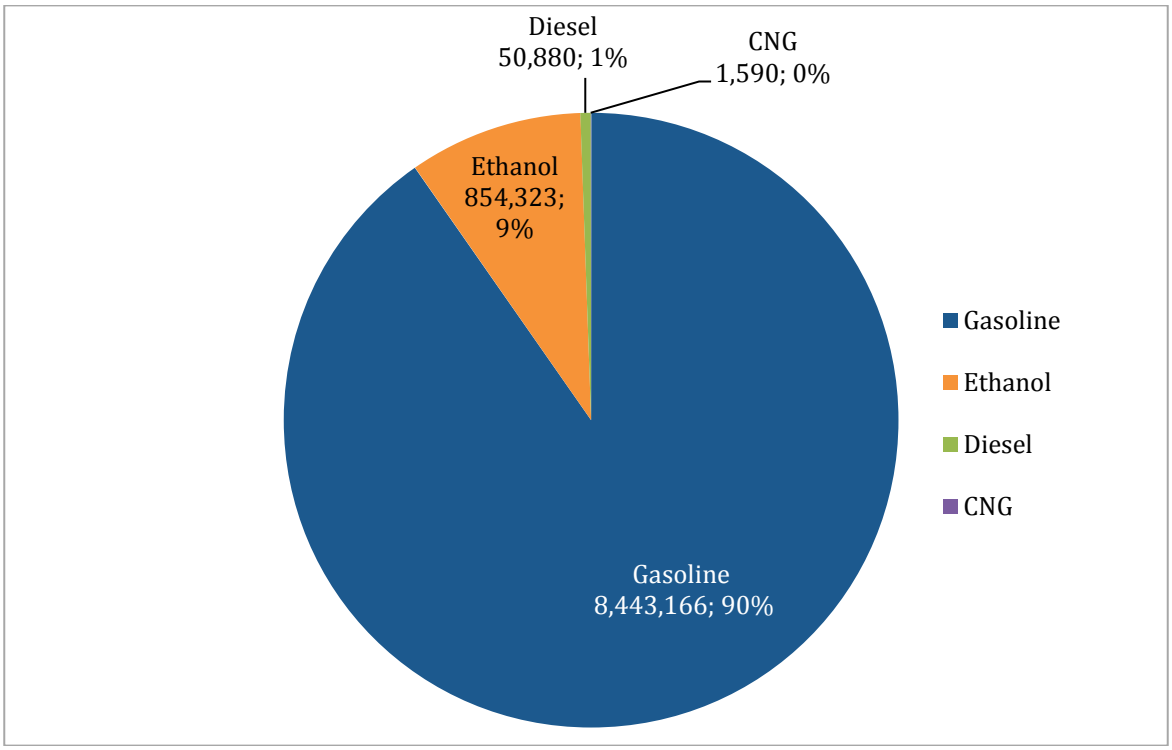


Figure 54 - MY 2010 Light-Duty Vehicle Production Volume by Fuel Type

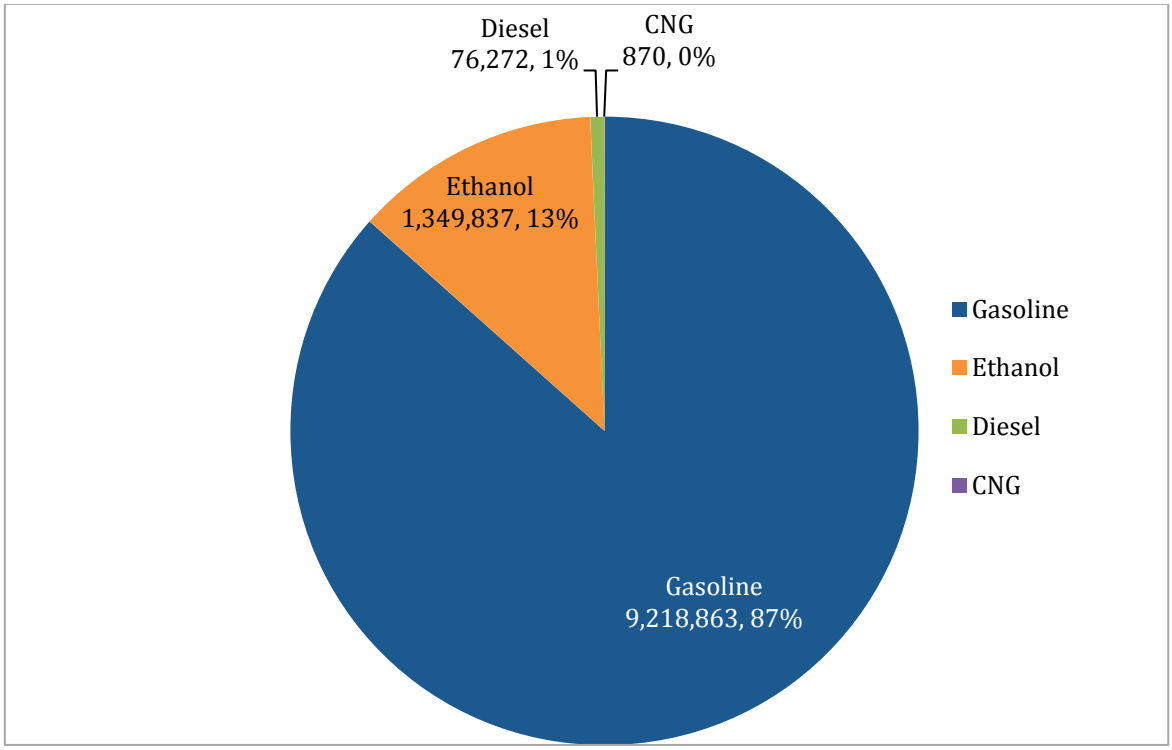
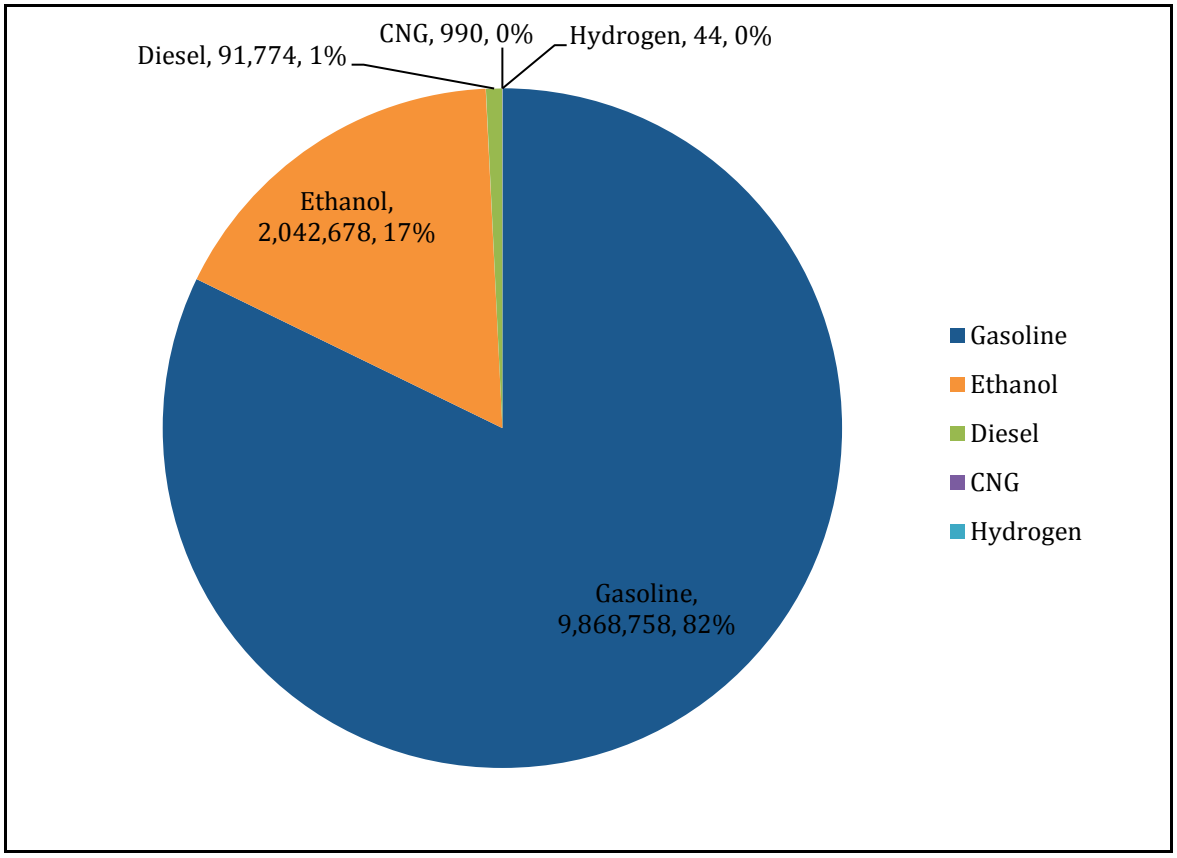


Figure 55 - MY 2011 Light-Duty Vehicle Production Volume by Fuel Type



All MY 2009 – 2011 ethanol vehicles were flexible-fuel vehicles which are capable of operating on gasoline, E85 (85 percent ethanol and 15 percent gasoline), or an intermediate blend.

Figure 56 summarizes the number of OEM light-duty vehicle diesel and alternative fuel test groups by manufacturer.

Figure 56
MY 2009-2011 Light-Duty OEM Diesel and Alternative Fuel Test Groups by Manufacturer

Fuel	Manufacturer	Number of Exhaust Test Groups		
		MY 2009	MY 2010	MY 2011
Battery Electric	Azure Dynamics	0	0	1
	BMW	0	0	1
	Mercedes Benz	0	0	1
	Nissan	0	0	1
	Tesla	0	1	1
	Think	0	0	1
	Wheego	0	0	1
CNG	Honda	1	1	2

Diesel	BMW	2	2	2
	Cummins	2	2	2
	Ford	0	0	2
	General Motors	0	0	2
	Isuzu	0	0	1
	Mahindra &	0	0	1
	Mercedes Benz	3	4	5
E85-Gasoline	Bentley	0	0	1
	Chrysler	4	3	5
	Ford	6	13	14
	General Motors	13	10	10
	Mercedes Benz	1	1	1
	Nissan	1	1	1
	Saab	0	0	1
	Toyota	1	1	1
Hydrogen Fuel Cell	Honda	1	1	1
	Toyota	1	1	1

Vehicles originally designed and certified to operate on gasoline or diesel fuel can be converted to operate on an alternative fuel. Converters of new vehicles must obtain a certificate of conformity to avoid violating the CAA prohibition against tampering.

A new regulation finalized in 2011 established alternative pathways to obtain a regulatory exemption from tampering beyond certification for converters of older vehicles and engines. For the 2011 model year there were 31 submissions through the Intermediate Age program and four submissions for the Outside Useful Life program.

Figure 57 summarizes the number of certificates issued for light-duty vehicle alternative fuel conversions by manufacturer in MY 2009 - 2011.[35]

Figure 57
MY 2009-2011 Light-Duty Alternative Fuel Conversion Certificates by Manufacturer

Fuel	Manufacturer	Number of Certificates		
		MY 2009	MY 2010	MY 2011
CNG	Altech-Eco	6	3	19
	BAF Technologies	6	3	5
	Baytech	1	2	3
	Evotek	-	5	10
	Go Natural CNG	-	-	2
	Greenkraft	-	-	1
	High Pressure Group	-	-	1
	Landi Renzo USA	-	-	3
	Nat Gas Car	-	-	2
	Natural Drive Partners	2	4	5

[35] Each light-duty vehicle certificate covers a unique combination of exhaust test group and evaporative emissions family. Therefore the number of light-duty certificates and test groups is usually different. MY 2009-2011 conversion certificates may be issued for conversion of either current or earlier model year OEM vehicles.

Fuel	Manufacturer	Number of Certificates		
		MY 2009	MY 2010	MY 2011
	NGV Conversion	-	2	2
	NGV Motori, USA	-	-	1
CNG/E85-Gasoline	Altech-Eco	-	-	4
	BAF Technologies	-	-	1
	Evotek	-	-	1
	Go Natural CNG	-	-	11
	IMPCO Technologies	-	-	15
	Parnell USA	-	-	1
	The CNG Store- Auto Gas	-	-	6
CNG/Gasoline	Altech-Eco	3	5	10
	Baytech	3	3	6
	Evotek	-	-	1
	FuelTek Conversion Corp.	4	-	-
	Go Natural CNG	-	-	5
	IMPCO Technologies	11	-	15
	Nat Gas Car	-	-	2
	The CNG Store- Auto Gas	-	-	3
	Altech-Eco	3	5	10
	Baytech	3	3	6
E85-Gasoline	Flex Fuel U.S.	3	3	2
LPG	Roush Industries	-	11	20
	Technocarb Equipment	7	-	-
	Yellow Checker Star	-	-	2
LPG/E85-Gasoline	American Alternative Fuel	1	2	13
	Evotek	-	-	1
	Icom North America	-	-	7
	IMPCO Technologies	3	-	19
LPG/Gasoline	American Alternative Fuel	5	7	14
	Icom North America	-	-	1
	IMPCO Technologies	10	-	7
	Parnell USA	-	-	3
	Technocarb Equipment	7	-	-
Plug-in Hybrid	A123 Systems	-	1	3

HIGHWAY MOTORCYCLE ALTERNATIVE FUEL DATA

The majority of highway motorcycles are certified to operate on gasoline. However, there are a few highway motorcycle engine families certified to operate as battery-electrics, obtaining energy by charging a battery with electricity from a 120V outlet. See Figure 58 for a breakdown of electric motorcycle manufacturers for MY 2009 - 2011.

Figure 58
MY 2009-2011 Highway Motorcycle OEM Alternative Fuel Engine Families by Manufacturer

Fuel	Manufacturer	Number of Engine Families		
		MY 2009	MY 2010	MY 2011
Battery Electric[36]	Brammo	1	1	1
	Green Vehicles	1	-	
	Puma	-	2	
	Tom Notch Technology	-	2	
	Xtreme Green	1	-	
	Zero Motorcycles	1	1	3
	ZT Power Station	-	1	
	Current Motors			1
	Evolve Motorcycles			1
	Oxygen World			1
	Ridelectric LLC			

HEAVY-DUTY HIGHWAY ALTERNATIVE FUEL DATA

Figure 59 presents the OEM heavy-duty highway engines that were certified to operate on alternative fuels in model years 2009 - 2011.

Figure 59
MY 2009-2011 Heavy-Duty Highway Engine OEM Alternative Fuel Engine Families by Manufacturer

Fuel	Manufacturer	Number of Engine Families		
		MY 2009	MY 2010	MY 2011
CNG	Cummins Inc.	4	3	3
	Doosan Infracore, Co	2	2	2
CNG/Diesel	Westport Fuel Systems	1	1	1
LPG	Cummins Inc.	1	-	-

HEAVY-DUTY HIGHWAY ALTERNATIVE FUEL CONVERSION DATA

Figure 60 presents the heavy-duty highway alternative fuel conversion certificates issued in model years 2009 - 2011.[37]

Figure 60
MY 2009-2011 Heavy-Duty Highway Engine Alternative Fuel Conversion Certificates by Manufacturer

Fuel	Manufacturer	Number of Certificates		
		MY 2009	MY 2010	MY 2011
CNG	BAF Technologies	1	2	2
	Baytech Corporation	3	3	4

[36] EPA began issuing certificates for battery electric highway motorcycles in MY 2009.

[37] MY 2009-2011 conversion certificates may be issued for conversion of either current or earlier model year OEM highway engines.

	Emission Solutions, Inc.	-	1	1
	Evotek, LLC			5
	Greenkraft Inc			1
CNG/Gasoline	Baytech Corporation	3	1	2
LPG	American Alternative Fuel			4
	Baytech Corporation	2	1	2
	Bi-Phase Technologies, LLC	1	-	3
	Clean Fuel USA Inc.	1	4	1
	Roush			8
LPG/Gasoline	Icom North America LLC	-	1	1

NONROAD COMPRESSION IGNITION ALTERNATIVE FUEL DATA

There were no MY 2009 - 2011 certificates issued for nonroad compression ignition engines that operate on alternative fuels.

NONROAD SPARK IGNITION ALTERNATIVE FUEL AND FUEL CONVERSION DATA

There are numerous engine manufacturers that certify nonroad spark ignition engines to run on alternative fuels, in both Small SI and Large SI categories.[38] About 10 percent of Small SI engine families in MY 2009 - 2011 were certified to operate on alternative fuels. The majority of Large SI engine families are certified to operate on alternative fuels. In MY 2009 of the 89 Large SI engine families, 77 were certified to operate on one or more alternative fuels. In MY 2010, of the 124 Large SI engines families, 91 were certified to operate on one or more alternative fuels. In MY 2011, of the 140 Large SI engines families, 123 were certified to operate on one or more alternative fuels. Figures 61 and 62 summarize information about MY 2009 - 2011 Small SI and Large SI alternative fuel engine families.

Figure 61
MY 2009-2011 Small Spark Ignition Engine OEM Alternative Fuel Engine Families

Fuel	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
E85-Gasoline	2	1	-
Natural Gas/CNG	21	17	15
Natural Gas/CNG / Propane/LPG	28	22	16
Propane/LPG	63	46	42
Propane/LPG / Gasoline	6	5	9
Natural Gas/CNG / Propane/LPG / Gasoline			1

[38] No marine SI engines were certified to operate on alternative fuels in either MY 2009 or 2010. One marine SI engine family was certified to operate on LPG in MY 2011.

Figure 62
MY 2009-2011 Large Spark Ignition Engine OEM Alternative Fuel Engine Families

Fuel	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Natural Gas/CNG	8	10	42
Natural Gas/CNG / Propane/LPG	5	17	23
Natural Gas/CNG / Propane/LPG / Gasoline	4	7	7
Propane/LPG	20	34	34
Propane/LPG / Gasoline	40	23	27

RECREATIONAL VEHICLE ALTERNATIVE FUEL DATA

The majority of recreational vehicles are certified to operate on gasoline. However, there were two ATV engine families certified to operate on diesel in MY 2009, two in MY 2010 and one in MY 2011. Figure 63 shows a breakdown of diesel recreational vehicle manufacturers.

Figure 63
MY 2009-2011 Recreational Vehicle OEM Diesel Engine Families by Manufacturer

Fuel	Manufacturer	Number of Engine Families		
		MY 2009	MY 2010	MY 2011
Diesel	Tomcar USA Inc.	1	1	0
	Deere & Company	1	1	1

MANUFACTURER LOCATIONS

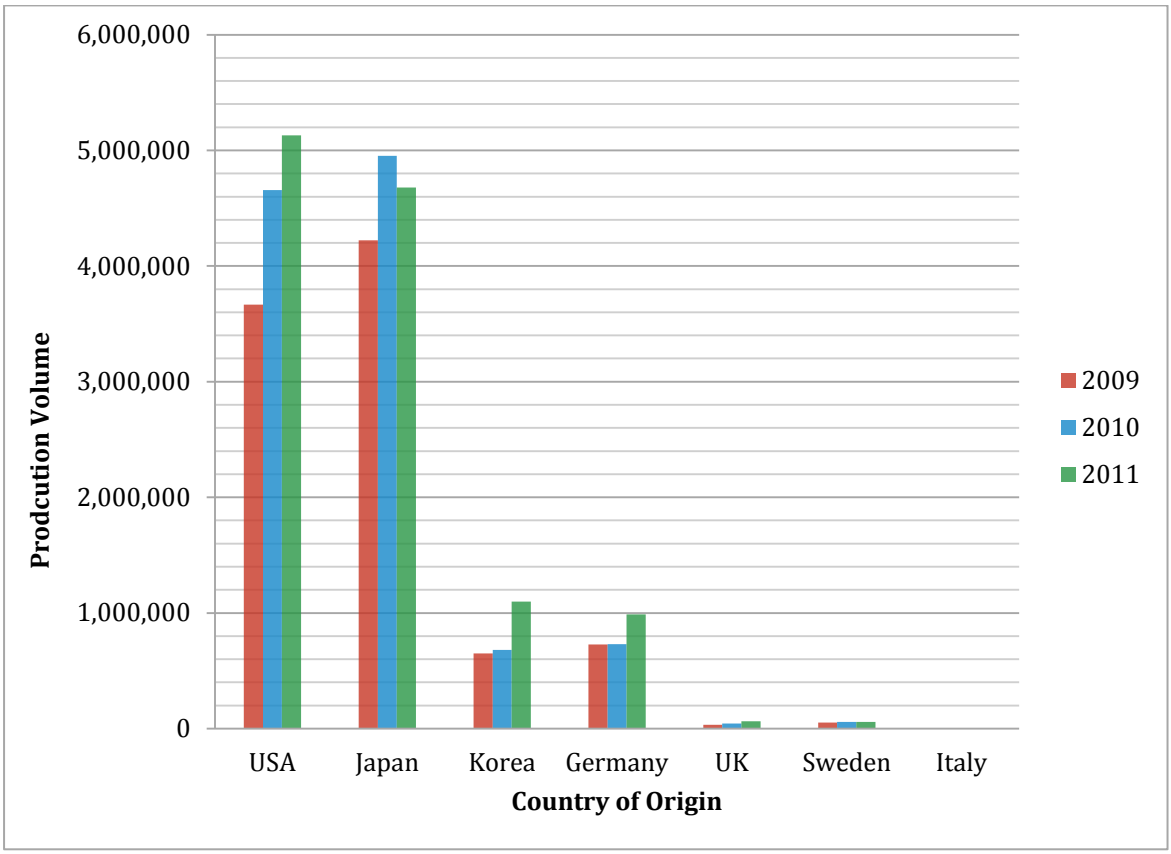
Consistent with past compliance reports, manufacturer locations here are attributed using two different approaches. For light-duty vehicles and locomotives, we report data based on where a manufacturer's headquarters are located, not necessarily where the vehicles are manufactured. For example, Toyota's corporate headquarters are in Japan, so all of Toyota's MY 2009 - 2011 vehicles produced for sale in the United States are presented with Japan listed as the country of origin, even though some Toyota vehicles are built in the United States. For all other sectors, EPA generally reports manufacturer location based on the actual location in which the vehicle or engine was manufactured.

LIGHT-DUTY VEHICLE MANUFACTURER LOCATIONS

Figure 64 presents the country of origin of MY 2009 - 2011 light-duty vehicles produced for sale in the United States.[39]

[39] These production data only include vehicles subject to Corporate Average Fuel Economy standards. Pickup trucks greater than 8,500 pounds Gross Vehicle Weight are not included.

Figure 64
MY 2009-2011 Light-Duty Vehicle Production Volume by Manufacturer's Country of Origin



HIGHWAY MOTORCYCLE MANUFACTURER LOCATIONS

In MY 2009 - 2011, Chinese, Japanese, and Taiwanese manufacturers produced a large fraction of Class Ia and Ib highway motorcycles sold in the United States while American, Japanese and European manufacturers produced the largest share of U.S. Class III highway motorcycles.

HEAVY-DUTY HIGHWAY MANUFACTURER LOCATIONS

Figure 65 presents the number of highway engine families (both compression ignition and spark ignition engine families) that were certified for sale in the United States by engine manufacturing plant location.

Figure 65
MY 2009-2011 Heavy-Duty Highway CI and SI Engines by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
USA	77	39	79
Japan	12	5	5
Germany	3	2	2
Brazil	3	1	1
Canada	1	0	0

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
The Netherlands	1	0	0
Italy	0	0	2
Multiple countries[40]	3	5	3
Total	**100**	**52**	**92**

NONROAD COMPRESSION IGNITION MANUFACTURER LOCATIONS

Figures 66 - 68 present the number of engine families intended for use in marine diesel (both EPA and IMO certificates), locomotive, and construction/agricultural equipment applications that were certified for sale in the United States by engine manufacturing plant location or country of origin.

Figure 66 - MY 2009-2011 Marine Diesel Engine Families by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
USA	86	86	107
Japan	20	20	27
Italy	17	17	19
Sweden	12	20	16
United Kingdom	11	13	18
Korea	10	3	5
The Netherlands	8	8	10
Germany	6	10	15
France	5	10	6
Mexico	4	0	1
Canada	0	0	4
Norway	2	0	0
Finland	1	1	0
Austria	1	1	1
Multiple Countries	16	17	30
Total	**199**	**206**	**259**

Figure 67 - MY 2009-2011 Locomotive Engine Families by Country of Origin

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
USA	70	43	43
Multiple countries	2	4	

[40] "Multiple countries" means that engines within an engine family are manufactured in more than one country.

Figure 68
MY 2009-2011 Construction and Agricultural Engine Families by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Japan	193	195	179
Germany	83	83	75
China	60	65	43
Italy	46	49	50
England	47	47	32
USA	43	47	21
Korea	31	36	27
India	23	25	22
Mexico	8	7	8
Sweden	8	2	9
Switzerland	7	11	3
France	8	7	2
Czech Republic	2	2	2
Austria	1	1	-
Brazil	1	1	-
Belgium	0	0	-
Slovakia	-	4	4
Multiple countries	50	59	43
Total[41]	**611**	**641**	**520**

NONROAD SPARK IGNITION MANUFACTURER LOCATIONS

Figures 69 - 71 present the number of Small SI, Marine SI and Large SI engine families that were certified for sale in the United States by engine manufacturing plant location.

Figure 69 - MY 2009-2011 Small Spark Ignition Engine Families by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
China	542	467	442
USA	308	264	198
Japan	158	153	134
Germany	43	37	12
Sweden	37	31	34
Italy	22	18	8
Mexico	16	20	16
Thailand	6	7	2
Brazil	6	4	60
Taiwan	2	1	-
Czech Republic	1	1	1

[41] This figure does not include stationary-only engine families.

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Multiple countries	19	17	78
Total	**1,160**	**1,020**	**985**

Figure 70 - MY 2009-2011 Marine Spark Ignition Engine Families by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
Japan	64	52	52
USA	37	44	52
China	10	12	13
France	5	-	-
Thailand	4	5	5
Canada	2	4	2
Germany	2	-	-
Total	**124**	**117**	**124**

Figure 71 - MY 2009-2011 Large Spark Ignition Engine Families by Manufacturing Location

Country	Number of Engine Families		
	MY 2009	MY 2010	MY 2011
USA	59	95	113
Korea	17	10	7
Canada	4	6	9
Germany	2	6	5
Japan	1	2	2
Mexico	1	1	1
Austria	1	1	1
China	-	1	-
Multiple countries	4	2	2
Total	**89**	**124**	**140**

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