MARK BRNOVICH
ATTORNEY GENERAL
Firm State Bar No. 14000
Brunn (Beau) Roysden (028698)
Assistant Attorney General
OFFICE OF THE ATTORNEY GENERAL
2005 North Central Avenue
Phoenix, Arizona 85004
Telephone: (602) 542-3702
Facsimile: (602) 542-4377

[Additional Counsel on Signature Page]

Attorneys for Plaintiff State of Arizona

THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

STATE OF ARIZONA, *ex rel.*, MARK BRNOVICH, Attorney General, Plaintiff, v. MERCEDES-BENZ USA, LLC, a Delaware limited liability company; and DAIMLER AKTIENGESELLSCHAFT, a foreign corporation; Defendants.	No. CV 2019-000792 **COMPLAINT**

TABLE OF CONTENTS

For its Complaint against Defendants MERCEDES-BENZ USA, LLC, a Delaware limited liability company ("Mercedes USA"), and DAIMLER AKTIENGESELLSCHAFT, a foreign corporation ("Daimler AG"), Plaintiff State of Arizona *ex rel.* Mark Brnovich, Attorney General (the "State"), alleges as follows:

I. INTRODUCTION

1. This action is brought under the Arizona Consumer Fraud Act (A.R.S. §§ 44-1521, et seq.) to obtain restitution for Arizona consumers who purchased or leased certain Mercedes-Benz diesel vehicles manufactured, sold, leased, or advertised by Defendants (the "Affected Mercedes Vehicles"); injunctive relief to prevent the unlawful acts and practices alleged herein; and other appropriate relief, including disgorgement, civil penalties, and attorneys' fees. This action is based on violations of the Arizona Consumer Fraud Act and not on any independent violations of federal laws regarding vehicle emissions.

2. Attempting to capitalize on growing consumer demand for products with favorable environmental impact profiles, many major automobile manufacturers rushed to develop "clean diesel" and promoted new diesel vehicles as environmentally friendly and clean. Certain manufacturers began marketing diesel cars and trucks as both more powerful *and* more environmentally friendly compared to gasoline vehicles. And the marketing worked, as millions of diesel vehicles were purchased between 2007 and 2016.

3. A key factor in the "clean diesel" message was the ability of car manufacturers to control emissions, and in particular the output of Nitrogen Oxides ("NOx"). NOx is an air pollutant that can cause serious illness. It also reacts in the atmosphere to form Ozone (O_3) and acid rain, and it does so not in the upper atmosphere, but in the ambient air we breathe.

4. In marketing their popular BlueTEC "Clean Diesel" vehicles, Defendants promised, among other "clean" promises, that the BlueTEC vehicles (1) convert nitrous oxide emissions into "pure, earth-friendly nitrogen and water," (2) produce "fewer greenhouse gases than gasoline," (3) exceed "statutory [emissions] requirements," (4) reduce "Nitrogen Oxides by up to 80%," and (5) use the "cleanest diesel technology in the world. For the air we breathe."

5. Defendants understood the materiality to consumers of a “clean car message.” Thus, Defendants aggressively and consistently marketed their BlueTEC vehicles across all media as “the world’s cleanest and most advanced diesel” with “ultra-low emissions, high fuel economy and responsive performance” that emits “up to 30% lower greenhouse-gas emissions than gasoline.”

6. Additionally, Defendants promoted their Clean Diesel vehicles as “Earth Friendly”: “With BlueTEC, cleaner emissions are now an equally appealing benefit.” In fact, Defendants proclaim themselves “#1 in CO2 emissions for luxury vehicles.”

7. The BlueTEC Clean Diesel marketing claims constitute false and deceptive acts and practices. In addition, they involve concealment, suppression, and omission of material facts with intent that others rely.

8. Such facts are material in that they relate to the operation and true environmental characteristics of the Affected Mercedes Vehicles. Among other critical, material suppressed facts is that Defendants programmed their BlueTEC vehicles to turn off or otherwise limit the effectiveness of the emission reduction systems during normal, real-world driving. As a consequence of this critical concealed material fact, consumers are unaware that—contrary to Defendants’ representations—the Affected Mercedes Vehicles are not clean diesels and, to the contrary, emit enormous amounts of NOx pollutants into the atmosphere.

9. Defendants recently admitted, in response to related litigation, that a shut-off device in the engine management of certain BlueTEC diesel cars stops NOx cleaning when ambient temperatures drop below 50 degrees Fahrenheit and under other, unspecified circumstances. Testing by an expert on Defendants' vehicles at highway speeds, at low temperatures, and at variable speeds indicates a systemic failure to adequately control NOx emissions. Low temperature testing at highway speeds, for example, produced emissions that were 8.1 to 19.7 times the highway emissions standard. Testing at low temperatures at variable speeds produced emissions as high as 30.8 times the standard.

10. But the operation of Defendants' shut-off device goes well beyond when the temperature drops below 50 degrees Fahrenheit. Testing by an expert also revealed that Defendants' BlueTEC vehicles do not meet emission standards in virtually ***all*** real-world driving conditions. In virtually every road test at a variety of speeds and temperatures, the emissions exceeded emissions standards, contrary to Defendants' representations to consumers that their cars were environmentally friendly.

11. Testing also reveals that the Affected Mercedes Vehicles intentionally shut down or severely limit the emissions control system when the BlueTEC vehicles are on the road. Expert testing revealed that, while the Defendants' BlueTEC vehicle's on-road emissions were very high and exceeded federal standards, the same vehicle when tested on a dynamometer in a laboratory using EPA testing protocols had low emissions and either passed the tests, or were within a close margin of doing so. This contrast demonstrates that Defendants programmed their vehicles' emission systems to reduce effectiveness or turn off altogether when the vehicle is on the road. As noted, these critical and material facts have been intentionally concealed and hidden from Arizona consumers at the same time that Defendants have touted the vehicles as "clean" and earth friendly.

12. The State alleges that the following Defendant vehicle models powered by BlueTEC diesel fueled engines are affected by the shut-off device described above: ML 320, ML 350, GL 320, E320, S350, R320, E Class, GL Class, ML Class, R Class, S Class, GLK Class, GLE Class, and Sprinter (the "Affected Mercedes Vehicles").

II. PARTIES

A. Plaintiff

13. Plaintiff is the State of Arizona, *ex rel.* Mark Brnovich, Attorney General (the "State").

B. Defendants

1. Daimler AG

14. Defendant Daimler Aktiengesellschaft ("Daimler AG") is a foreign corporation headquartered in Stuttgart, Baden-Württemberg, Germany.

15. Daimler AG is engaged in the business of designing, engineering, manufacturing, testing, marketing, supplying, selling and distributing motor vehicles, including the Affected Mercedes Vehicles.

16. Daimler AG engineered, designed, developed, manufactured and installed the emissions systems on the Affected Mercedes Vehicles, manipulated the emission systems in such a manner so as to reduce the systems' effectiveness during on-road driving conditions, and exported these vehicles with the purpose and intent of selling them throughout the State of Arizona. Daimler AG purposely availed itself of Arizona's laws and markets and intended to profit by selling its vehicles to Arizona consumers.

17. Daimler AG is, and was at all relevant times, doing business in a continuous manner through a chain of distribution and dealers throughout the United States, including throughout the State of Arizona, by selling, advertising, promoting, and distributing Mercedes-Benz motor vehicles.

18. Through its wholly owned subsidiaries and/or agents, Daimler AG markets its products in a continuous manner in the State of Arizona. Daimler AG also developed, reviewed, and approved the marketing and advertising campaigns designed to sell the Affected Mercedes Vehicles.

2. Mercedes-Benz USA, LLC

19. Defendant Mercedes-Benz USA, LLC ("Mercedes USA") is a Delaware limited liability company whose principal place of business is 303 Perimeter Center North, Suite 202, Atlanta, Georgia 30346.

20. Mercedes USA designs, manufactures, markets, distributes and sells Mercedes-Benz automobiles throughout the State of Arizona. Mercedes USA and/or others with whom it was working designed, manufactured, and installed the BlueTEC Clean Diesel engine systems in the Affected Mercedes Vehicles. Mercedes USA also participated in developing, approving, and disseminating the owner's manuals and warranty booklets, advertisements, and other promotional materials relating to the Affected Mercedes Vehicles.

21. Mercedes USA intends that its dealerships disseminate brochures, booklets and advertisements, including information regarding its BlueTEC Clean Diesel engine systems, to potential consumers. Mercedes USA also communicates with its dealer network through Technical Services Bulletins and through electronic mail. These communications provided Mercedes USA with opportunities to disclose the truth about the Affected Mercedes Vehicles to dealers for dissemination to potential purchasers or owners; yet, Mercedes failed to utilize these opportunities to disclose materials facts regarding the BlueTEC Clean Diesel engine systems.

3. Relationship between Defendants

22. Daimler AG is the ultimate parent of, controls, and communicates with Mercedes USA concerning, among other things, virtually all aspects of the Affected Mercedes Vehicles distributed in the United States.

23. Mercedes USA acts as the sole distributor for Mercedes-Benz vehicles in the United States, purchasing those vehicles from Daimler AG in Germany for sale in this country.

24. On information and belief, the relationship between Daimler AG and Mercedes USA is governed by a General Distributor Agreement.

25. That General Distributor Agreement gives Daimler AG the right to control nearly every aspect of Mercedes USA's operations—including sales, marketing, management policies, information governance policies, pricing, and warranty terms.

26. Daimler AG directly or indirectly owns 100% of the capital share in Mercedes USA.[1]

27. Daimler AG paid 19 million euros (approximately 21.8 million U.S. dollars) in relocation expenses for Mercedes USA's headquarters.

III. JURISDICTION AND VENUE

28. This Complaint is filed, and these proceedings are instituted under, the provisions of the Arizona Consumer Fraud Act, A.R.S. §§ 44-1521, *et seq.*

29. This Complaint asserts claims solely under Arizona law. The State does not intend to assert any claim under federal law, and this Complaint should not be construed to advance any claim that arises under federal law under 28 U.S.C. § 1331.

30. Venue is proper in Maricopa County under A.R.S. § 12-401.

IV. FACTUAL ALLEGATIONS

A. The Environmental Challenges Posed By Diesel Engines

31. Diesel engines pose a difficult challenge to the environment because they have an inherent trade-off between power, fuel efficiency, and emissions. Compared to gasoline engines, diesel engines generally produce greater torque, greater low-end power, better drivability, and much higher fuel efficiency. But these benefits come at the cost of much dirtier and more harmful emissions.

32. Instead of using a spark plug to combust highly refined fuel with short hydrocarbon chains, as gasoline engines do, diesel engines compress a mist of liquid fuel and air to very high temperatures and pressures, which causes the diesel to spontaneously combust. This causes a more powerful compression of the pistons, which produces greater engine torque (that is, more power).

33. The diesel engine can do this both because it operates at a higher compression ratio than a gasoline engine and because diesel fuel contains more energy than gasoline.

[1] Daimler AG 2015 Annual Report, Notes to the Consolidated Financial Statement, p. 274.

34. But this greater energy and fuel efficiency comes at a cost: diesel produces dirtier and more dangerous emissions. One byproduct of diesel combustion is oxides of nitrogen (NOx), which includes a variety of nitrogen and oxygen chemical compounds that only form at high temperatures.

35. These compounds are formed in the cylinder of the engine during the high temperature combustion process. NOx pollution contributes to nitrogen dioxide, particulate matter in the air, and reacts with sunlight in the atmosphere to form ozone. Exposure to these pollutants has been linked with serious health dangers, including asthma attacks and other respiratory illnesses serious enough to send people to the hospital. Ozone and particulate matter exposure have been associated with premature death due to respiratory-related or cardiovascular-related effects. Children, the elderly, and people with pre-existing respiratory illness are at acute risk of health effects from these pollutants. As a ground level pollutant, NO_2, a common byproduct of NOx reduction systems using an oxidation catalyst, is highly toxic in comparison to nitric oxide (NO). If overall NOx levels are not sufficiently controlled, then concentrations of NO_2 levels at ground level can be quite high, where they have adverse acute health effects.

36. United States Government, through the EPA, has passed and enforced laws designed to protect United States citizens from these pollutants and certain chemicals and agents known to cause disease in humans. Automobile manufacturers must abide by these U.S. laws and must adhere to EPA rules and regulations. This case is not based on these laws but on deception aimed at consumers.

B. Defendants Market The Affected Diesel Vehicles As Environmentally Friendly, And The World's Cleanest Diesel Vehicles, Among Other Claims

1. Defendants advertised and promoted BlueTEC Clean Diesels as the world's cleanest diesel vehicles.

37. Defendants understood that promoting its BlueTEC vehicles as environmentally superior to gasoline cars would be material to a reasonable consumer interested in environmental issues with respect to a decision to purchase a car.

38. Defendants' customers expect "exceptional environmental sustainability."[2] In a 2008 press release, Defendants acknowledged that "the environmental sustainability of vehicles is gaining importance in the purchasing decision."[3]

39. To induce consumers to purchase BlueTEC Clean Diesel vehicles, Defendants marketed the BlueTEC-equipped vehicles as environmentally friendly and fuel efficient "without the need to forego the characteristic brand features—safety, comfort and refined driving pleasure."[4]

40. Defendants' advertising is widely disseminated throughout the United States and Arizona. It includes, among other things, televised advertisements, online social media campaigns, press releases and public statements, print advertising, brochures and other materials distributed to dealers and distributors, and strategic product placement (for instance, a Mercedes fleet of "low-emission" vehicles, including the E320 BlueTEC Clean Diesel, shuttled superstar musicians at each of the eight 2007 Live Earth climate protection concerts, two of which took place in the United States[5]).

2. Defendants advertised and promoted BlueTEC Clean Diesel vehicles as low-emitting.

41. Defendants' advertisements, promotional campaigns, and public statements represented that the Affected Mercedes Vehicles had high fuel economy, low emissions, reduced

---

[2] Press Release, Mercedes-Benz, Mercedes-Benz launches "Formula Green" in the five, four and three-litre consumption class, *available at* http://media.daimler.com/dcmedia/0-921-658901-1-1277592-1-0-0-0-0-1-0-0-0-1-0- 0-0-0-0.html.

[3] Press Release, Mercedes-Benz, Road to the Future: From BlueTEC Diesel Vehicles to Electric Vehicles: Modular Technologies for a Clean Future of the Premium Automobile, *available at* http://media.daimler.com/ dcmedia/0-921-657591-1-1091617-1-0-1-0-0-1-12639-0-0-1-0-0-0-0-0.html?TS=1459448202325.

[4] Press Release, Mercedes-Benz, Road to the Future: From BlueTEC Diesel Vehicles to Electric Vehicles: Modular Technologies for a Clean Future of the Premium Automobile, *available at* http://media.daimler.com/ dcmedia/0-921-657591-1-1091617-1-0-1-0-0-1-12639-0-0-1-0-0-0-0-0.html?TS=1459448202325.

[5] Press Release, Mercedes-Benz, Phil Collins, Jon Bon Jovi, Snoop Dogg and the Black Eyed Peas Join Smart to Protect the Environment, *available at* http://media.daimler.com/dcmedia/0-921-1653632-1-893475-1-0-0-0-0-1- 0-0-0-1-0-0-0-0-0.html.

NOx by 90%, had lower emissions than comparable diesel vehicles, and had lower emissions than other comparable vehicles. For example:

a) According to Defendants, they offer consumers "the world's cleanest diesel automobiles."[6]

b) Defendants promise that BlueTEC Clean Diesel vehicles have "ultra-low emissions,"[7] with "up to 30% lower greenhouse-gas emissions than gasoline."

c) On its website, Defendants depict a BlueTEC Clean Diesel SUV driving next to a shoreline with ebullient waves under a clear-blue sky. In a faded-blue portion in the vehicles' path, Defendants ask consumers to "imagine a fuel that produces fewer greenhouse gases than gasoline."[8]

d) Defendants claim that BlueTEC Clean Diesel produces up to 90% fewer emissions than equivalent gas-powered vehicles,[9] and converts nitrous oxide emissions into "pure, earth-friendly nitrogen and water."[10]

e) In a technical explanation of BlueTEC Clean Diesel on its website, Defendants tell consumers that their technology "reduces Nitrogen Oxides by up to 80%"[11]

f) Defendants proclaim themselves "#1 in CO_2 emissions for luxury vehicles."[12]

g) Defendants' web site proclaimed:

> Mercedes-Benz continues to reinvent this alternative fuel that offers higher torque and efficiency with up to 30% lower greenhouse-gas emissions than gasoline.
>
> Today's BlueTEC models are simply the world's most advanced diesels, with the ultra-low emissions, high fuel

---

[6] Press Release, Mercedes-Benz, Phil Collins, Jon Bon Jovi, Snoop Dogg and the Black Eyed Peas Join Smart to Protect the Environment, *available at* http://media.daimler.com/dcmedia/0-921-1653632-1-893475-1-0-0-0-0-1- 0-0-0-1-0-0-0-0-0.html.

[7] *E.g.*, 2011 GL Class Brochure, p. 5 ("Advanced BlueTEC technology starts with cleaner combustion of its diesel fuel, and finishes with certified Ultra Low Emissions, even in the most stringent U.S. states.").

[8] *BlueTEC Clean Diesel*, https://www.mbusa.com/mercedes/benz/green/diesel_bluetec (last visited March 29, 2016).

[9] *E.g.*, 2016 Sprinter Van Brochure, p. 2.

[10] *E.g.*, 2011 M-Class Brochure, p. 5.

[11] How Mercedes-Benz BlueTEC Works—Clean Diesel Technology, Mercedes-Benz Official YouTube Channel, https://youtu.be/w4T5B_UmgJo.

[12] *BlueTEC Clean Diesel*, https://www.mbusa.com/mercedes/benz/green/diesel_bluetec (last visited March 29, 2016).

economy and responsive performance that makes them not merely available in all 50 states, but desirable.

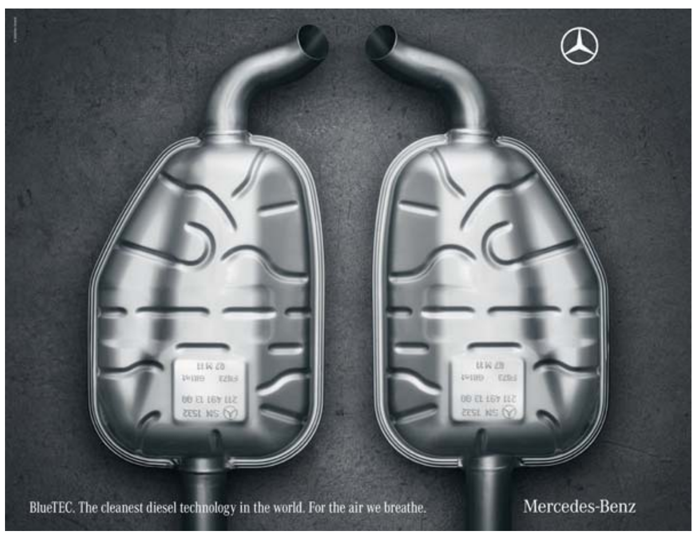
Earth-friendly, around the world

THE LEADER IN DIESEL, SINCE THE BEGINNING.

Drivers in much of Europe and Asia frequently choose diesel over gasoline for its rich torque output and higher fuel efficiency. With BlueTEC, cleaner emissions are now an equally appealing benefit.

ADAC, Germany's largest automobile association, rates BlueTEC as #1 in CO_2 emissions for luxury vehicles.

h) One Mercedes BlueTEC Clean Diesel advertisement depicts two rear mufflers side-by-side in the shape of human lungs. The caption underneath claims that BlueTEC is "For the air we breathe."



[13]

42. Defendants hold themselves out as protectors of the environment: "Long before it became front-page news, Mercedes-Benz has been innovating and implementing new ways to help minimize the impact of cars and trucks on the world we share. It's a promise that's been kept for generations, and not just with cleaner, more efficient power under the hood."[14] Indeed,

[13] Advertisement created by Jung von Matt, Swiss creative agency, *available at* http://www.jvm.ch/en/arbeiten /kampagne/mercedes-benz/bluetec-1/print.

[14] *Mercedes-Benz & The Environment*, https://www.mbusa.com/mercedes/benz/green#main (last visited March 31, 2016).

the company relishes its message that it plays an industry leading role in advancing "green" technologies like BlueTEC Clean Diesel.

43. BlueTEC is part of a lineup of Mercedes technologies that it says are "green."[15] Defendants widely disseminated advertisements, promotional campaigns, and public statements throughout the United States to induce the purchase of BlueTEC Clean Diesel vehicles by customers that are concerned about the environment. For example:

a) Defendants call their BlueTEC engine, "[e]arth-friendly, around the world."[16]

b) A promotional video created for Mercedes in 2009 opens with the camera pointing up to the sky with rays of sun coming through clouds. "The Earth," says the narrator "is changing." He then tells us that Mercedes-Benz BlueTEC is "cleaner … and—with a revolutionary system which significantly reduces greenhouse gases and smog-forming pollutants—more respectful of the earth."[17]

c) A technical description of BlueTEC available on the Mercedes-Benz website closes with, "BlueTEC—the world's cleanest diesel engines. Environmentally-friendly technology, without sacrificing performance or driving pleasure."[18]

d) Defendants claim in a brochure for the 2016 Sprinter that, "Thanks to BlueTEC clean-diesel technology, the Sprinter is one of the greenest vans in the land."[19]

e) Defendants strategically placed their BlueTEC Clean Diesel vehicles among a fleet of Mercedes-Benz vehicles that shuttled superstar musicians like Bon Jovi, Snoop Dogg, The Police, Kanye West, and others at the 2007 Live Earth climate protection concerts. Live Earth attendees were asked to pledge

---

[15] *Mercedes-Benz & The Environment*, https://www.mbusa.com/mercedes/benz/green#main (last visited March 31, 2016).

[16] *BlueTEC Clean Diesel*, https;//www.mbusa.com/mercedes/benz/green/diesel_bluetec (last visited March 29, 2016).

[17] Studio Dialog, Video for Mercedes-Benz BlueTEC, *available at* https://vimeo.com/8989688.

[18] How Mercedes-Benz BlueTEC Works—Clean Diesel Technology, Mercedes-Benz Official YouTube Channel, https://youtu.be/w4T5B_UmgJo.

[19] 2016 Sprinter Van Brochure, p. 2.

that they would take personal action to solve the climate crises and "buy from businesses…who share my commitment to solving the climate crises."[20]

f) A 2009 website designed for Mercedes-Benz pictured a 2009 ML320 BlueTEC Clean Diesel driving in the sky through clouds, with the title, "Why you should go BLUE if you want to go green."[21] The site promised consumers "an environmentally-smart solution that doesn't demand sacrifices." On information and belief, this design was disseminated to U.S. consumers by Mercedes-Benz U.S. via its website in or around 2009.

3. Defendants advertised and promoted BlueTEC Clean Diesel as meeting and exceeding compliance with U.S. emissions standards in all 50 states.

44. Defendants also expressly marketed the Affected Mercedes Vehicles as Clean Diesel vehicles, with registration approvals in all 50 states. For example:

a) Mercedes' website proudly presents "BlueTEC: … now available in five different Mercedes-Benz BlueTEC models in all 50 states."[22]

b) A June 2008 press release boasts that Mercedes-Benz was the first manufacturer in the world to achieve registration approval in all 50 states for Diesel SUVs.[23]

c) In an April 2009 interview about the Mercedes-Benz E Class, Professor Dr. Herbert Kohler, Chief Environmental Officer at Daimler AG, claims that Mercedes-Benz "***goes beyond statutory requirements***," because "sustainable mobility means more than the mere fulfillment of rigid environmental guidelines" (emphasis added).[24]

C. Emission Test Cycles And Emission Standards

45. As will be shown below, Defendants' claims about the Affected Mercedes Vehicles' characteristics were false and deceptive, and also involved the concealment,

---

[20] *Gore Urges "7 Point Pledge" Ahead of Live Earth*, Associated Press, June 29, 2007 *available at* http://www. nbcnews.com/id/19502465/ns/us_news-environment/t/gore-urges-point-pledge-ahead-live-earth/#.

[21] Portfolio of Chris Lacey, Mercedes-Benz BlueTEC, http://www.chrislacey.net/354/uncategorized/mercedes-benz-bluetec.

[22] *Mercedes-Benz & The Environment*. http://www.mbusa.com/mercedes/benz/green#module-2 (last visited March 31, 2016).

[23] Press Release, Mercedes-Benz, Road to the Future: From BlueTEC Diesel Vehicles to Electric Vehicles: Modular Technologies for a Clean Future of the Premium Automobile, *available at* http://media.daimler.com/ dcmedia/0-921-657591-1-1091617-1-0-1-0-0-1-12639-0-0-1-0-0-0-0-0.html?TS=1459448202325.

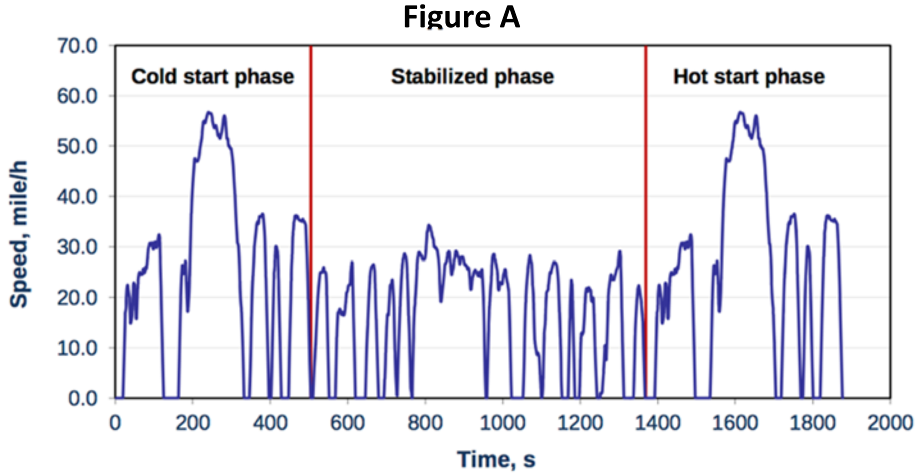
[24] Life Cycle, Environmental Certificate for the E-Class, p. 6 (April 2009).

suppression, and omission of material facts with the intent that others rely. To effectuate their consumer fraud, defendants employed a defeat device to make their vehicles appear to emit low levels of pollution when under certain testing conditions; but, in actual driving conditions, the vehicles emitted much higher levels. This fraud, which has now been exposed, violated the Arizona Consumer Fraud Act.

1. Government testing was performed using FTP-75 and a dynamometer.

46. To test whether vehicles comply with emissions requirements, government agencies use emissions test cycles. An emissions test cycle defines a protocol that enables repeatable and comparable measurements of exhaust emissions to evaluate compliance. The protocol specifies all conditions under which the engine is tested, including lab temperature and vehicle conditions. Most importantly, the test cycle defines the speed and load over time that is used to simulate a typical driving scenario. An example of a driving cycle is shown in Figure A. This graph represents the FTP-75 (Federal Test Procedure) cycle that has been created by the EPA and is used for emission certification and fuel economy testing of light-duty vehicles in the U.S. The cycle simulates an urban route with frequent stops, combined with both a cold and a hot start transient phase. The cycle lasts 1,877 seconds (about 31 minutes) and covers a distance of 11.04 miles (17.77 km) at an average speed of 21.2 mph (34.12 km/h).

Figure A



47. Besides urban test cycles such as FTP-75, there are also cycles that simulate driving patterns under different conditions. To assess conformance, several of these tests are carried out on a chassis dynamometer, a fixture that holds a car in place while allowing its drive

wheel to turn with varying resistance. Emissions are measured during the test and compared to an emissions standard that defines the maximum pollutant levels that can be released during such a test. In the U.S., emissions standards are managed on a national level by the EPA. In addition, California has its own emissions standards that are defined and enforced by the California Air Resources Board ("CARB"). California standards are also used by a number of other states ("Section 177" states). Together with California, these states cover a significant fraction of the U.S. market, making them a de facto second national standard. In Europe, the emissions standards are called Euro 1 through Euro 6, where Euro 6 is the most recent standard in effect since September 2014.

48. The FTP-75 is the primary dynamometer cycle used to certify the light- and medium-duty passenger cars/trucks. This cycle is primarily a dynamic cycle, with rapid changes in speed and acceleration meant to reflect city driving along with some steadier higher speed sections meant to account for some highway driving.

2. Researchers tested vehicles under different conditions using a different testing technology—PEMS—and discovered discrepancies, ultimately leading to one of the biggest scandals in the history of the automotive industry.

49. The green bubble with respect to diesel vehicles popped on September 18, 2015, when the EPA issued a Notice of Violation of the Clean Air Act (the "First NOV") to Volkswagen AG and/or certain of its affiliates for installing illegal "defeat devices" in 2009-2015 Volkswagen and Audi diesel cars equipped with 2.0-liter diesel engines. A defeat device, as defined by the EPA, is any apparatus that unduly reduces the effectiveness of emissions control systems under conditions a vehicle may reasonably be expected to experience. The EPA found that the Volkswagen/Audi defeat device allowed the vehicles to pass emissions testing but in the real world these vehicles polluted far in excess of emissions standards.

50. This was exposed by researchers at West Virginia University testing certain vehicles "on the road" rather than only in laboratory conditions, and discovering huge discrepancies between the actual amount of NOx emitted and what the laboratory conditions suggested would be emitted.

51. On September 22, 2015, Volkswagen announced that 11 million diesel cars worldwide were installed with the same defeat device software that had evaded emissions testing by U.S. regulators. Volkswagen pled guilty to criminal charges and settled civil class actions for over ten billion dollars.[25]

52. Volkswagen wasn't alone—soon, government agencies began to reveal that other manufacturers both in the U.S. and in Europe had produced dozens of models that were exceeding emissions standards. On January 12, 2017, the EPA issued a Notice of Violation to Fiat Chrysler America relating to emissions from its popular Dodge Ram 1500 and Jeep Grand Cherokee vehicles, and on May 23, 2017, the United States filed a civil suit in the Eastern District of Michigan alleging violations of the Clean Air Act (E.D. Mich. No. 2:17-cv-11633).

D. The Affected Mercedes Vehicles Contained A Shut-Off Device To Mask Their True Emissions Characteristics, Similar To The Volkswagen Vehicles

53. Just as with Volkswagen and other manufacturers, expert testing shows that the Affected Mercedes Vehicles emit much higher levels of pollution in real world vs. specific testing conditions. Defendants' manipulations of the BlueTEC Clean Diesel emission controls put the lie to Defendants' claims that BlueTEC Clean Diesel is "the world's cleanest diesel passenger vehicle" with "ultralow emissions." Defendants misrepresented and concealed the true emissions performance of its vehicles equipped with BlueTEC engines because of its manipulations that limit emission controls in normal driving conditions.

54. All vehicles described below were PEMS tested, and PEMS testing is reliable and accurate. Each of the Affected Mercedes Vehicles tested in this Complaint was tested over a variety of conditions using a Portable Emission Measurement System (PEMS). PEMS is a collection of measurement devices that allow the measurement of gaseous vehicle emissions of oxides of nitrogen, total hydrocarbon, methane, carbon monoxide, and carbon dioxide as well as particulate matter (PM) emissions during on-road driving of light- and heavy-duty vehicles. The

[25] *See* Nathan Bomey, *Volkswagen Emission Scandal Widens: 11 Million Cars Affected*, USA Today (Sept. 22, 2015), http://www.usatoday.com/story/money/cars/2015/09/22/volkswagen-emissions-scandal/72605874/.

system is essentially a “portable laboratory” that allows measurement of emissions outside of a conventional chassis dynamometer-based laboratory setting of the type used for certification testing. The results of all tests by experts for the respective vehicles are included herein. No test results regarding these vehicles were omitted from the Complaint.

55. These systems are highly accurate when compared to conventional chassis dynamometer tests used for vehicle emissions certification. In fact, their accuracy is such that they are currently integrated into the European vehicle emission certification process to test real driving emissions. Both EPA and CARB employ PEMS as part of the heavy duty in-use compliance program to measure emissions against the not to exceed standards, where procedures have been codified in the code of federal regulations. Furthermore, both CARB and EPA make wide use of PEMS to evaluate vehicles for the presence of defeat devices. One such study, published by the Center for Alternative Fuels and Emissions (CAFEE) in collaboration with CARB, made heavy use of PEMS to discover the presence of defeat devices in Volkswagen Diesels.[26]

56. PEMS has been used since the 1990s to measure real-world vehicle emissions performance. These systems are manufactured by highly respected and well-established emissions measurement equipment suppliers like AVL, Horiba, and Sensors Incorporated. All three of these companies are leading suppliers of emissions measurement systems used for vehicle and engine certification, and they bring their experience in conventional emissions analyzers to bear in designing PEMS. Conventional gas analysis systems are very large and complex. Since the years when chassis dynamometer testing was originally introduced, advances in analyzer technologies over the past three decades have allowed for the miniaturization of conventional laboratory analyzers, yielding major size and weight reductions. These technological advances made it possible for high-accuracy emissions analyzers to be deployed on vehicles while driving on the road outside of the laboratory setting.

---

[26] Thompson, Gregory J., *et. al.* “In-Use Emissions Testing of Light-Duty Diesel Vehicles in the United States,” CAFEE publication, May 15, 2014.

57. Conventional emissions testing used for certification of vehicles is performed on a chassis dynamometer. The dynamometer is a "treadmill" for the driven wheels of a vehicle. The driven wheels are placed on rollers attached to one of more flywheels and an electric motor capable of simulating the forces on the vehicle during real-world driving on the road. The chassis dynamometer simulates inertial forces (*i.e.*, the resistance to acceleration or deceleration from the vehicle's weight), static friction, rolling resistance, and aerodynamic drag. When properly calibrated, the chassis dynamometer will simulate real-world driving with a high degree of accuracy. A "coastdown" procedure is used to verify that rolling resistance and drag are accurately simulated. However, the inertial load simulation requires very rapid and precise response from the electric motor for high accuracy. Slow responding systems can under-load the vehicle during acceleration. By contrast, real-world inertial forces on the vehicle are inherent in PEMS testing since this testing is conducted on the road in normal driving.

58. The analyzers used to measure gaseous emissions in the chassis dynamometer setting are accurate to within 1% of the full measurement scale. These analyzers are calibrated before and after each emissions test to ensure that they deliver a high level of accuracy and that the calibration does not appreciably change (or drift) during the emissions test. Furthermore, analyzers undergo monthly 10-point calibrations to ensure their response is accurate throughout the measurement range of each analyzer. These measurements are supplemented with high precision measurement of ambient temperature and relative humidity. NOx is adjusted for those values.

59. PEMS analyzers are subject to the same requirements. In fact, analyzers used by the experts have an accuracy of 0.3% of full scale, well within the 1% requirement used for chassis dynamometer analyzers. These analyzers are also subject to the same monthly 10-point calibration to ensure accuracy throughout the measurement range. The analyzers are calibrated before and after each test to ensure that they are both accurate and free of excessive drift. Drift has been shown to be far less than 1%, even after several hours of testing. PEMS also employs high-accuracy temperature and relative humidity measurements to adjust NOx.

60. Put simply, the analyzers used in chassis dynamometer testing and PEMS testing have virtually identical levels of accuracy and are subject to the same strict requirements for calibration and drift.

61. One primary difference between PEMS and chassis dynamometer emissions testing is that the latter mixes the raw exhaust with ambient air in a dilution tunnel to simulate the effects of vehicle exhaust mixing with ambient air immediately after emission from the tailpipe. In the case of PEMS, the raw exhaust emissions are measured. The dilution tunnel has the largest effect on particulate matter measurements, where sulfate and hydrocarbon aerosols may be formed during the dilution process, thereby increasing particulate matter emissions. In modern diesels using low-sulfur fuels, these effects are much less important than in the past, where hydrocarbon and sulfate formation was much higher. The effect on gaseous pollutants, and in particular NOx, is negligible. Therefore, the raw gas measurement of NOx taken during PEMS testing will closely match the diluted exhaust measurement taken in a dilution tunnel.

62. A wide variety of studies have been performed over the years to validate the accuracy of PEMS. One such study, conducted by experts at Ricardo UK, one of the world's leading vehicle research and development companies, concluded that "NOx emissions agreed within ~10% across a wide range of values."[27] When considering that defeat devices result in emissions that are often several times, or even orders of magnitude, higher than the relevant emissions standards, this level of agreement with chassis dynamometer emissions measurement is more than sufficient to identify the presence of defeat devices and to quantify the effects. PEMS tested also recently triggered a recall by CARB of 500,000 trucks with Cummins engines.[28]

63. That being said, test conditions are highly controlled in a chassis dynamometer laboratory setting. Ambient temperature, wind, and road quality are consistent from test to test.

[27] Anderson, Jon, *et. al.*, "On-Road and Chassis Dynamometer Evaluations of Emissions from Two Euro 6 Diesel Vehicles," SAE 2014-01-2826, October 2014.

[28] *See CARB Investigation Leads to nationwide recall of 500,000+ Cummins Heavy-Duty Trucks*, https://ww2.arb.ca.gov/news/carb-investigation-leads-nationwide-recall-500000-cummins-heavy-duty-trucks.

Although PEMS measures emissions with a high degree of accuracy, great care must be taken to ensure that the driving conditions are representative, consistent, and can be compared to the emission standards in a meaningful way. However, a well-designed PEMS test program can account for ambient temperature, traffic variability, relative positive acceleration (RPA—*i.e.*, the "hardness" or "softness" of the driver's driving style), road quality, and wind speed. The effect of wind speed, in particular, can be averaged out by conducting a large number of tests with variable wind conditions. Tests are typically repeated dozens of times, with careful attention paid to, among other things, the average cycle speed, ambient temperature, RPA, and road grade.

64. In order to perform chassis dynamometer testing to certify a vehicle, on-road data must be collected for each vehicle that is tested to obtain a proper model of the vehicle's rolling resistance and aerodynamic drag (called the vehicle's "road load model"). This procedure is conducted over the road and must be repeated multiple times to account for the effects of variable wind speeds and directions. This kind of repetition is no different than that required to average out the effects of wind speed during PEMS testing.

65. For the chassis dynamometer to simulate real-world driving accurately, the testing conducted over the road to create the road load model must be generated with great care, accounting for effects like tire pressure, drive train resistance, state of maintenance, vehicle inertial load, et cetera—the same issues that must be addressed when conducting PEMS tests.

66. Furthermore, it is possible to re-create virtually any chassis dynamometer certification cycle over the road using a PEMS by simply following the same vehicle speed cycle in a carefully controlled setting. Special test software has been developed by experts to allow these test cycles to be performed on the road. In the case of medium-duty passenger vehicles, like the Dodge Ram 2500/3500, it is virtually impossible to test the full combined weight rating of 24,000 pounds on a chassis dynamometer, as most of these dynamometers either lack the ability to simulate those inertial loads or maintain traction of the driven wheels on the dynamometer roller (or rollers) during testing. For the same reason, sharp accelerations and aggressive driving can be problematic for these heavier vehicles.

67. High ambient temperatures can generally not be tested in a chassis dynamometer laboratory; the same is true of very low temperatures. During certification testing on the FTP-75 and the highway fuel economy standard test (HWFET), ambient temperature is controlled to a narrow window between 68°F and 86°F. PEMS testing can be conducted at a wide variety of temperatures, which is important because many defeat devices are triggered based on changes in ambient temperature.

68. Importantly, it is often not possible to test conditions on a chassis dynamometer that might be experienced in the real world. As was discovered during the Volkswagen diesel scandal, the vehicle's engine control module can often detect that the vehicle is being tested on a chassis dynamometer. In addition to being able to detect that a certification test cycle is being run, as with Volkswagen, vehicles can use various sensors to determine the vehicle is on a chassis dynamometer. Types of algorithms used to detect a chassis dynamometer include, but are not limited to, the following:

a) driven wheels are moving but the front wheels are not turning, a condition only experienced on a chassis dynamometer;

b) on a 2-wheel drive vehicle, the driven wheels are moving but the non-driven wheels are not, a condition only experience on a chassis dynamometer; and

c) on a vehicle equipped with GPS, the vehicle's wheels are moving while the GPS position is not changing.

69. For this reason, while testing on a chassis dynamometer for defeat devices, it can never be ruled out that the vehicle can detect that it is being tested on a chassis dynamometer. Therefore, results from chassis dynamometer testing may be dramatically different than those measured in real-world driving. In contrast to chassis dynamometer testing, the vehicle cannot detect the presence of a PEMS. PEMS is not only accurate for detection and quantification of defeat devices, it is essential.

70. PEMS testing was also used by CAFEE at West Virginia University to test light duty vehicles under a contract from the International Council on Clean Transportation ("ICCT"). CAFEE relied primarily on PEMs testing and, in the process, uncovered the fact that

Volkswagen vehicles were not meeting emissions standards. The ICCT contract with CAFEE mandates that CAFEE use PEMs.

E. Defendants' Emissions Deception

1. Expert testing of BlueTEC Clean Diesels in the United States.

71. The following three Mercedes clean-diesel vehicles were tested over the course of testing.

(1) 2013 Mercedes GLK250 BlueTEC

a. Approximately 39,000 miles (120,000-mile useful life).

b. OM651 2.1 Liter engine.

c. Clean vehicle record with no accidents and regular scheduled maintenance.

(2) 2012 Mercedes R350 BlueTEC

a. Approximately 45,000 miles (120,000-mile useful life).

b. OM642 3.0 Liter engine.

c. Clean vehicle record with no accidents and regular scheduled maintenance.

(3) 2014 Mercedes/Freightliner Sprinter 2500 BlueTEC (the 2.1-liter OM-651 engine variant)

a. Approximately 32,000 miles (150,000-mile useful life).

b. OM651 2.1 Liter engine.

c. Clean vehicle record with no accidents and regular scheduled maintenance.

72. All vehicle records were checked for proper maintenance history and to ensure the vehicles were accident free. The vehicles were loaded to the equivalent test weight listed in the EPA certification application for each vehicle. None of the vehicles displayed any fault codes or malfunction indicator lights (MILs) indicating there might have been a problem with the vehicle(s) and their emission systems.

2. All vehicles are well under the useful life listed on their emissions certificate.

73. Emissions on all three vehicles were found to be well in excess of the relevant standards for emissions of nitrogen oxides (NOx). The excesses stem from a variety of defeat devices described for each vehicle below.

74. In general, the defeat devices trigger a reduction in performance of the two main NOx reduction systems in a clean-diesel vehicle: 1) the exhaust gas recirculation (EGR) system and 2) the selective catalytic reduction (SCR) system.

75. Exhaust gas recirculation feeds some of the exhaust gas back into the engine intake using a controllable valve that routes the exhaust from the exhaust manifold, through an EGR cooler, and into the engine intake. The mixture of exhaust gas with fresh incoming air reduces NOx generated in the cylinder during normal engine operation. The system can be shut off by completely closing the valve that allows exhaust gases to enter the intake. The amount of EGR can be controlled by opening the valve to a larger or smaller extent. A lower "percentage" of EGR indicates a valve that is more closed, which restricts the amount of EGR. Conversely, a high percentage indicates a high level of EGR. High EGR results in a more significant reduction in NOx emissions. Simply speaking, high EGR rates lead to lower NOx. The EGR rate is controlled by the engines' electronic control module (ECM), and can thus be programmed to behave in any way.

76. The SCR system is a catalyst through which all of the exhaust stream flows. When urea (sometimes called diesel exhaust fluid (DEF) or AdBlue) is injected into the tailpipe upstream of the SCR system, a reaction takes place on the surface of the catalyst to reduce NOx to nitrogen and water. With no urea present, the reaction will not take place, and no NOx reduction will occur over the SCR catalyst. Therefore, by changing the amount of urea injected, the effectiveness of the SCR system can be altered by the engine's ECM. If high levels of urea are injected, high NOx reduction occurs provided there is sufficient exhaust temperature. If no urea is injected, no NOx reduction takes place.

77. Exhaust gas temperatures were studied extensively for all three vehicles over a wide variety of operating conditions. Except in the most extreme conditions on hills in excess of 6% downhill and very briefly during startup, exhaust gas temperatures entering the SCR systems were well in excess of the light-off temperature (*i.e.*, the minimum temperature for the reaction to occur) required for successful SCR operation.

78. NOx emissions are first reduced in the engine cylinder by various means related to injection timing and engine design. The EGR system is the next system in line to reduce NOx coming out of the engine. The SCR system comes last in line.

79. In the case of all three vehicles, Mercedes manipulated the programming of the software to reduce EGR and SCR effectiveness at various times using defeat devices, AECDs (auxiliary emission control devices), which are not approved by the EPA or California Air Resources. The programming of these vehicles is meant to cheat the emissions certification standards.

80. The vehicles were tested with a PEMS as well as a chassis dynamometer running the federal certification FTP-75 and HWFET tests. The vehicles were outfitted with an on-board diagnostics (OBD) monitoring system to monitor data on the vehicle's ECM (e.g., EGR rate, exhaust gas temperatures, SCR inlet and outlet NOx, etc.).

81. The relative positive acceleration, a measurement of how aggressively the vehicle is being driven, was tracked for every test performed. The RPAs were kept well below the values experienced during the certification cycles, which means that the vehicles were driven less aggressively than the conditions experienced during certification. The results are therefore *conservative* and representative of "light footed" driving styles. It is anticipated that more aggressive driving styles would lead to even higher emission values than those presented below.

82. Furthermore, the vehicles tested were relatively "young" compared to their full useful life. It is anticipated that vehicles closer to full useful life will have experienced, among other things, degradation in the SCR catalyst as well as possible fouling of the EGR valve and cooler. This degradation would likely lead to higher NOx levels than those presented below as the vehicles approach their full useful lives.

83. Lastly, all vehicles were monitored for active regenerations, events where high exhaust temperatures are used to remove soot collected in the DPF. In general, NOx emissions increase dramatically during these infrequent events (though a high frequency of these events would be of great concern). These infrequent events are monitored and noted where relevant. They are not included in the analyses of defeat devices as they would confuse the data on the

defeat device strategy. For these three vehicles, active regenerations are so infrequent that they can be excluded from the analysis.

3. 2014 GLK250 BlueTEC.

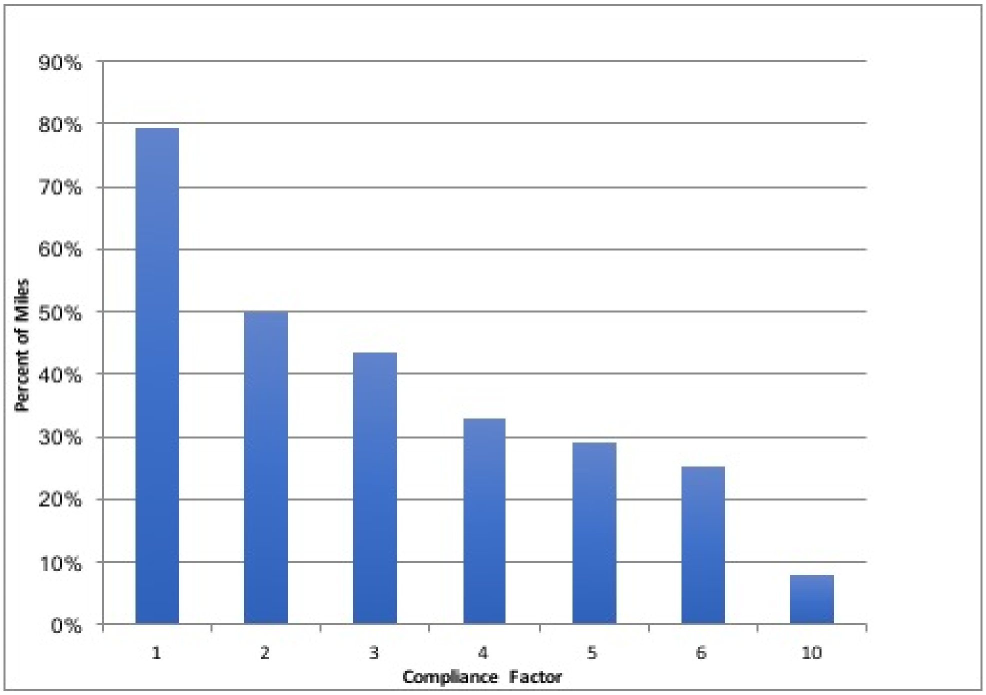
84. This vehicle was tested with a PEMS over the course of 1,330 miles, 953 of which were on the highway and 207 of which were in stop-and-go or variable speed conditions. A generator was installed on the rear of the vehicle to power the PEMS equipment in a position that was considered to have a minimal impact on the vehicle's aerodynamic drag.

85. The stop-and-go emissions were found to be 208 mg/mile on average over all tests conducted, or 4.2 times the standard of 50 mg/mile. Maximum emissions in stop-and-go conditions were found to be 1,725 mg/mile, a condition where the EGR and SCR systems had been completely shut off. That is 34.5 times the standard.

86. The "compliance factor" can be considered a multiple of the emission standard. It is the actual emission rate found during testing divided by the certification standard. A vehicle that meets the standard will have a compliance factor less than 1. A vehicle with a compliance

factor of one meets the standard exactly. A compliance factor of two means the vehicle exceeds the standard by a factor of 2.

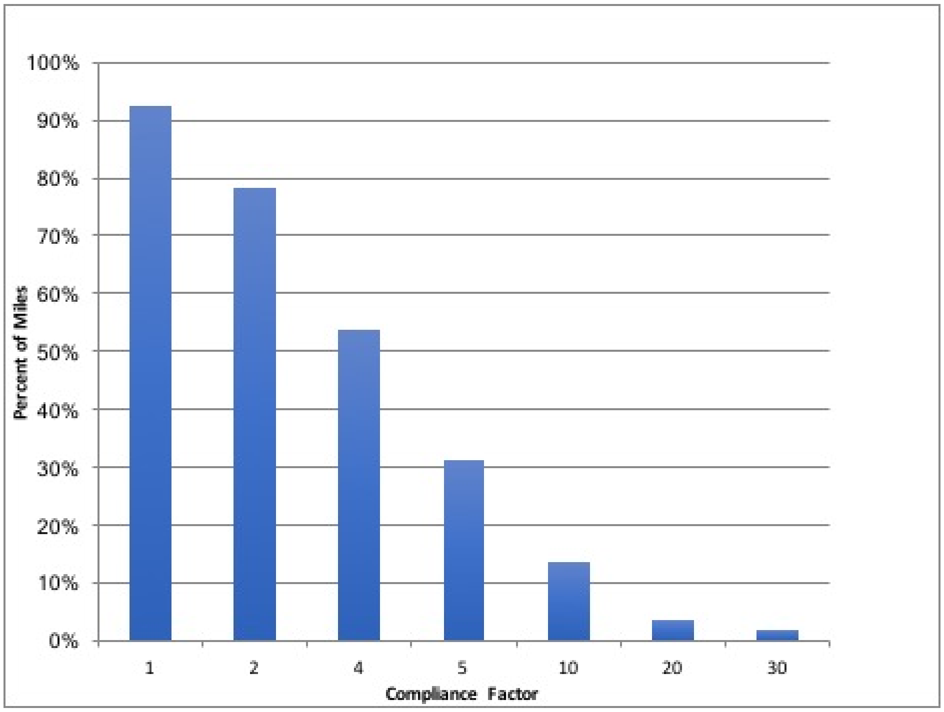
87. The compliance factor for stop-and-go conditions is plotted below.



88. The bar chart for a compliance factor of "1" represents the fraction of the total miles that are at or above the standard. The bar for a compliance factor of "2" represents the total miles that are twice the standard or more, and so on. What is notable is that the vehicles spend 79% of its time above the standard. That means only 21% of the miles traveled in stop-and-go conditions actually met the standard. What is also notable is that the vehicle spends 50% of its time at twice the standard *or more*. Finally, we see that the vehicle spends 8% of its time at ten times the standard or more.

89. The highway emissions were found to be 319 mg/mile on average over all tests conducted, or 6.4 times the standard of 50 mg/mile. Maximum emissions in highway conditions were found to be 4,166 mg/mile, or 83 times the standard.

90. Similarly, the compliance factor for highway driving is plotted below.



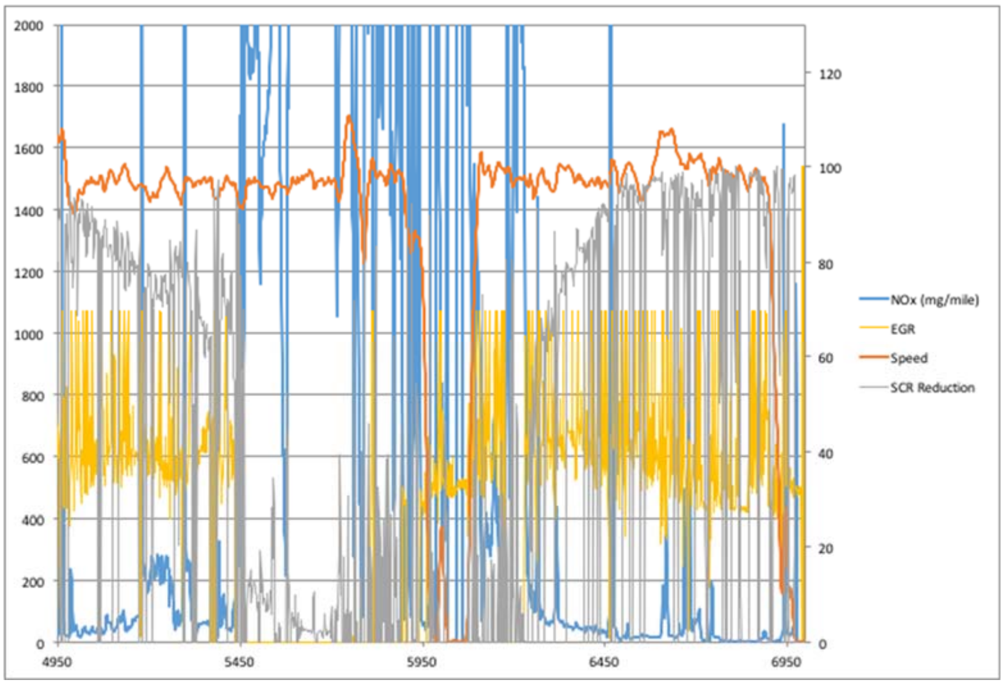
91. The vehicle spends 92% of the miles traveled above the standard (a compliance factor greater than 1), leaving only 8% of the vehicle miles traveled (VMT) having met the standard. The vehicle spends 54% of its VMT at four times the standard or above, and 4% at 20 times the standard or above.

92. The excessive emissions are a result of a number of defeat devices. On the GLK250, the EGR and SCR rates are both turned down significantly at various moments in time where one would not expect a change, most notably when the speed and road grade are not changing.

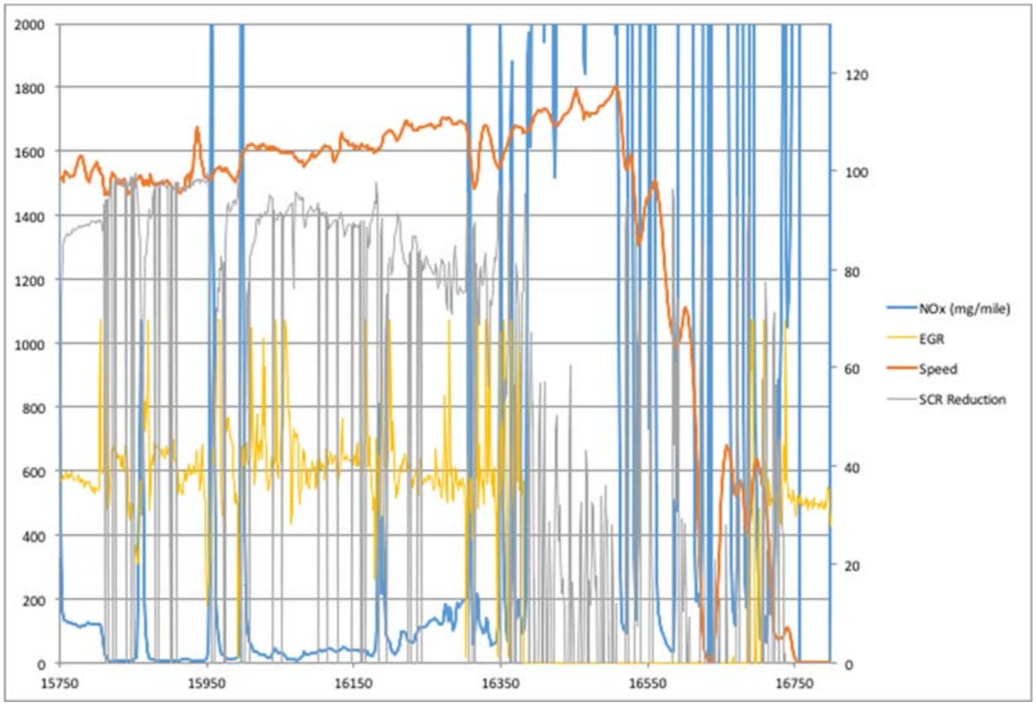
93. The plot below is one of several that shows the typical behavior. The orange line represents the vehicle speed. Note that it is relatively constant at 100 km/hour (62 mph). The small fluctuations observed in the speed over the several plots presented below are normal, as vehicle speed is usually maintained by small accelerations and decelerations that the driver doesn't usually notice.

94. The gray line indicates the percent reduction of the SCR system. A higher percentage reduction represents a very low NOx emission rate from the tailpipe. In the limit that NOx reduction is 100% on the SCR catalyst, the emissions will be 0 mg/mile from the tailpipe.

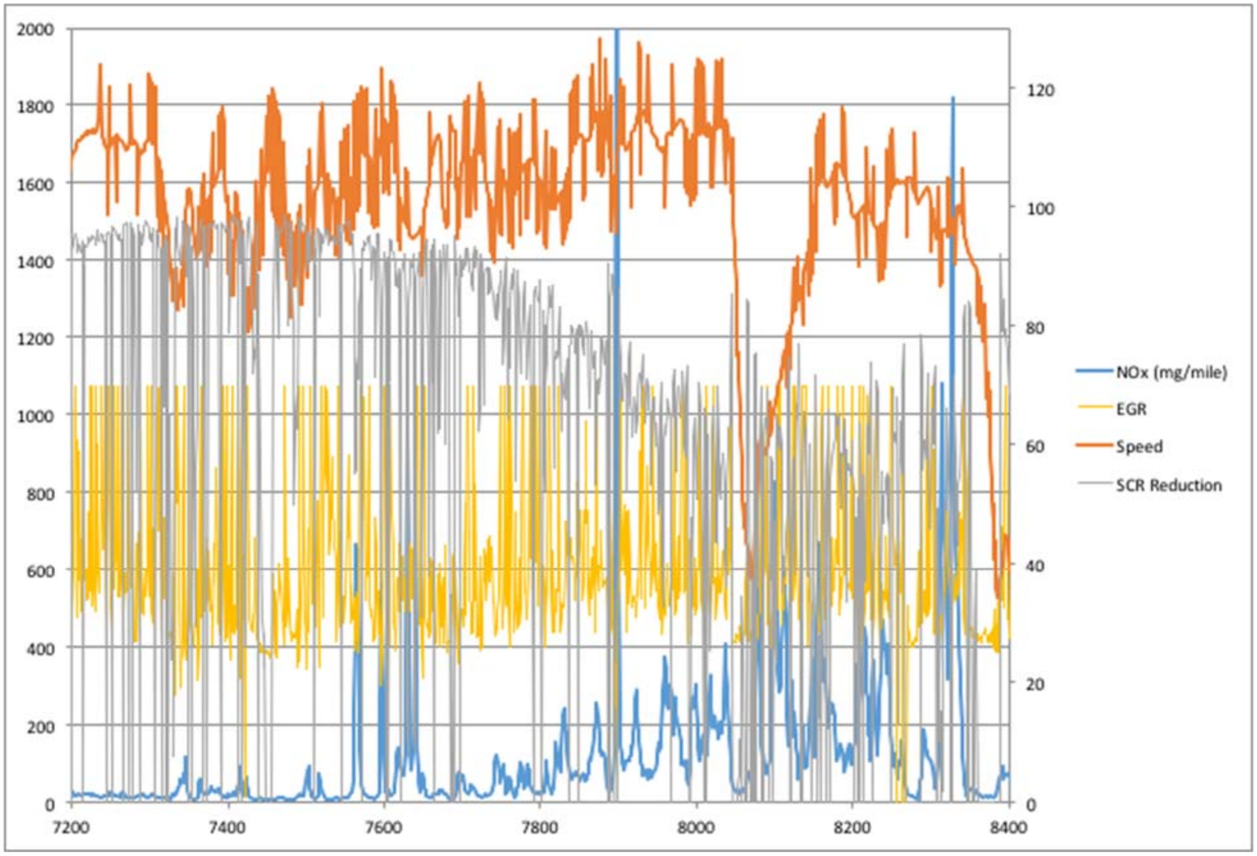
The yellow line represents the percent EGR. The absolute value of this number is not so important compared to the relative value in various situations. Note that around 5,450 seconds in the plot EGR is shutoff (the yellow line goes to 0) and the SCR reduction (gray line) also goes to near 0. As a result, the NOx emission rate (represented by the blue line) exceeds the upper limit of the chart. After a short period of time, the EGR system is reactivated, but the SCR system doesn't come back up to high NOx reduction until about 6,450 seconds. This is typical.



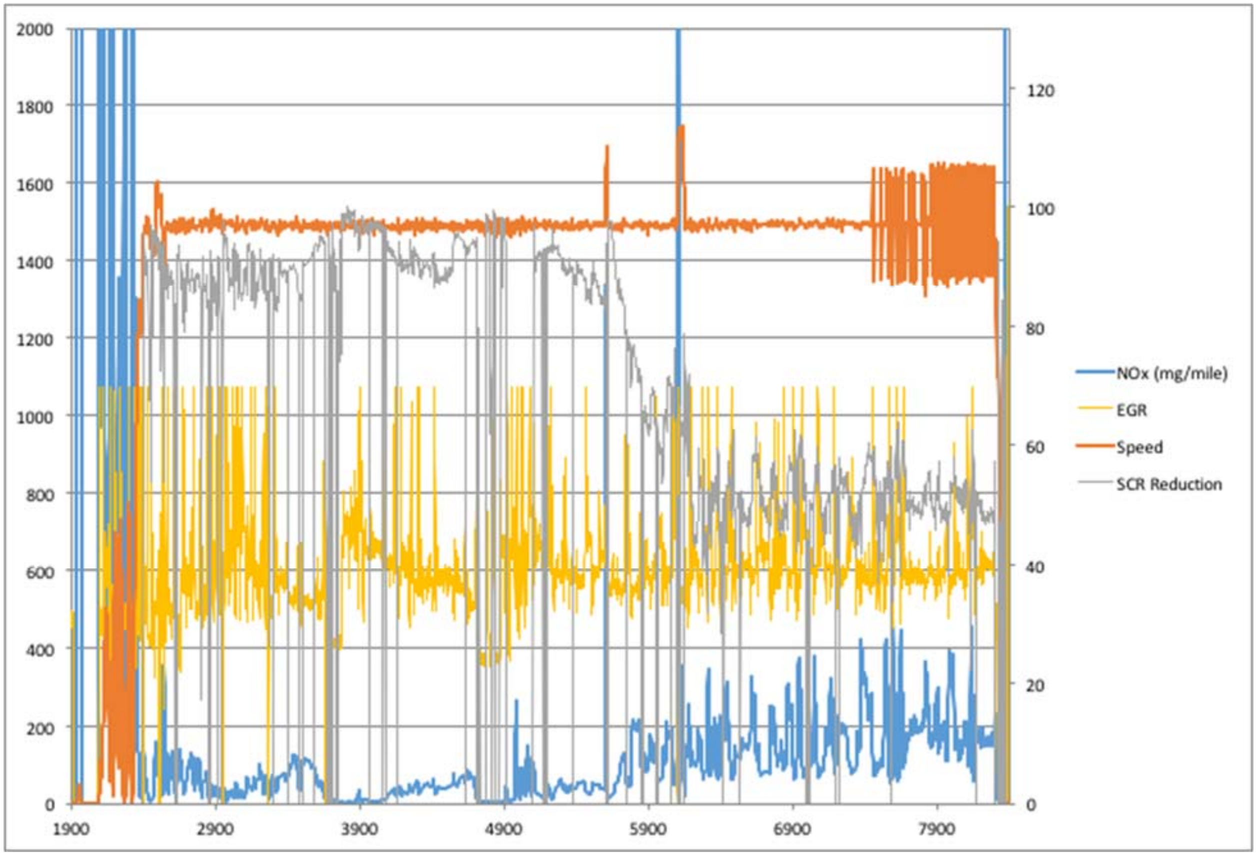
95. The following plot shows similar behavior. At around 16,150 seconds, the SCR system reduction begins to decrease and NOx begins to increase. At 16,350 seconds, the EGR system is shut off completely and the SCR reduction goes to near 0. Again, the NOx emissions (blue line) increase to values that exceed the maximum 2,000 mg/mile limit on the chart. These changes are not associated with any load change due to speed or road grade.



96. The GLK250 also seems to employ a timer that will meet the emission standard for a certain period of time and then begin to increase emissions after a certain period of operation. In the plot below, the vehicle speed remains constant at 110 km/hr while the SCR reduction (gray line) decreases over time. In this case, the emissions are 46 mg/mile for about 400 seconds, and then the SCR effectiveness (*i.e.*, amount of urea injected) decreases starting at 7,800 seconds. Although the speed and road grade haven't changed at all, the emissions increase to 203 mg/mile after the SCR system is slowly turned off.



97. The same behavior is observed in the plot below. Emissions are 63 mg/mile for about 400 seconds before the SCR system is de-rated (*i.e.*, urea injection is reduced). After the SCR system is de-rated, emissions increase to 167 mg/mile.



98. Similar events are summarized in the following table.

Condition	Temp	Event #	Pre-timeout NOx (mg/mile)	After timeout NOx (mg/mile)	Factor increase	Del NOx mg/mile
Flat	71.6	1	46	203	4.4	157
Flat	60.6	2	63	167	2.7	104
Flat	63.1	3	119	252	2.1	133
Uphill 2.8%	57.8	4	355	4166	11.7	3811
				Average	5.2	1051

99. On average, these events result in an increase in NOx emissions by a factor of 5.2, but in some cases as high as 11.7. On average, the EGR rate is decreased from 36.6% to 32.0% after the system is de-rated and the SCR effectiveness is reduced from 80% to 43% after the urea injection is turned down.

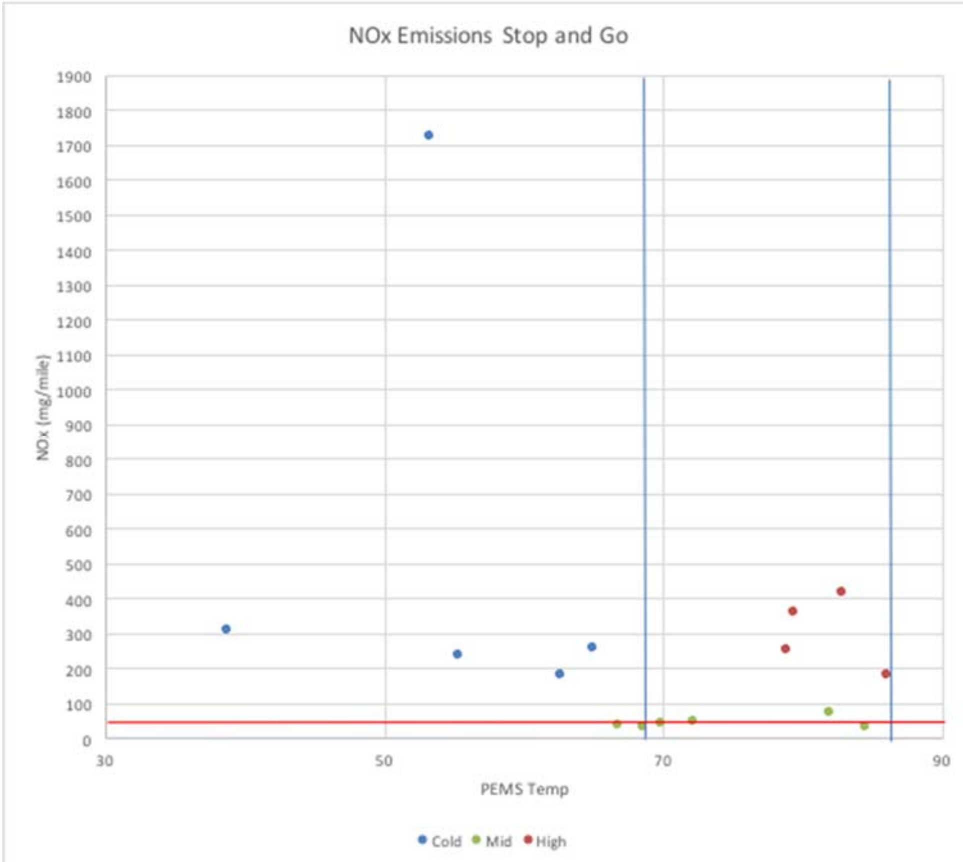
100. The data were analyzed for both stop-and-go conditions and highway conditions on flat roads and several road grades. The results from flat roads in stop-and-go conditions are

plotted below. Each represents an individual test point. The horizontal red bar represents the NOx emission standard of 50 mg/mile. The vertical blue lines are the upper and lower bounds for the ambient temperature while performing certification testing (68 and 86°F). It is believed that the vehicle triggers an increase in NOx when the ambient temperature is outside the certification test window.

101. In the plot below, the blue dots represent emission tests for which low ambient temperature defeat device is triggered (i.e. temperature generally below 68°F). The red dots represent emission tests for which the high ambient temperature defeat device is believed to be active (*i.e.*, temperature generally above 86°F). The green dots represent the tests for which the certification test software is active (*i.e.*, low NOx, in between 68 and 86°F).

102. The vehicle's ambient temperature sensor is usually mounted in front of the radiator close to the road. These sensors are not necessarily shielded from the sun and are highly susceptible to false readings at high ambient temperatures from heat generated by hot black top or direct sunlight.

103. When it comes to a defeat device based on ambient temperature, the vehicle may use one or more temperature sensors in the intake that are affected by ambient temperature. There are several temperature sensors in the intake manifold for the engine, any combination of which could be used to trigger a defeat device (in addition to the possible use of the ambient temperature sensor). The temperature sensors may not directly measure ambient temperature, but are certainly related to ambient temperature. Therefore, the cutoff temperatures, as measured by the ambient temperature sensor, are not necessarily exactly 68°F or 86°F. Hence, the high and low temperature defeat devices can occasionally fall within the certification test window. In general, however, these instances occur when the vehicle is very close to the certification test window temperature or when the ambient temperature is changing and the intake temperature sensors may not yet have changed in response. This applies to the R350 data presented in the next section as well.



104. It appears that NOx emissions are high in both the low ambient temperature modes and high ambient temperature modes, while the emissions appear to meet the standard inside the test window. In this case, the red dots occur during a transition from high temperature to low temperature. In this case, it is believed that the high temperature defeat device is active even though the ambient temperature sensor is below 86°F (probably triggered by another sensor in the intake manifold that still shows a high reading as a result of the high ambient temperature). As explained above, this is likely due to lingering high temperatures at some sensor or combination of sensors in the intake under the hood.

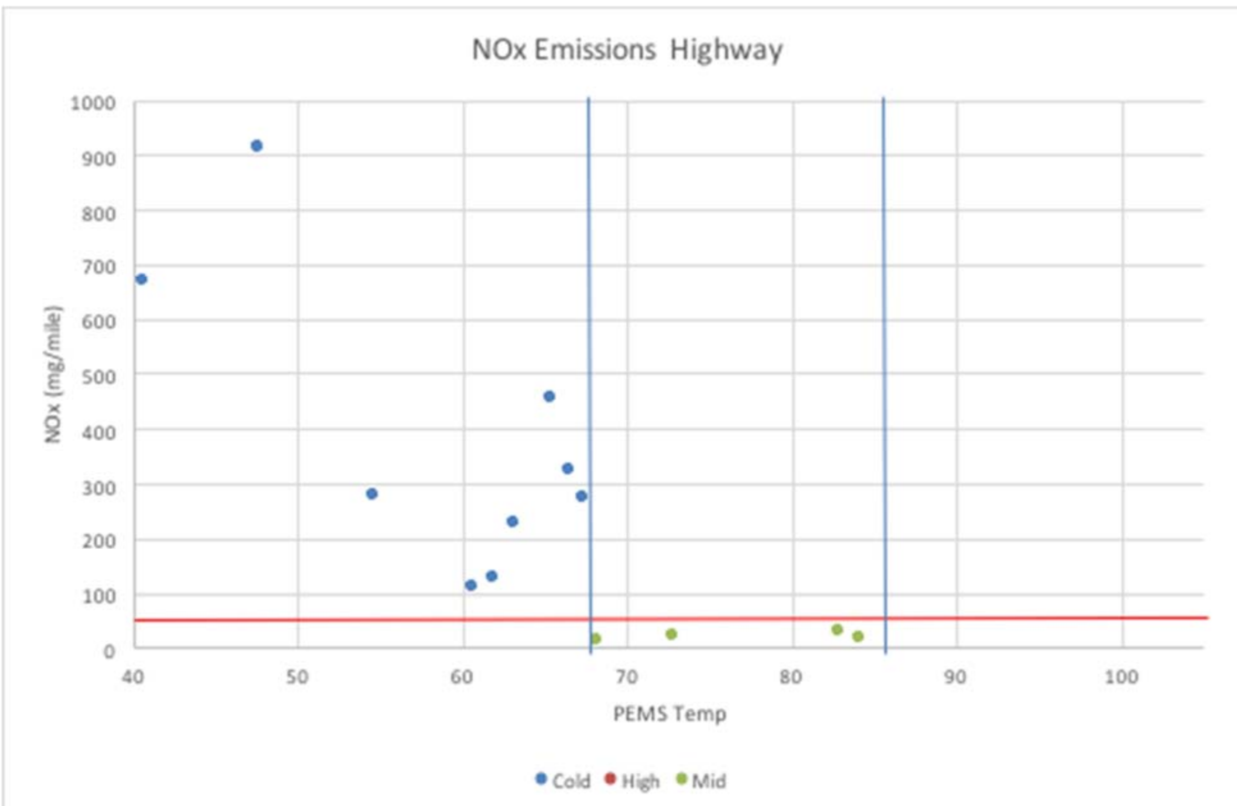
105. The emissions for the cold ambient defeat device are 453 mg/mile on average. The emissions for the high ambient temperature defeat device are 278 mg/mile, while the emissions inside the certification test window are 41 mg/mile on average (*i.e.*, meet the standard).

106. Similar behavior is observed for highway driving on flat roads. In this case, high temperature data was not taken as these temperatures were not available in the necessary road conditions during testing. Emissions in the certification test window are well below the standard,

while emissions below 68°F are well in excess of the standard. Cold defeat device NOx emissions are 230 mg/mile while emissions in the certification window are 19 mg/mile.

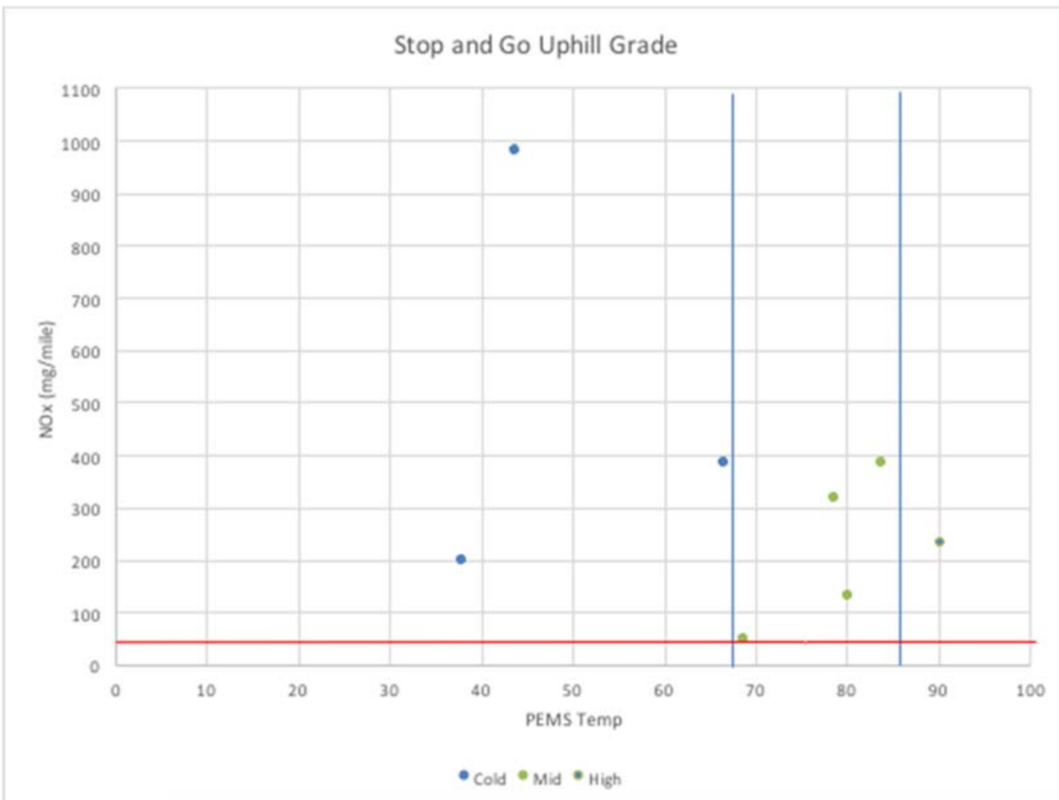
107. In general, the SCR reduction efficiency in stop-and-go flat road conditions is 96% for conditions where the vehicle meets the standard and 33% on average for all other conditions. That is a major reduction in SCR reduction efficiency, accomplished by a major reduction in injected urea by the program in the engine's ECM. The EGR rate is reduced from 34% to 32% for the compliant and non-compliant conditions, respectively.

108. Similarly, for steady highway driving on flat roads, the SCR efficiency decreases from 97% to 65%, while the EGR rate decreases from 39% to 36%.



109. The vehicle also employs a defeat device that detects the grade in the road. During certification, the vehicle does not experience either physical or simulated road grade. Therefore, a defeat device that triggers higher emissions on an uphill or downhill road grade would not be detectable on a certification dynamometer. That device could only be detected using a PEMS system.

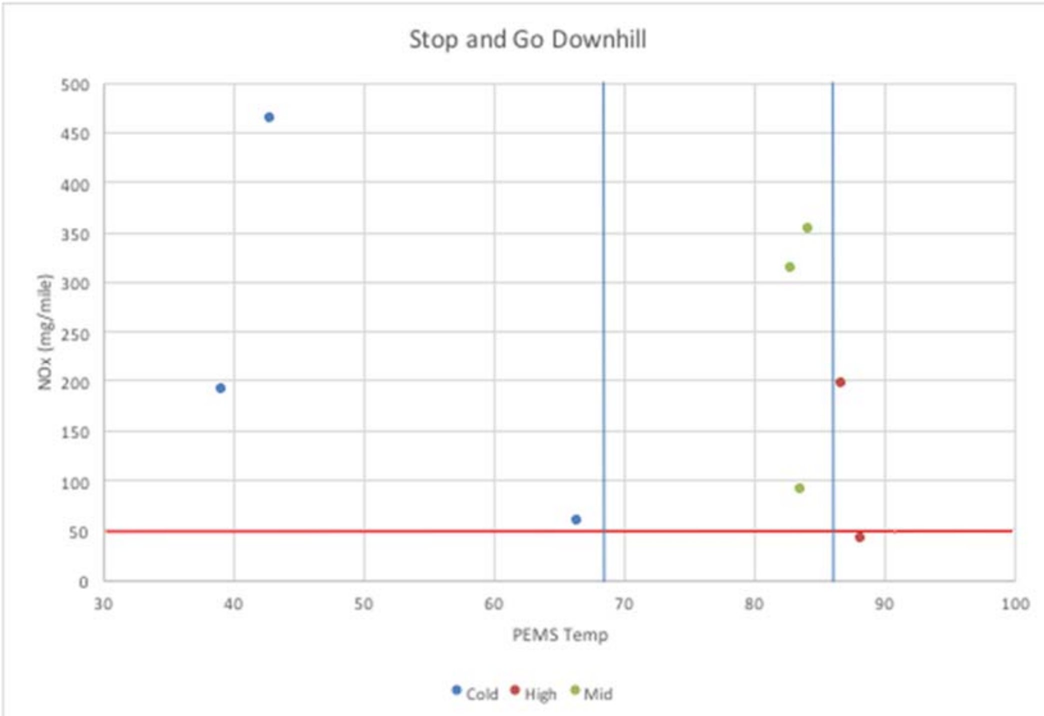
110. Road grades tested in stop-and-go conditions ranged from 0.4 to 3.7%. It should be noted that, in the colloquial sense, a road grade less than 1.0% would be considered "flat" by the average person. Even at modest grades like 2.7% in stop-and-go conditions, the NOx emissions increase to 983 mg/mile (nearly 20 times the standard). That level of road grade would generally be considered a very slight hill. As shown in the plot below, this defeat device appears to be active at all temperature ranges, not just above and below the certification test window.



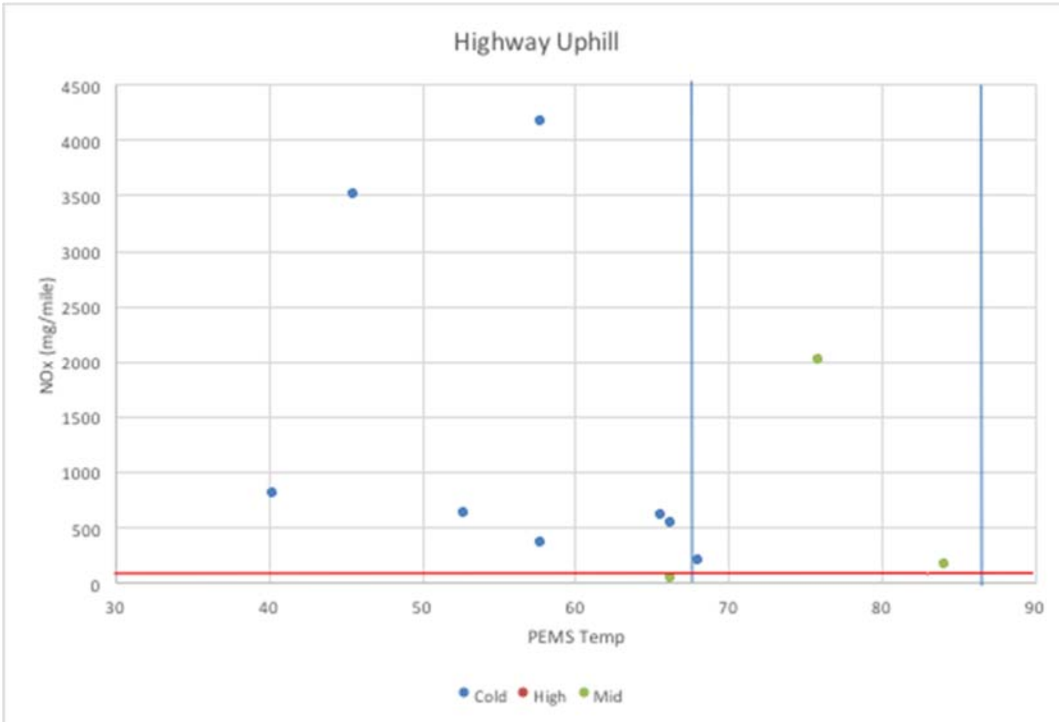
111. Average stop-and-go emissions on hills are 308 mg/mile, which is 7.5 times the value of 41 mg/mile measured during stop-and-go conditions in the certification test window. The SCR efficiency is reduced from 96% when the vehicle meets certification in flat stop-and-go driving to 73% in this case.

112. Emissions during downhill stop-and-go test runs ranging in grade from 0.5 to 3.3% downhill were as high as 464 mg/mile and were 190 mg/mile on average. That's 4.6 times the emissions measured during stop-and-go conditions in the certification test window. The SCR

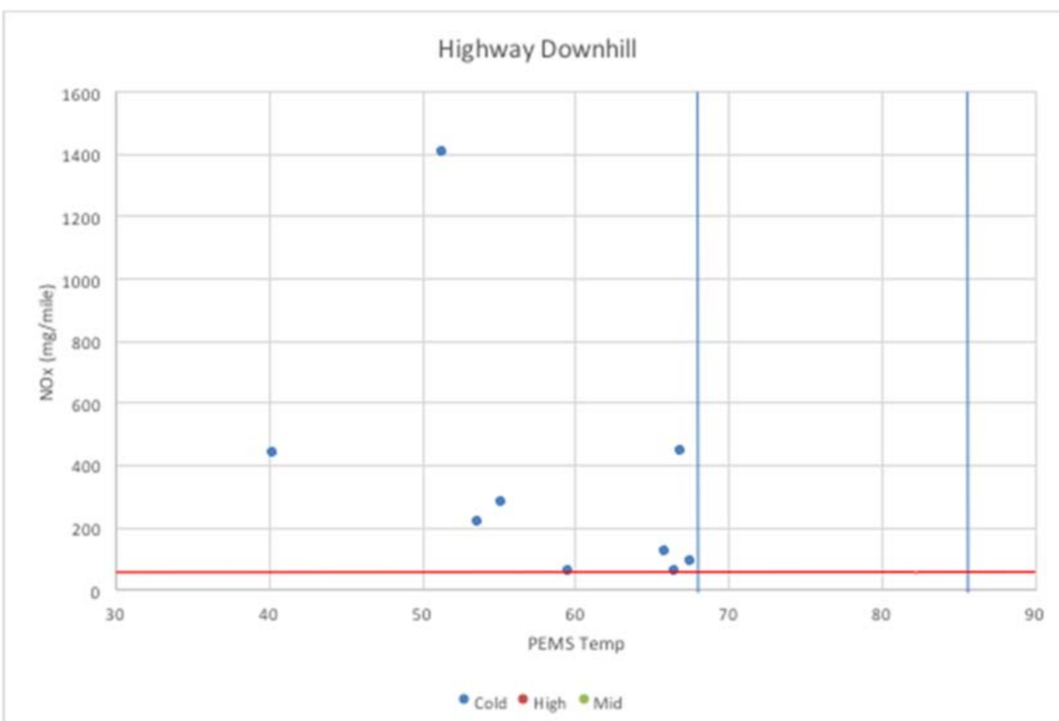
system effectiveness is reduced to 55%, compared to 96% when the vehicle meets the standard on flat roads.



113. Uphill grades between 0.6% and 5.3% were tested. On average, highway emissions on uphill grades are 1,035 mg/mile, more than 20 times the standard. Emissions are as high as 4,166 mg/mile on a 4.2% road grade. That's 83 times the standard. Even on a grade as small as 1.7%, emissions were 355 mg/mile, some seven times the standard. The overall SCR reduction effectiveness is reduced to 61%, compared to 97% where the vehicle meets the standard on flat roads. EGR rates are reduced from 39% in cases where the vehicle meets the standard on flat roads to 30% on uphill grades.



114. Downhill grades between 0.4% and 5.5% were tested, with an average NOx emission rate of 210 mg/mile. Even on a road grade as small as 1.4%, emissions were as high as 1,408 mg/mile. The SCR effectiveness is reduced, on average from 97% where the vehicle meets the standard on flat roads to 61%.



115. Finally, this vehicle was tested on a chassis dynamometer following the protocol for the FTP-75 and HWFET tests, with the following results.

	Test Cycle (values in mg/mile)	
	FTP	**HWFET**
EPA Cert Standard	50	70
Reported Cert Values	40	20
Dyno Test Values	66	8

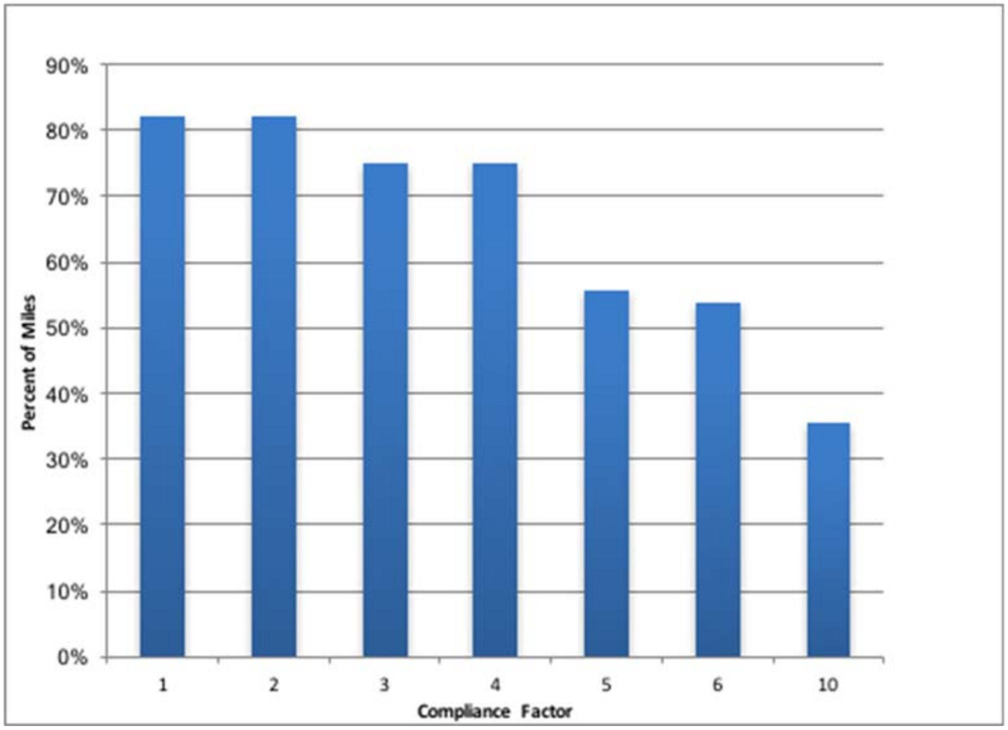
116. The certification values are either close to (in the case of the FTP-75) or under the standards, so the vehicle is believed to operate according to the manufacturer's original specifications. It is clear that the over-the-road driving emissions increase dramatically above the standard, which would suggest the vehicle is able to detect the certification test, as was done in the case of the Volkswagen diesel emissions scandal.

4. 2012 R350 BlueTEC.

117. This vehicle was tested with a PEMS over the course of 1,742 miles, 1,395 of which were on the highway and 347 of which were in stop-and-go or variable speed conditions. A generator was installed on the rear of the vehicle to power the PEMS equipment in a position that was considered to have a minimal impact on the vehicle's aerodynamic drag.

118. The stop-and-go emissions were found to be 361 mg/mile on average over all tests conducted, or 7.2 times the standard of 50 mg/mile. Maximum emissions in stop-and-go conditions were found to be 1,500 mg/mile, or 30 times the standard.

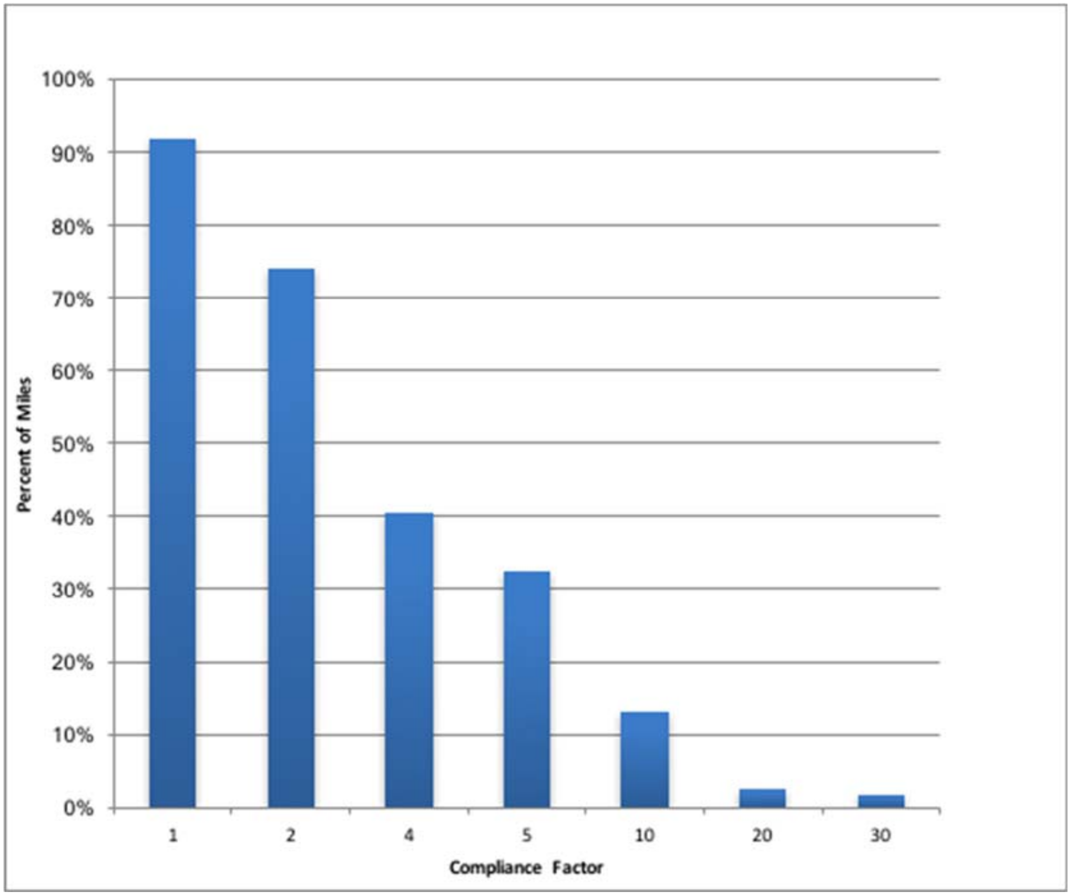
119. The compliance factor for stop-and-go conditions is plotted below.



120. The vehicle spends 82% of its time above the standard. That means only 18% of the miles traveled in stop-and-go conditions actually met the standard. The vehicle spends fully 36% of the time more than ten times the emission standard.

121. The highway emissions were found to be 286 mg/mile on average over all tests conducted, or 5.7 times the standard of 50 mg/mile. Maximum emissions in highway conditions were found to be 4,558 mg/mile, or 91 times the standard.

122. Similarly, the compliance factor for highway driving is plotted below.

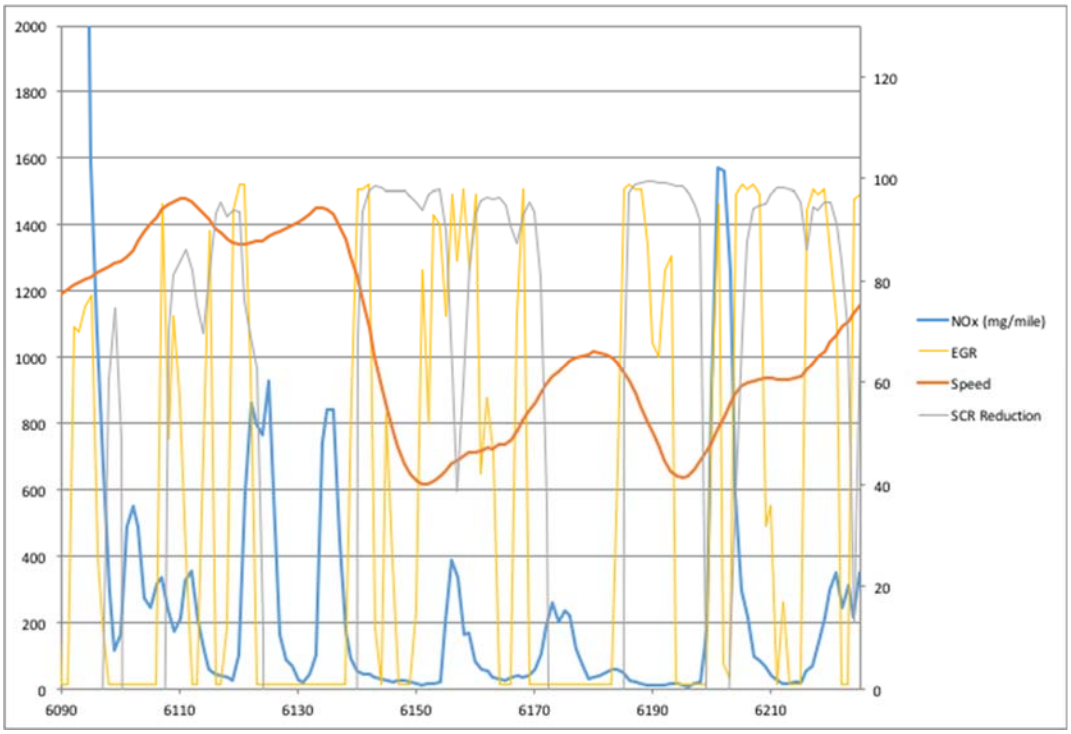


123. The vehicle spends 92% of the miles traveled above the standard, leaving only 8% of the vehicle miles traveled (VMT) having met the standard. The vehicle spends 41% of its VMT at four times the standard or above, and 13% at ten times the standard or above.

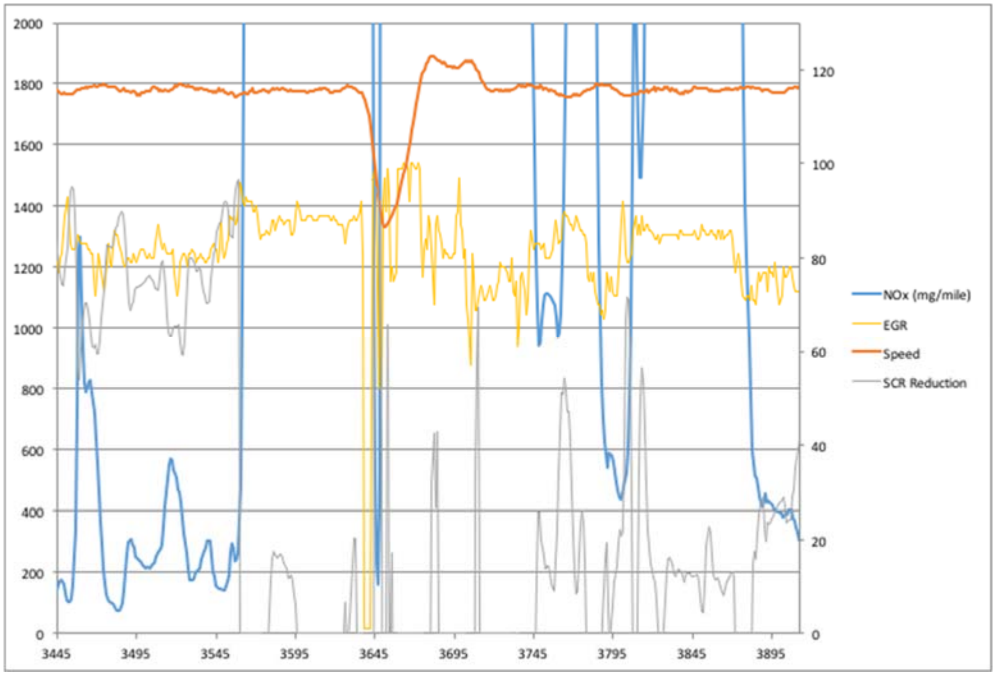
124. As with the GLK250, the R350 employs a number of defeat device strategies that reduce the effectiveness of the EGR and SCR systems. Like the GLK250, the EGR and SCR systems are periodically turned off or de-rated in a manner which is not justified by operating conditions (e.g., steady operation with no change in speed or road grade). This behavior is also observed in stop-and-go conditions, where the EGR system is periodically turned off, leading to a spike in NOx.

125. The plot below shows one such event. As with the plots above, the orange line is the vehicle speed; the blue line is the NOx emissions in mg/mile; yellow line is the EGR rate; and the gray line is the SCR percent reduction. At multiple points in this plot, the yellow line (EGR rate) drops to zero, leading to a significant spike in NOx emissions. These periodic spikes

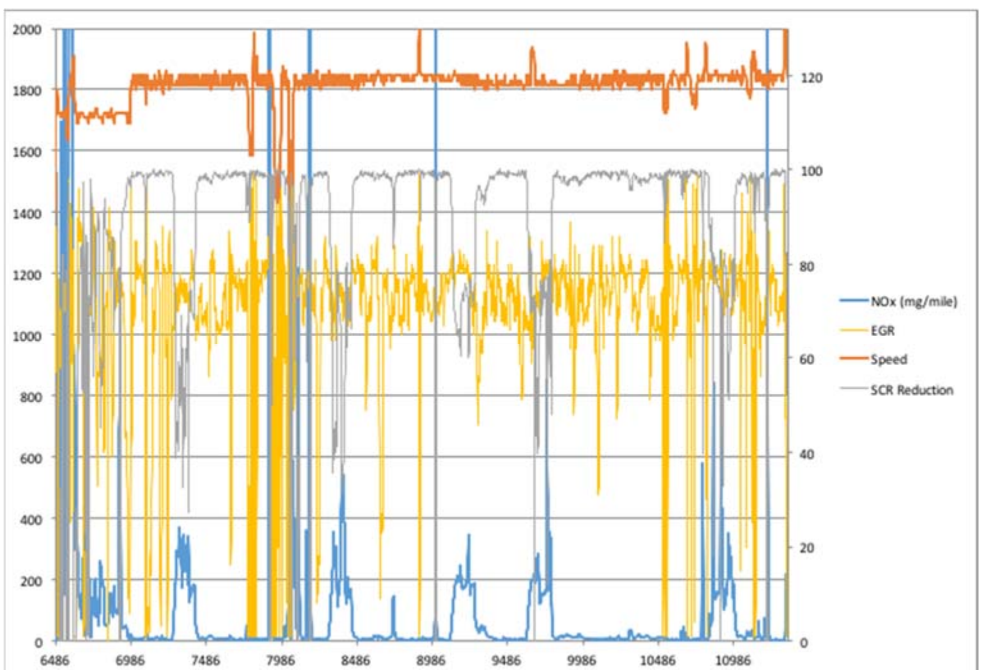
lead to greatly increased overall NOx emissions. The first event in the plot occurs near 6,000 seconds, the second at 6,120 seconds, and the third at 6,170 seconds. Notice that in each case, the NOx spikes are well above the standard. In the first case, we see a spike to nearly 600 mg/mile. The second spike leads to over 800 mg/mile. The third leads to over 200 mg/mile. These spikes are well in excess of the 50 mg/mile standard and lead to a composite emission rate for this test of 279 mg/mile, or 5.6 times the standard.



126. In many circumstances, the SCR system is significantly de-rated. In the plot below, the speed is relatively constant at 120 km/hr (71.2 mph). Near 3,550 seconds, the SCR system (gray line) drops from approximately 80% reduction to 0-40% reduction. The resulting NOx goes off the plot, with levels exceeding the 2,000 mg/mile upper bound of the plot. The resulting NOx rate for this test is 4,558 mg/mile, or 91 times the standard.

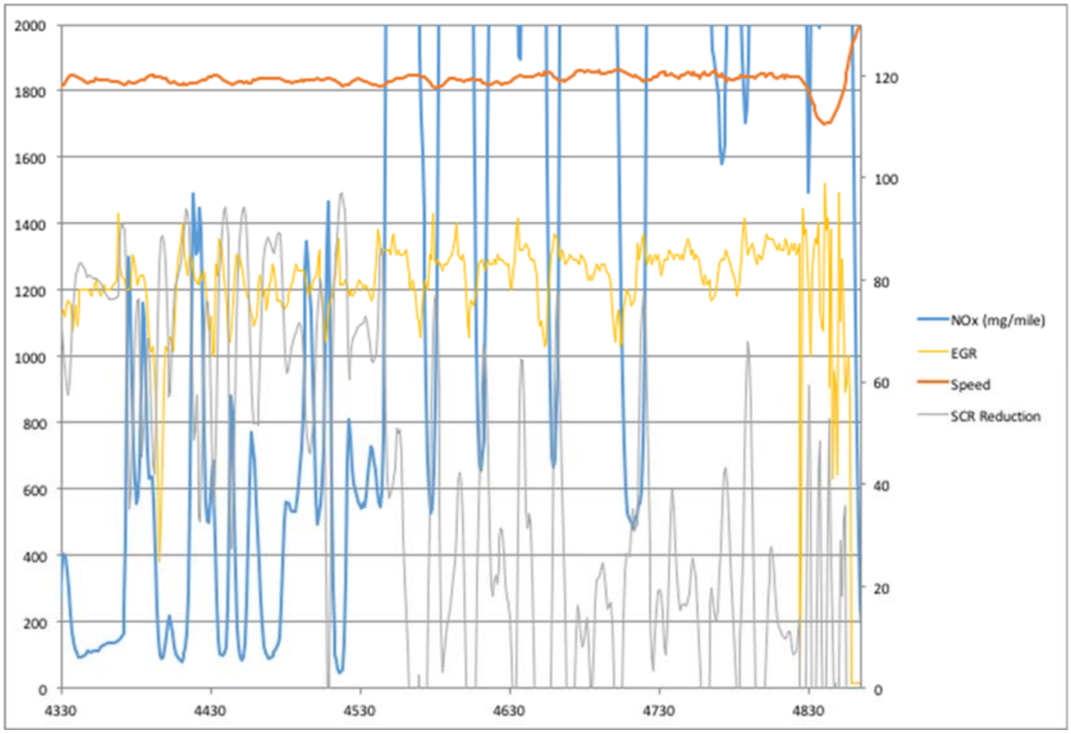


127. Here we see a plot where the SCR system is de-rated on a periodic basis (gray line) over the course of 1.2 hours, driving the NOx up to levels above 200 mg/mile. As a result, the overall NOx emission rate for this segment is 131 mg/mile.



128. The plot below shows the same behavior, with SCR effectiveness dropping from the 80% region to 0-40% region around 4,550 seconds. Again, the NOx levels exceed the upper

bound of the plot, with NOx in excess of 2,000 mg/mile, with the composite NOx emission rate for the test at 1,880 mg/mile.

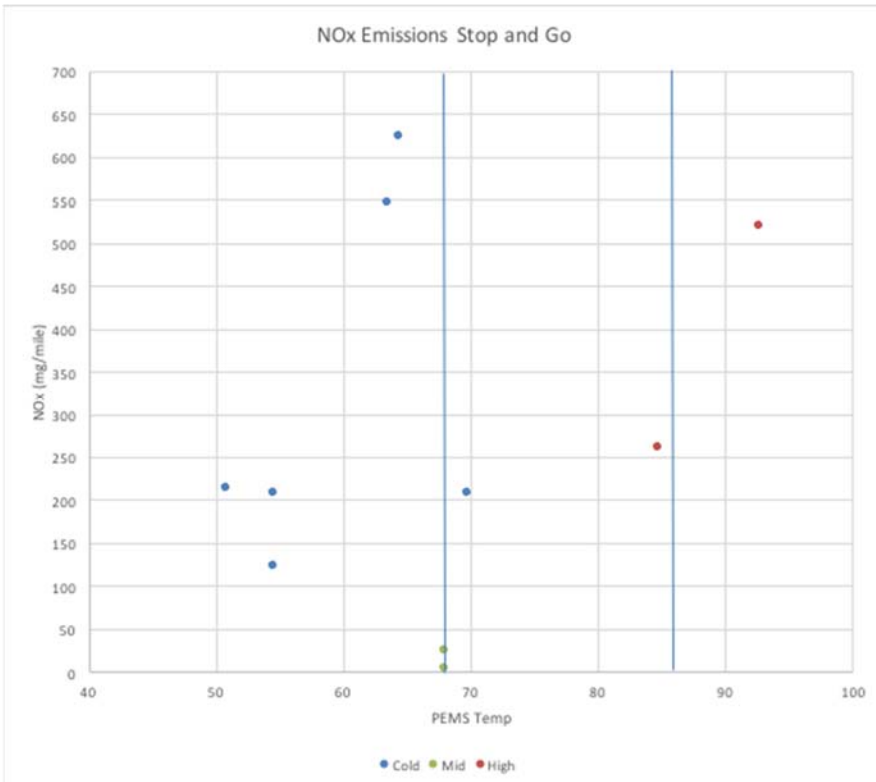


129. These plots are presented for illustrative purposes, as there are dozens of similar plots that were collected over the course of testing the R350.

130. As with the GLK250, the data was analyzed in stop-and-go and highway conditions on flat roads and grades. This data is plotted against ambient temperature, as a similar ambient temperature defeat device strategy is employed with the R350.

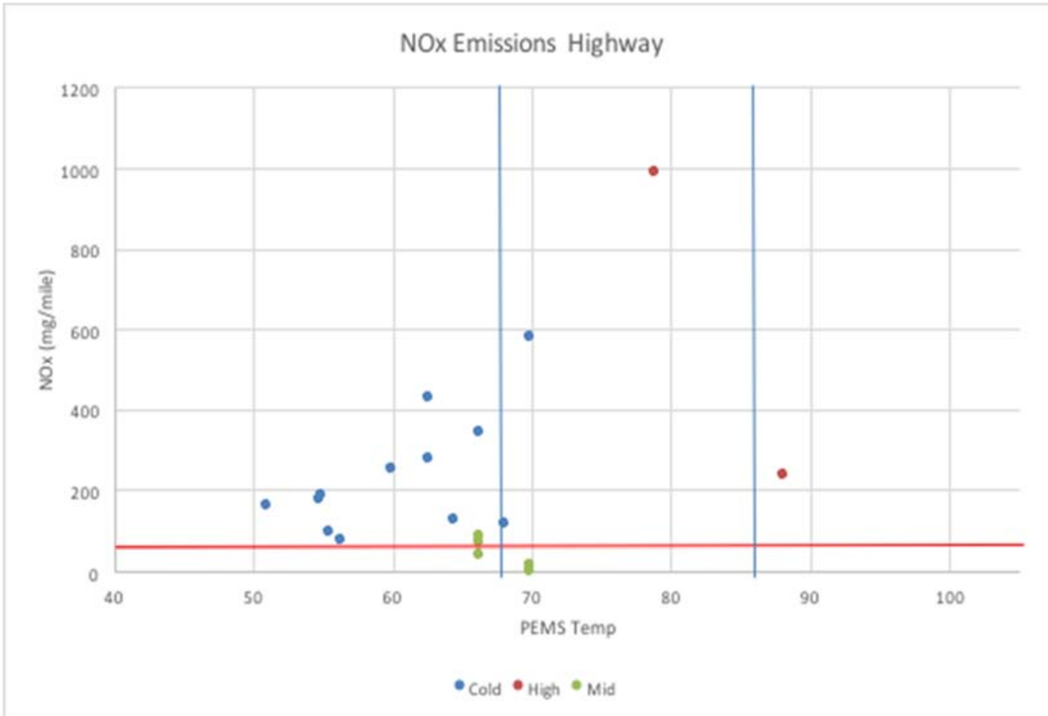
131. For stop-and-go driving on flat roads, the emissions appear to meet the standard in the temperature window between 68 and 86°F, as with the GLK250. However, outside of that temperature window, the NOx emissions increase significantly. The details of the coloring for the points (and classification as "cold," "mid," or "high") and justification are presented above in the discussion of the GLK250. Within the certification test window, stop-and-go results are 23 mg/mile on average, well below the 50 mg/mile standard. At temperatures below 68°F, emissions spike as high as 624 mg/mile, with an average of 264 mg/mile. At temperatures above 86°F, emissions spike as high as 521 mg/mile, with an average of 428 mg/mile. Temperature-related defeat devices are particularly dangerous in the State of Arizona, with daily temperatures

far above the U.S. average. Phoenix, for example, averages 168 days above 90 degrees. The Environmental Protection Agency (EPA) has warned that "[t]he adverse health impacts from excessive NOx emissions–excessive ozone formation–are most acute on hot days." A defeat device shuts down emissions at high temperatures poses real health risks for the residents of Arizona because of Arizona's hot weather.



132. For stop-and-go flat driving, the SCR reduction rate is 97% for conditions where the vehicle meets the standard. This number drops to 74%, on average, for conditions where the vehicle exceeds the standard. Similarly, the EGR rate drops from 44% to 29%, on average.

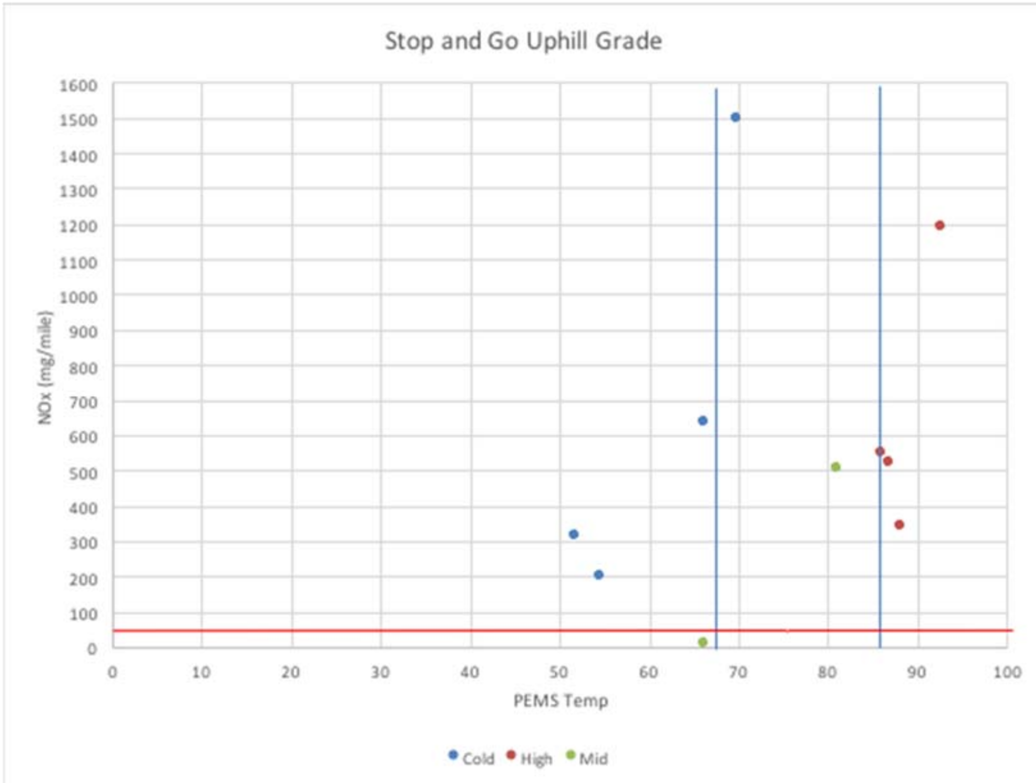
133. The same behavior is observed for highway driving. Note that the coloring of the points presented on the plots and discussion of the exact ambient temperature where the defeat devices are active is discussed in the GLK250 section above. Within the certification test window, highway results are 62 mg/mile on average, very close to the 50 mg/mile standard. At temperatures below 68°F, emissions spike as high as 583 mg/mile, with an average of 216 mg/mile. At temperatures above 86°F, emissions spike as high as 991 mg/mile, with an average of 401 mg/mile.



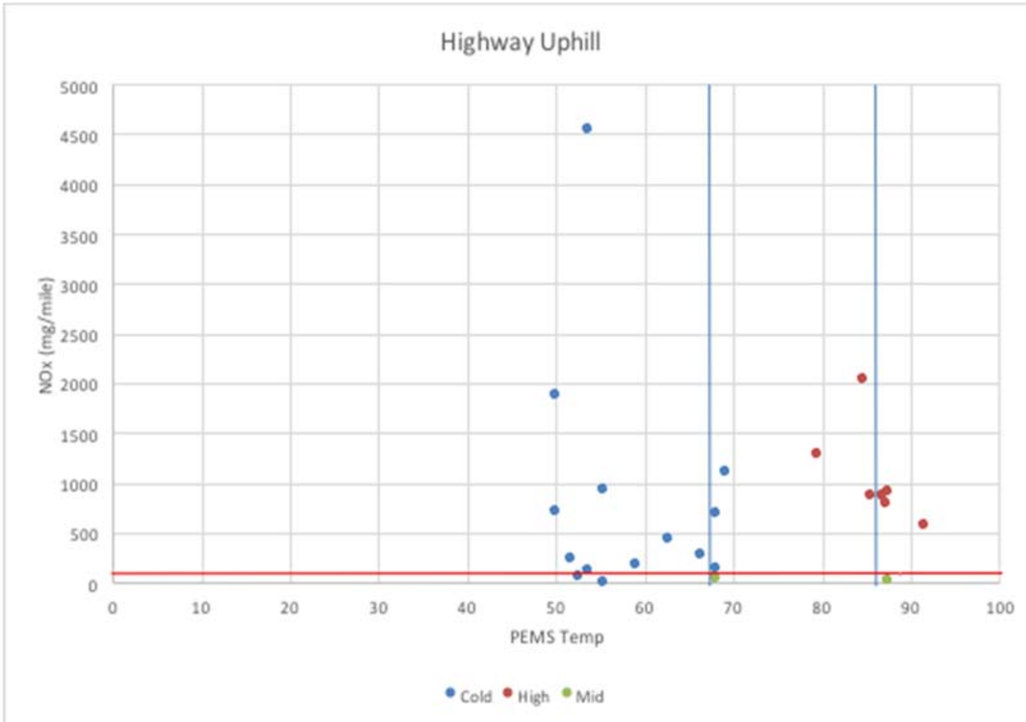
134. For highway flat driving, the SCR reduction rate is 88% for conditions where the vehicle meets the standard. This number drops to 80%, on average, for conditions where the vehicle exceeds the standard. Similarly, the EGR rate drops from 47% to 38%, on average.

135. Similar to the GLK250, the R350 has a defeat device that dramatically increases NOx on uphill and downhill road grades. The vehicle was driven on uphill road grades ranging from 0.4% to 2.6%. These are modest grades, and yet NOx increases to levels as high as 1,500 mg/mile, some 30 times the standard. Average NOx emissions for all stop-and-go testing on an uphill grade are 523 mg/mile. SCR effectiveness drops from 97% in cases where the vehicle meets the standard on flat roads to 70% on uphill grades. Similarly, EGR drops from 44% to 27% for the flat road and uphill road tests, respectively.

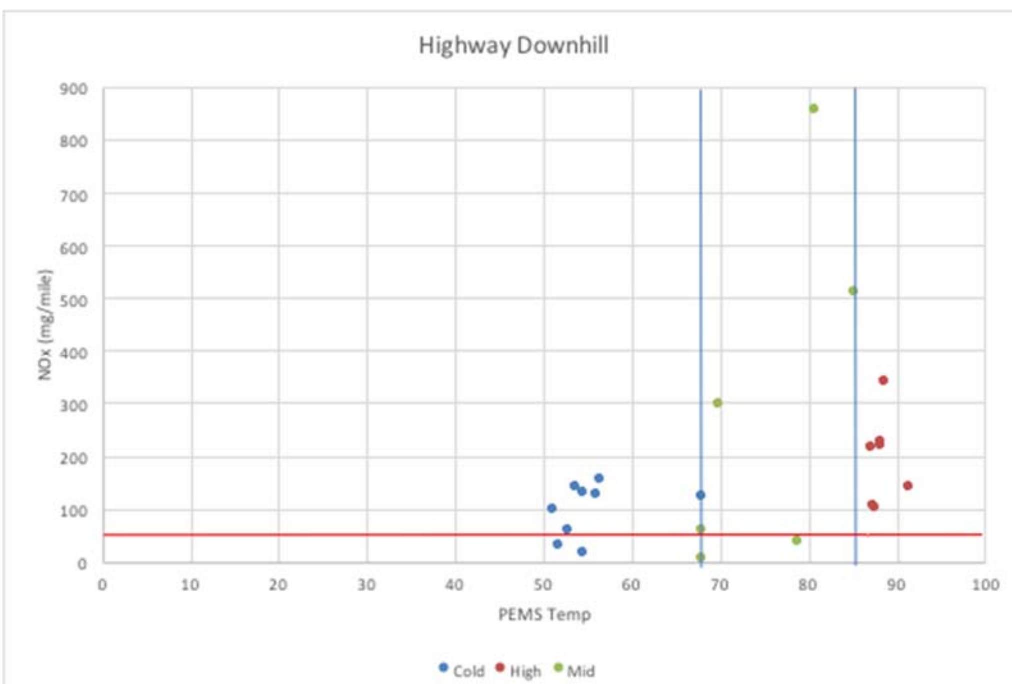
136. There are not enough data points in stop-and-go downhill conditions to present, but downhill emissions for steady highway driving are presented later.



137. For steady highway driving, grades between 0.5% and 3.5% were tested. Emission levels were measured as high as 4,558 mg/mile, with an average of 942 mg/mile. These are extraordinarily high numbers given the relatively low road grade. The SCR effectiveness drops from 88% in cases where the vehicle meets the standard on flat roads during highway driving to 54%. Similarly, the EGR rates drops from 47% to 32% for the flat road and uphill grade conditions, respectively.



138. Downhill emissions under steady highway conditions were measured from 0.5% downhill grade to 3.2% downhill grade. On average, emissions were 190 mg/mile, with values as high as 857 mg/mile. The SCR effectiveness drops from 88% in cases where the vehicle meets the standard on flat roads during highway driving to 74%. Similarly, the EGR rates drops from 47% to 37% for the flat road and downhill grade conditions, respectively.



139. Finally, the R350 was tested using the certification protocols for the FTP-75 and HWFET tests. As can be seen, the vehicle meets the certification standard for both tests, so the emissions system is operating within the manufacturer's design specifications. It is clear that the over-the-road driving emissions increase dramatically above the standard, which would suggest the vehicle is able to detect the certification test, as with the Volkswagen scandal.

	Test Cycle (values in mg/mile)	
	FTP	**HWFET**
EPA Cert Standard	50	70
Reported Cert Values	50	10
Dyno Test Values	23	47

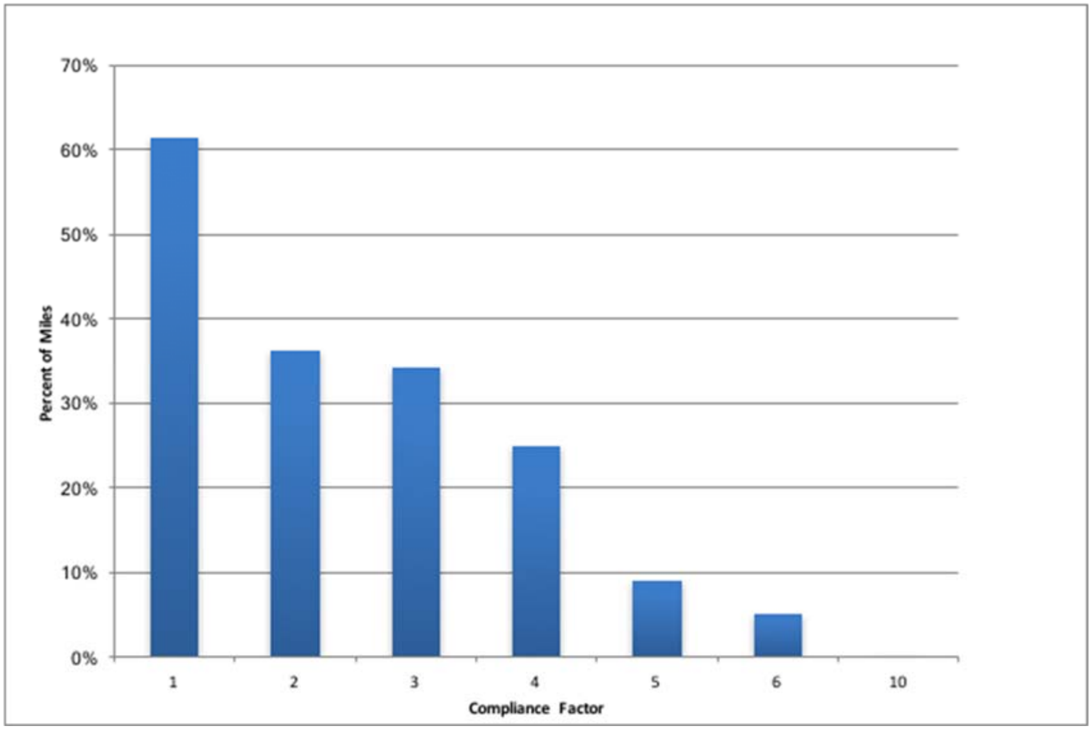
5. 2014 Mercedes/Freightliner Sprinter 2500 BlueTEC

140. This vehicle was tested with a PEMS over the course of 1,712 miles, 1,224 of which were on the highway and 488 of which were in stop-and-go conditions (or city conditions as represented by the FTP-75 certification test). A generator was installed on the rear of the vehicle to power the PEMS equipment in a position that was considered to have a minimal impact on the vehicle's aerodynamic drag.

141. The vehicle was found to have at least two defeat devices: 1) a timer on the SCR system that reduces the effectiveness after a short period of time, and 2) a defeat device that detects road grade and reduces overall emission system performance.

142. The stop-and-go emissions were found to be 465 mg/mile on average over all tests conducted, or 2.3 times the standard of 200 mg/mile. Maximum emissions in stop-and-go conditions were found to be 1,844 mg/mile, or 9.2 times the standard.

143. The compliance factor for stop-and-go conditions is plotted below.

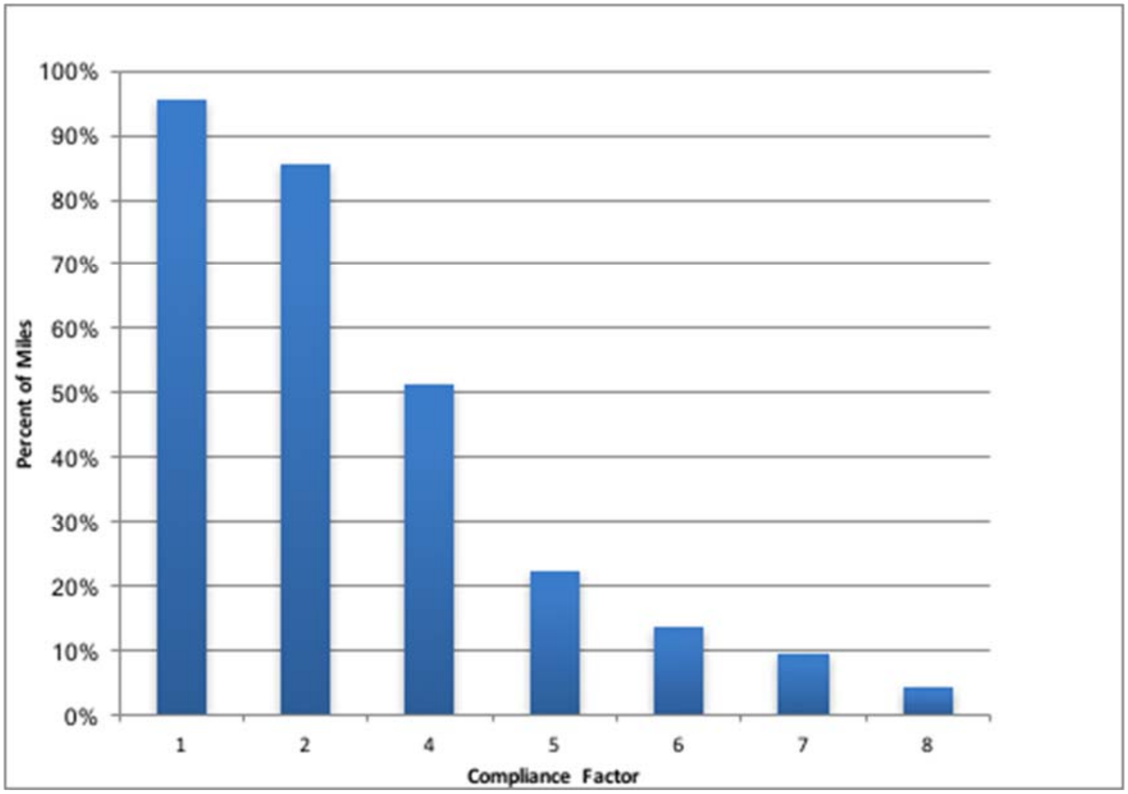


144. The vehicle spends 61% of its time above the standard. That means only 39% of the miles traveled in stop-and-go conditions actually met the standard. The vehicle spends fully 25% of the time more than four times the emission standard.

145. It should be noted that, although the magnitude of the compliance factors is lower than with the passenger cars (GLK250 and R350), the actual excess NOx emitted is just as significant as that seen on the passenger cars. For example, if the passenger cars are at 1,000 mg/mile NOx, that's 20 times the standard of 50 mg/mile, with an increase of 950 mg/mile above the standard. If the Sprinter is at 1,000 mg/mile NOx, that's 5 times the standard with an increase in 800 mg/mile above the standard. In terms of excess NOx emitted, the Sprinter is similar to the passenger cars even though the compliance factors are relatively lower.

146. The highway emissions were found to be 798 mg/mile on average over all tests conducted, or 4.0 times the standard of 200 mg/mile. Maximum emissions in highway conditions were found to be 1,790 mg/mile, or 9.0 times the standard.

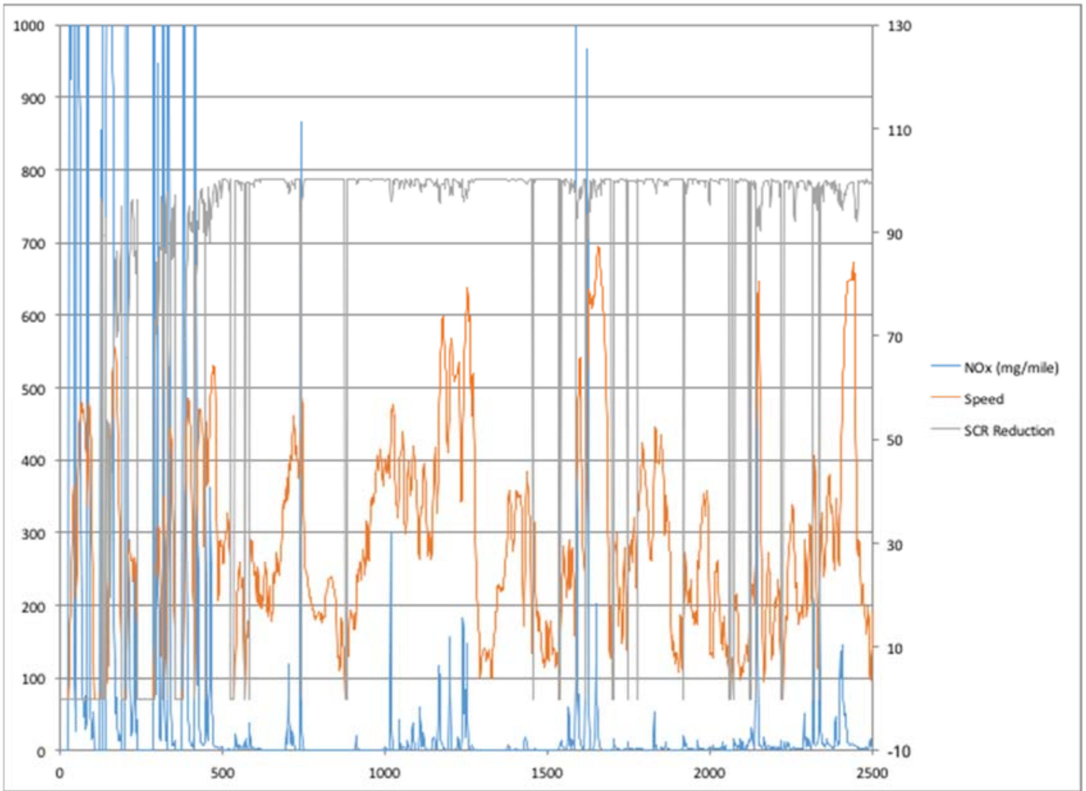
147. Similarly, the compliance factor for highway driving is plotted below.



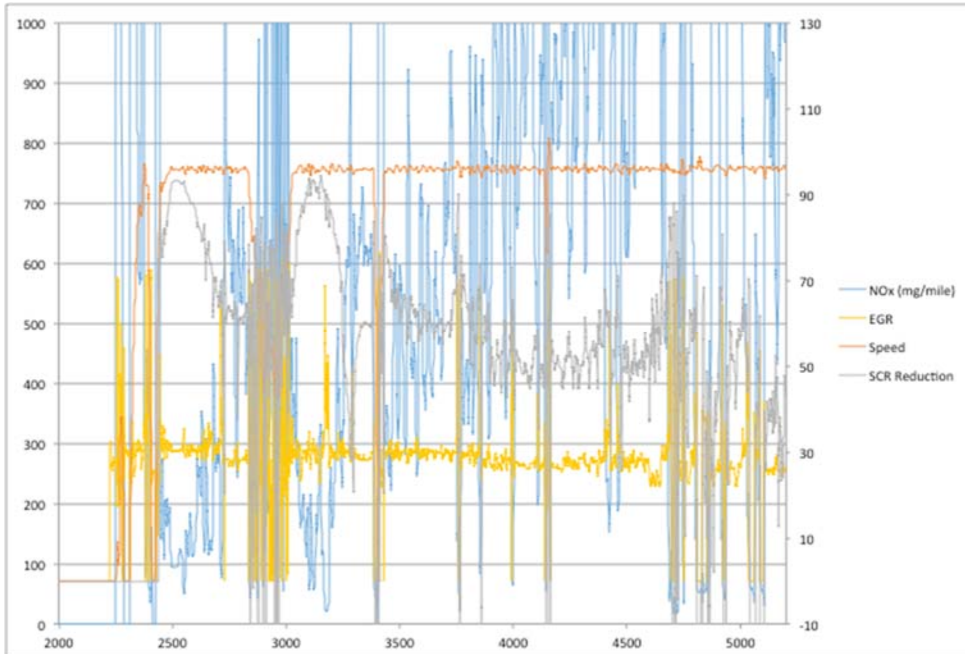
148. The vehicle spends 96% of the miles traveled above the standard, leaving only 4% of the vehicle miles traveled (VMT) having met the standard. The vehicle spends 51% of its VMT at four times the standard of above, and 4% at eight times the standard or above.

149. As with the GLK250 and R350, the Sprinter employs a number of defeat device strategies that reduce the effectiveness of the EGR and SCR systems. As with the passenger cars, the EGR and SCR systems are periodically turned off or de-rated in a manner which is not justified by operating conditions (e.g., steady operation with no change in speed or road grade).

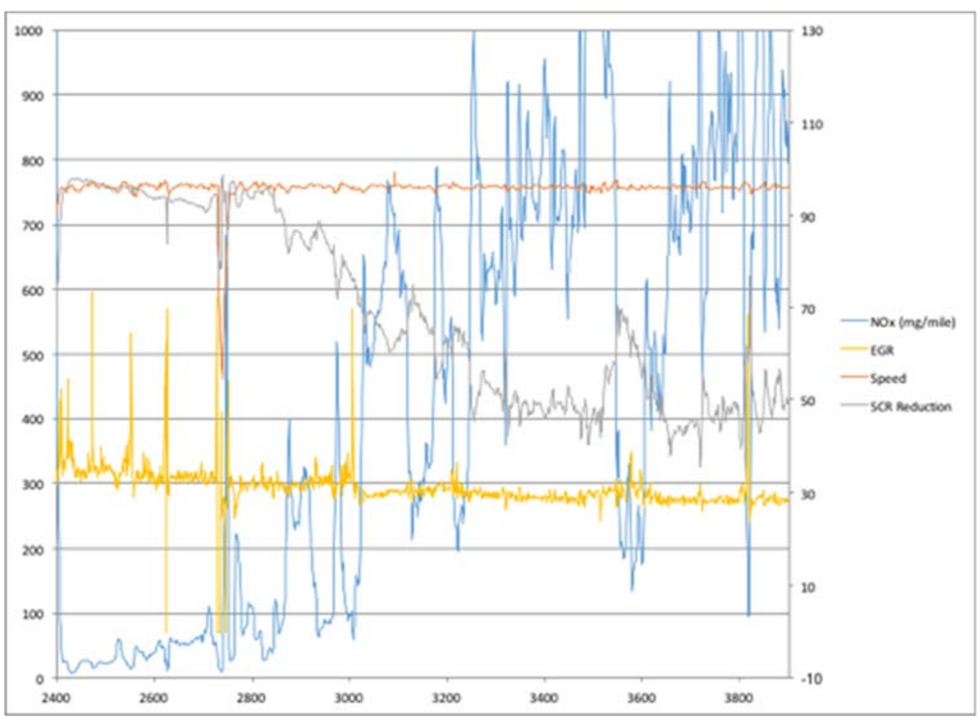
150. In several instances, the SCR effectiveness is de-rated significantly after a short period of time, if not shut off altogether. Here we observe a very well-behaved system. The EGR rate is removed from the plot for the sake of clarity, though it's relatively constant throughout. Although the vehicle is operating at a variety of speeds, the SCR reduction rate (gray line) is 94% overall, and the resulting NOx emissions are 116 mg/mile, well within the 200 mg/mile standard.



151. Here, however, the SCR effectiveness is reduced from over 90% to some 50% over the course of a short period of time during steady driving at approximately 60 mph (triggered by a reduction in urea injected into the SCR system by the engine ECM). The reduction starts at about 3,250 seconds. The resulting NOx levels spike above the 1,000 mg/mile limit of the plot, with the composite emission rate for this segment of 710 mg/mile. Prior to the reduction in urea injection, the emission rate is 216 mg/mile, which is very close to the standard. After the reduction in urea injection, the emission rate increases to 766 mg/mile.



152. Another instance in the following plot, where the reduction in SCR effectiveness begins to reduce at 2,900 seconds. The SCR effectiveness reduces from well over 90% to approximately 50%, just as before, with a composite NOx emission rate of 428 mg/mile. Prior to the reduction in urea injection, the emission rate is 58 mg/mile, well below the standard. After the reduction in urea injection, the emission rate increases to 586 mg/mile.

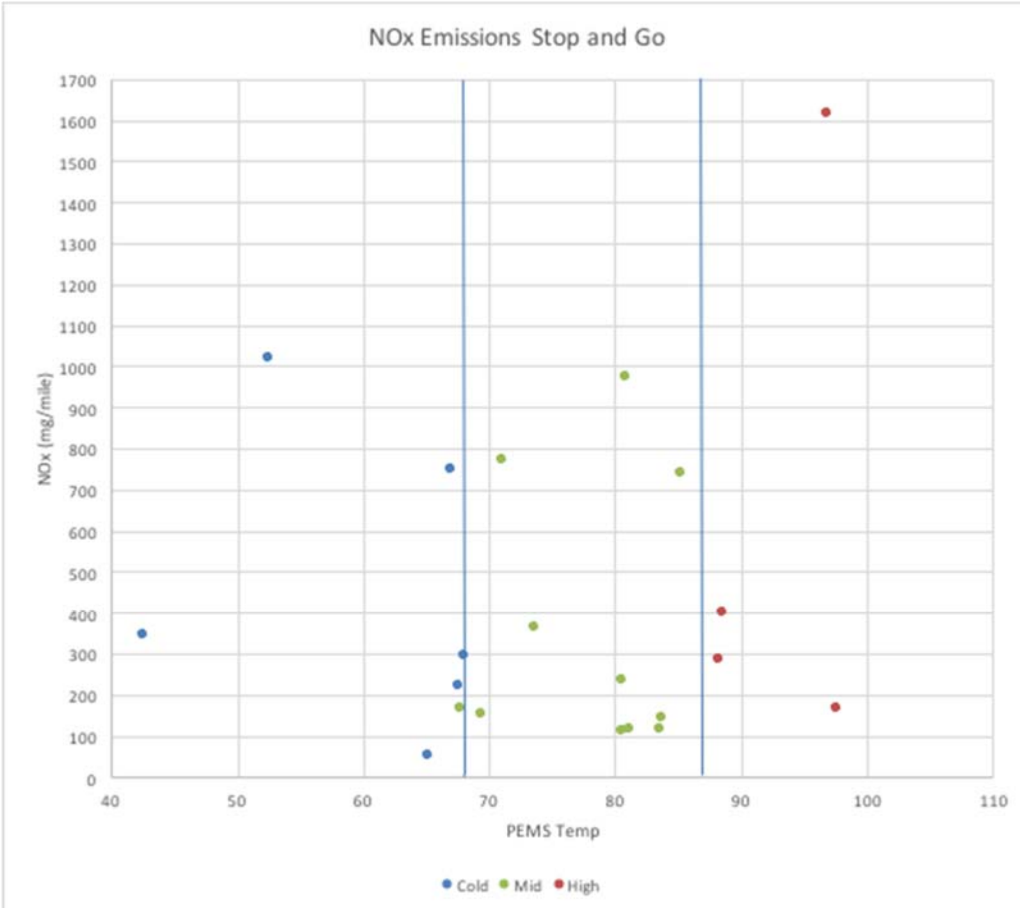


153. A wide variety of these SCR urea injection defeat devices were observed over the course of testing. These instances are summarized in the table below. In general, this defeat device results in a factor of 6.4 increase in NOx once the defeat device is triggered. The defeat device generates an additional 467 mg/mile of NOx above the standard. The SCR effectiveness is decreased on average from 90% to 59% once the defeat device is enabled. The EGR rate drops from 29.8% to 28.6%, so it would appear the primary defeat device is related to a reduction in urea injection into the SCR system.

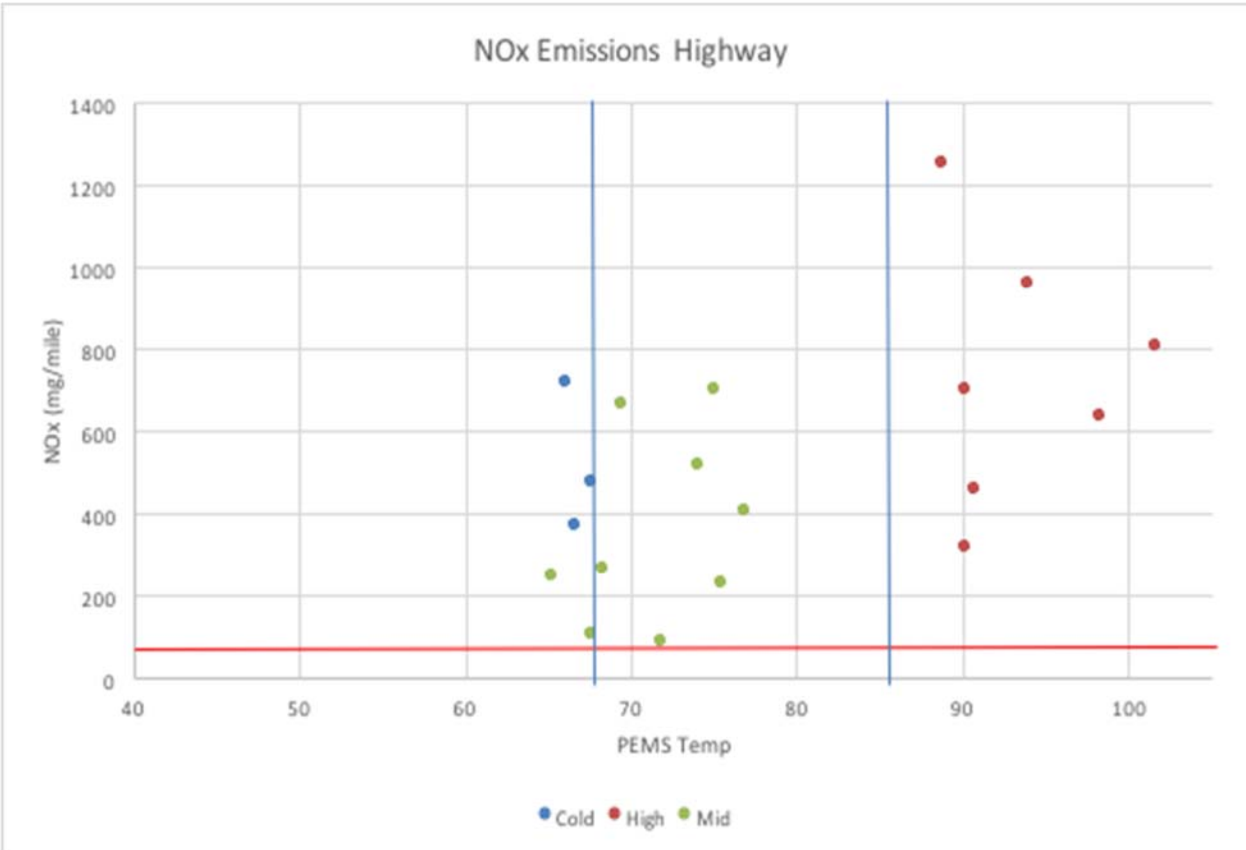
Condition	Temp	Event #	Pre timeout NOx (mg/mile)	After timeout NOx (mg/mile)	Factor Increase	Del NOx mg/mile
Uphill 0.7%	70	**1**	77	507	6.6	430
Uphill 2.0%	91	**2**	788	1176	1.5	388
Flat	94	**3**	103	965	9.4	862
Flat	90.2	**4**	210	667	3.2	457
Flat	75.5	**5**	109	324	3.0	215
Flat	88.5	**6**	127	811	6.4	684
Downill -0.6%	78.3	**7**	101	272	2.7	171
Uphill 0.5%	91.4	**8**	216	766	3.5	550
Flat	86	**9**	58	586	10.1	528
Flat	67.6	**10**	98	445	4.5	347
Hilly	80.8	**11**	108	851	7.9	743
Flat	90.7	**12**	74	603	8.1	529
Flat	76.9	**13**	52	529	10.2	477
Flat	65.2	**14**	16	206	12.9	190
Uphill 0.7%	70	**15**	77	507	6.6	430
				Average	**6.4**	**467**

154. The vehicle was tested on flat roads in stop-and-go conditions across a wide variety of ambient temperatures. Unlike the GLK250 and R350, there does not appear to be any ambient temperature dependence for the SCR defeat device. The defeat devices are active across all ambient temperatures.

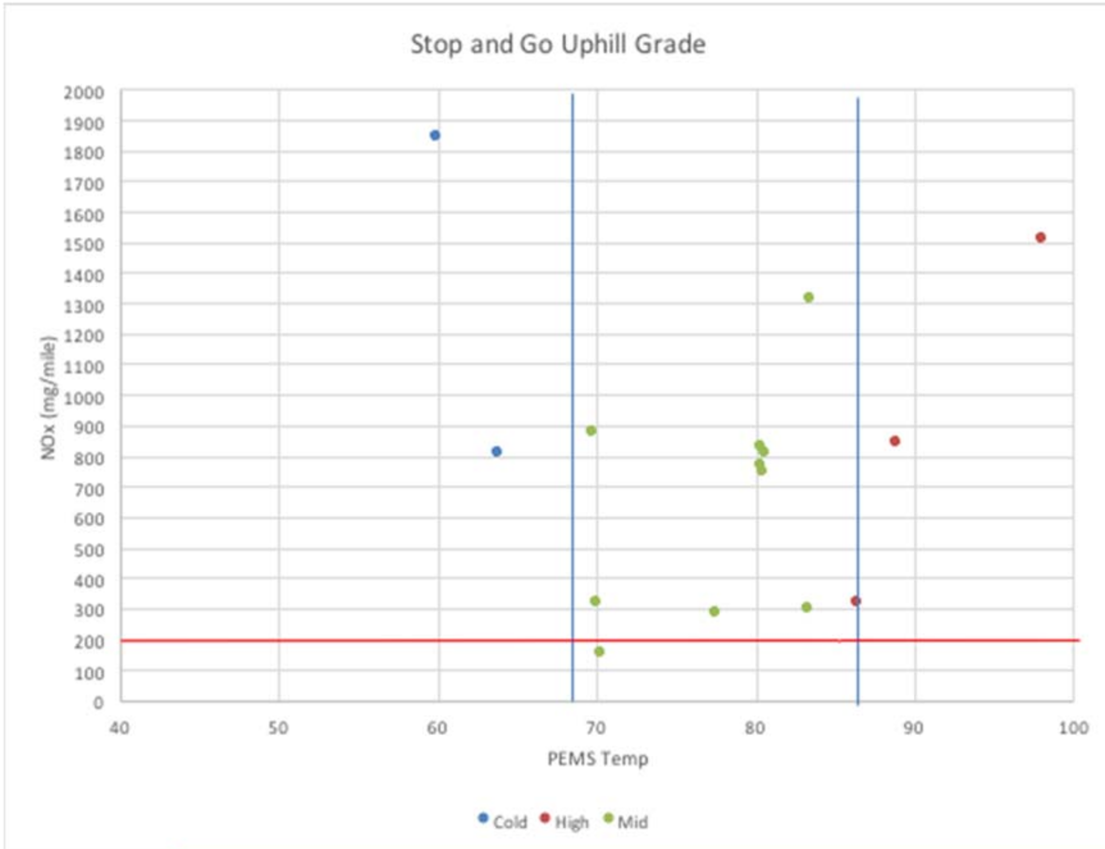
155. On average, the NOx emissions are 293 mg/mile, with spikes as high as 1,618 mg/mile. On average, the SCR effectiveness is reduced from 87% in cases where the vehicle meets the standard to 63% in cases where the vehicle exceeds the standard.



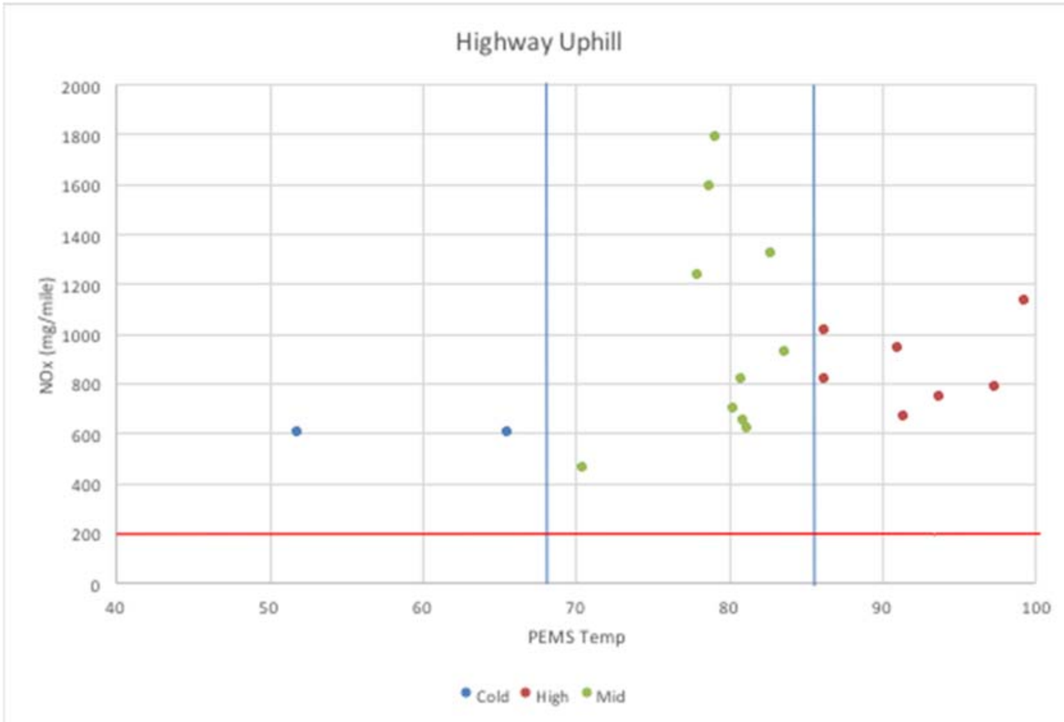
156. Similarly, for steady highway conditions on flat roads, the average NOx emission rate is 615 mg/mile, or three times the standard of 200 mg/mile. We observe emission rates as high as 1,254 mg/mile, or 6.3 times the standard. On average, the SCR effectiveness is reduced from 86% in cases where the vehicle meets the standard to 54% in cases where the vehicle exceeds the standard.



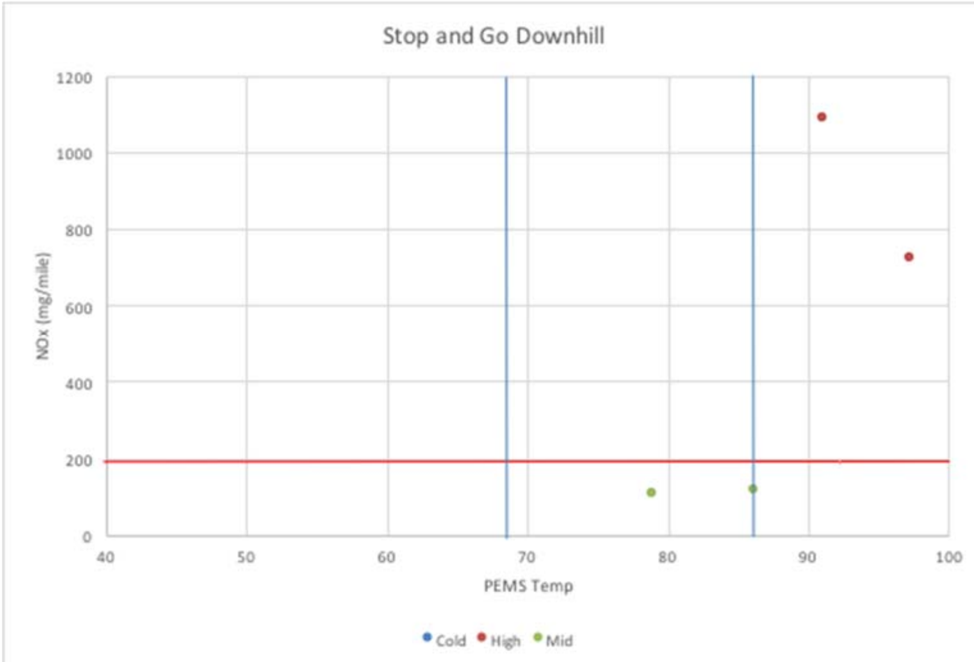
157. As with the passenger cars, the effects of modest road grades were studied in both stop-and-go and highway driving conditions. In stop-and-go conditions, road grades between 0.7% and 3.7% were tested, with a resulting average NOx of 738 mg/mile and maximum of 1,844 mg/mile. Even on a grade as insignificant as 1.0%, the emissions are as high as 845 mg/mile. In only one case on uphill grades did the vehicle meet the standard. The SCR effectiveness is reduced from 87% in cases where the vehicle meets the standard on flat roads to 53% on uphill grades. The EGR rate is reduced from 30% in cases where the vehicle meets the standard on flat roads to 23% on uphill grades.



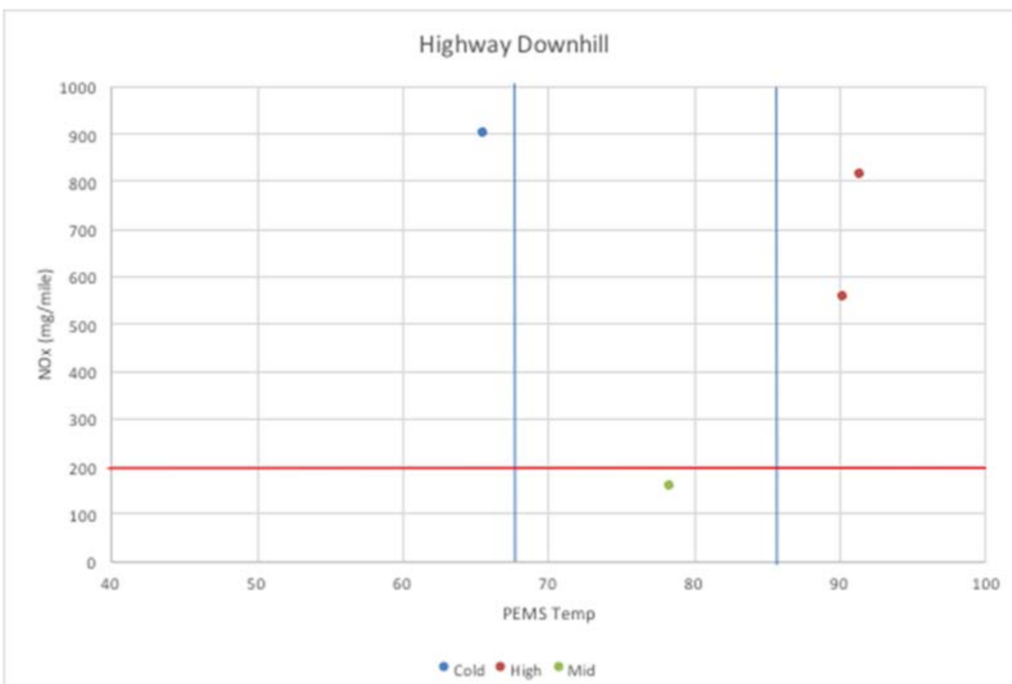
158. For highway conditions, road grades between 0.6% and 4.4% were tested, with a resulting average NOx of 1,003 mg/mile and a maximum of 1,790 mg/mile. Even with an almost imperceptible grade of 0.4%, the emissions are 698 mg/mile, or 3.5 times the standard. In no cases does the vehicle meet the standard on uphill grades. On average, the SCR reduction rate is 43%, compared to the high 80% range when the vehicle meets the standard. EGR rates are on average 22%, compared to 27% when the vehicle meets the standard in highway conditions (only on flat roads in this case).



159. Stop-and-go data for downhill conditions is relatively limited, but grades were tested between 0.7% downhill to 2.4% downhill, producing NOx emissions of 343 mg/mile on average. Interestingly, the highest NOx emission rate for downhill stop-and-go occurs at a very modest 0.7% downhill grade, yielding a NOx emission rate of 1,087 mg/mile. The SCR reduction rate is, on average, 70%, which compares to the 87% reduction rate when the vehicle meets the standard on flat roads.



160. Downhill grades between 0.6% and 2.9% were tested under steady highway conditions. The average NOx for these conditions is 714 mg/mile, with a maximum of 899 mg/mile at 1.0% downhill. The SCR effectiveness is 42% on average, compared to 86% where the vehicle meets the standard on flat roads.



161. It is thus clear that the vehicle is able to detect both uphill and downhill grades and reduce the level of urea injection. This defeat device results in a reduced effectiveness of the SCR and EGR systems and dramatic and consistent increases in NOx above the standard. Combined with the timeout defeat device that reduces the SCR effectiveness after a short period of time, the vehicle rarely meets the NOx emission standard.

6. Summary of the Mercedes deception.

162. It is clear from the testing that Mercedes uses a systematic set of defeat devices across their entire OM642 and OM651 engine platforms. The tested vehicles are representative of the entire group of vehicles in the Complaint as they test both the 3.0- and 2.1-Liter platforms. In the latter case, the OM651 platform is demonstrated to use defeat devices in both passenger car and medium-duty vehicle applications. The vehicles use consistent defeat devices to reduce both EGR rates and SCR rates under a wide variety of test conditions that are not discoverable using the certification test.

163. These defeat devices are only discoverable when conducting over-the-road testing that is not part of the certification protocol. A variety of defeat devices are used, including ambient temperature sensing, road grade sensing, SCR "timeout" (reduction after a period of time), and periodic and sporadic de-rate of the EGR and SCR systems. The result is that all three vehicles grossly exceed the relevant emission standards when operated in normal driving conditions representative of a wide variety of driving styles.

164. The State did not test each model to derive plausible allegations that each Affected Mercedes Vehicle violates U.S. and CARB emissions standards and produces emissions beyond those a reasonable consumer would have expected when he or she purchased their Mercedes, because there was no need to do so. As set forth in more detail below, all of the models share either identical or very similar engines and emissions systems, allowing experts to plausibly conclude that all Affected Mercedes Vehicles violate U.S. and CARB standards and the expectations of a reasonable consumer.

165. Mercedes itself grouped various engines and vehicles into certain emission control groups. There is a standard EPA and CARB allowed practice, whereby vehicle manufacturers

combine vehicles and engines into groups to reduce the cost of testing. This same approach lays the groundwork for allegations of similarity and sameness across multiple models, model years, and configurations.

166. When a manufacturer submits an application for emissions certification to the EPA or CARB, they will group similar vehicles into the same test group that (i) have the same engine and emission control system, (ii) have similar weights, and (iii) are certified to the same emission standard. In some cases, only one vehicle will go in a test group. In other cases, there may be two or more vehicles in a test group. The manufacturer will group them based on the equivalency of the engine/emission control system and weight. For example, the 2009 ML320 BlueTEC and R320 BlueTEC are grouped together in the same test group because their engines/emission control systems are identical (3.0 Liter OM642 with SCR after-treatment) and they are a similar weight class. The GL320, which has the same engine and emission control system as the ML320/R320, goes into a different test group because it is in a different weight class (even though the engine and emission control system is the same). When a manufacturer groups multiple models onto the same certification application, only one vehicle is used for the manufacturer's testing in order to reduce cost; the manufacturer need not test every vehicle or even a sampling.

167. If the EPA considers the vehicles similar enough to allow grouping on the same application for a test group, then the EPA considers the vehicles identical from an emissions standpoint.

168. Comparisons to the "emissions data vehicle" (EDV) and the "durability data vehicle" (DDV) across multiple test groups also reinforces this conclusion. An EDV is used to demonstrate compliance with the relevant emission standard; this is the vehicle that is actually tested on the dynamometer to determine emissions performance and compliance with the standard. The DDV is used to show the durability of the emission control system and to determine the rate of deterioration for the emission control system over the vehicle's useful life.

169. When a manufacturer submits an application for certification, it will use a unique identifier (like a serial number) to identify the EDV and DDV that are being used to support the

application. In many cases, the EDV will be the same vehicle as used in previous years, which means the application is a carryover from the previous year and no model changes were made. If the EDV is the same from one application to the next, the vehicles in those test groups should be considered equivalent from an emissions performance standpoint.

170. The DDV applies more broadly across multiple test groups, as it is primarily a measure of catalyst deterioration. Many different models and model years may use the same DDV to demonstrate the durability of the emissions system. If two test groups use the same DDV, it provides some additional evidence that there is equivalence between the two engines and emission control systems.

171. All variants of the two base Mercedes BlueTEC engines sold in the U.S.—the 2.1L OM651 and the 3.0L OM 642—are well represented by both the State's list of vehicles and expert testing of the vehicles. Though there are different configurations and possibly subtle changes from vehicle to vehicle and model year to model year, these engines are substantially similar.

172. As noted, manufacturers tend to try to leverage the same engine/emissions technology across multiple vehicle platforms and model years in order to reduce the burden of testing. In fact, a single engine and/or vehicle has been used across multiple vehicle models and model years to achieve certification. This strongly (and plausibly) suggests that any defeat strategies would reasonably operate across the broad class of similar engines. Indeed, it would be prohibitively expensive and impractical for Mercedes to develop completely separate emissions control systems for vehicles that have the same or similar engines.

173. Experts also conducted additional research into the public technical literature providing an understanding of the various configurations of BlueTEC engines sold between 2007 and 2016. The literature provides some insight into the architecture of the variants of the OM642 and OM651 engines. In all cases, the engines are shown to have much more commonality than not, leading experts to conclude there is a strong basis for sufficient similarity or "sameness" to warrant inclusion on the list of Affected Mercedes Vehicles. *The vehicles are*

either equivalent from an emissions standpoint to the test vehicles or use the same core technologies and engine platforms as the tested vehicles.

174. The vehicles can be broken down into four categories, all of which are well represented by the test vehicles identified for the reasons discussed above and as further explained below:

> *3.0 Liter OM642 with SCR*
>
> All of the Affected Mercedes Vehicles featuring a 3.0 Liter engine share the same basic engine architecture, code named OM642-30 by Mercedes. Although there are variations from revisions of the OM642-30, the same basic emission control architecture is employed through the line.
>
> This architecture of the OM642 engine comprises the following emission control technologies: exhaust gas recirculation (EGR), a turbo-charger, a diesel oxidation catalyst (DOC), a diesel particulate filter (DPF), a selective catalytic reduction (SCR) system, a urea dosing tank and dosing system, and a Bosch EDC17 engine control module (ECM).
>
> This architecture is well represented by the 2012 R350 BlueTEC test vehicle, which uses the OM642-30 engine along with all the aforementioned emission control devices. This test vehicle should be considered a reasonable representation of all 3.0 Liter Affected Mercedes Vehicles that employ SCR.
>
> *3.0 Liter OM642 with NOx Storage Catalyst*
>
> The very earliest (MY2007) implementation of the BlueTEC diesel engine employed an OM642-30 engine with a NOx storage catalyst after-treatment. Although this older after-treatment technology differs from the SCR systems, the *same* OM642-30 engine is used. In particular, the EGR system is well represented by the 2012 R350 BlueTEC tested. This is important because the tested R350 employs a defeat device (EGR valve de-rate or shutoff at ambient temperatures below approximately 50°F) to significantly reduce EGR flow rate to prevent condensation in the engine intake. NOx emissions increase as EGR flow rates are reduced. This defeat device is well-documented in Europe and has been demonstrated on the Plaintiff's R350 BlueTEC test vehicle. This defeat device results in a significant increase in NOx emissions. The 2007-2009 E320 BlueTEC vehicles configured with the NOx storage catalyst make use of the same EGR system as the tested 2012 R350 BlueTEC (as well as many other parts of the same OM642-30 engine system) and, for this reason, the 2012 R350 BlueTEC is be considered appropriately representative.

2.1 Liter OM651 with SCR

All of the Affected Mercedes Vehicles featuring a 2.1 Liter engine share the same basic engine architecture, internally code named OM651-22 by Mercedes. Based on literature and certification documents, the OM651-22 does not appear to have been significantly altered since its introduction in 2013.

This architecture comprises the OM651-22 engine with exhaust gas recirculation (EGR), a turbo-charger, a diesel oxidation catalyst (DOC), a diesel particulate filter (DPF), a selective catalytic reduction (SCR) system, a urea dosing tank and dosing system, and a Bosch EDC17 engine control module (ECM).

This architecture is well represented by the 2013 GLK250 BlueTEC 4matic test vehicle, which uses the OM651-22 engine along with all the aforementioned emission control devices. This test vehicle should be considered a reasonable representation of all 2.1 Liter Affected Mercedes Vehicles.

Sprinter

In the Sprinter, the emission control architecture remains largely unchanged from the aforementioned passenger cars. In fact, the Sprinter makes use of the same OM642-30 and OM651-22 engines and SCR emission control systems.

In both cases, this architecture comprises the base engine (either OM651-22 or OM642-30) with exhaust gas recirculation (EGR), a turbo-charger, a diesel oxidation catalyst (DOC), a diesel particulate filter (DPF), a selective catalytic reduction (SCR) system, a urea dosing tank and dosing system, and a Bosch EDC17 engine control module (ECM).

The tested 2014 Freightliner Sprinter 2500 with 2.1 Liter engine is representative of all 2.1 Liter equipped OM651-22 Sprinter vans. Although the 2.1 Liter Sprinter is certified to multiple weight classes in some cases, the emissions generally increase with higher weight ratings. The same engine and emissions control system is used across the various weight ratings, probably with very minor tweaks to account for the difference in weight.

The 3.0 Liter versions of the Sprinter contain OM642-30 engines that were taken from the passenger car market. The 2012 R350 BlueTEC, which employs the same basic OM642-22 architecture and emission control setup, is representative. Furthermore, the more modern 2014 Freightliner Sprinter 2500 that was tested provides additional evidence that a defeat device is likely to be employed in the 3.0 Liter Sprinter platform as well.

175. The foregoing summary, backed by a deeper analysis that is not necessary to further detail at this time, is sufficient to demonstrate the representativeness of the test vehicles to the Affected Mercedes Vehicles. Any differences between the test vehicles and the Affected Mercedes Vehicles are not material and not significant enough to suggest that the same defeat device would not be present in the Affected Mercedes Vehicles.

176. Indeed, in the Volkswagen case, the EPA issued violation notices based on engine size (2.0 and 3.0 liters) and did not differentiate based on models or years. In other words, all 2.0 models were in violation, not, for example, some but not all Jettas or Jettas but not Passats.

177. The test results reported above are consistent with findings by testing agencies in Europe. Emissions Analytics is a British testing company that holds itself out as "the leading independent global testing and data specialist for real world emissions." The company publishes the EQUA Air Quality Index that identifies vehicles emissions on a scale from "A+" (best), to "H" (worst).

178. The Mercedes Diesel vehicles at issue were rated D, E, F, and H. The Mercedes gas cars were rated A+. A reasonable consumer would not expect his or her "clean" BlueTEC to rate far worse than a Mercedes gas powered car.

179. Recently Daimler recalled 700,000 vehicles in Europe as a result of an administrative order by the German Federal Motor Transport Authority. The recall was to address emissions systems and includes the same engine codes at issue here. These vehicles, the European version of the U.S. models at issue here, violated the Euro 6(b) emissions standard of .60 (the U.S. is .50).

F. The Bosch EDC17

180. All modern engines are integrated with sophisticated computer components to manage the vehicle's operation, such as an EDC. Bosch GmbH tested, manufactured, and sold the EDC system used by Volkswagen, FCA, Mercedes, and others. This system is more

formally referred to as the Electronic Diesel Control Unit 17 ("EDC Unit 17" or "EDC17"). Upon its introduction, EDC Unit 17 was publicly touted by Bosch as follows:[29]

> EDC17…controls every parameter that is important for effective, low-emission combustion.
>
> Because the computing power and functional scope of the new EDC17 can be adapted to match particular requirements, it can be used very flexibly in any vehicle segment on all the world's markets. In addition to controlling the precise timing and quantity of injection, exhaust gas recirculation, and manifold pressure regulation, it also offers a large number of options such as the control of particulate filters or systems for reducing nitrogen oxides. The Bosch EDC17 determines the injection parameters for each cylinder, making specific adaptations if necessary. This improves the precision of injection throughout the vehicle's entire service life. The system therefore makes an important contribution to observing future exhaust gas emission limits.

181. Bosch worked with Mercedes and utilized EDC Unit 17 to create a unique set of specifications and software code to manage Mercedes' engines operation.

182. The software calibrations are an interactive process between Bosch and any OEM, including Mercedes. Bosch employees used email to regularly communicate with Mercedes' employees over various changes to various code functions such as "T-Eng," sensor faults, online dosing, and other software parameters. Bosch employees also regularly communicated with Defendants' employees concerning dosing rates into the SCR catalyst and the impact of such on NOx emissions.

183. Bosch employees regularly communicated with Mercedes' employees about presentations to the EPA and CARB concerning Mercedes' ability to meet emissions standards.

184. Bosch's EDC Unit 17 controls emissions by periodically reading sensor values, evaluating a control function, and controlling actuators based on the control signal.[30] Sensor readings include crankshaft position, air pressure, air temperature, air mass, fuel temperature, oil

[29] Bosch Press Release, *The brain of diesel injection: New Bosch EDC17 engine management system* (Feb. 28, 2006), http://www.bosch-presse.de/presseforum/details.htm?txtID=2603&locale=en.

[30] Moritz Contag, *et al.*, How They Did It: An Analysis of Emission Defeat Devices in Modern Automobiles, p.4 (2017).

temperature, coolant temperature, vehicle speed, exhaust oxygen content, as well as driver inputs such as accelerator pedal position, brake pedal position, cruise control setting, and selected gear. Based on sensor input, EDC17 controls and influences the fuel combustion process including, in particular, fuel injection timing, which affects engine power, fuel consumption, and the composition of the exhaust gas.[31]

185. All Bosch ECUs, including the EDC17, run on complex, highly proprietary engine management software over which Bosch exerts near-total control. In fact, the software is typically locked to prevent customers, like Mercedes, from making significant changes on their own. Accordingly, both the design and implementation are interactive processes, requiring Bosch's close collaboration with the automaker from beginning to end.

186. With respect to the Affected Mercedes Vehicles, the EDC 17 was used surreptitiously to evade emissions regulations. Mercedes and Bosch worked together to develop and implement a specific set of software algorithms for implementation in the Affected Mercedes Vehicles, including algorithms to adjust fuel levels, EGR, air pressure levels, and urea injection rates in vehicles equipped with SCR systems.[32]

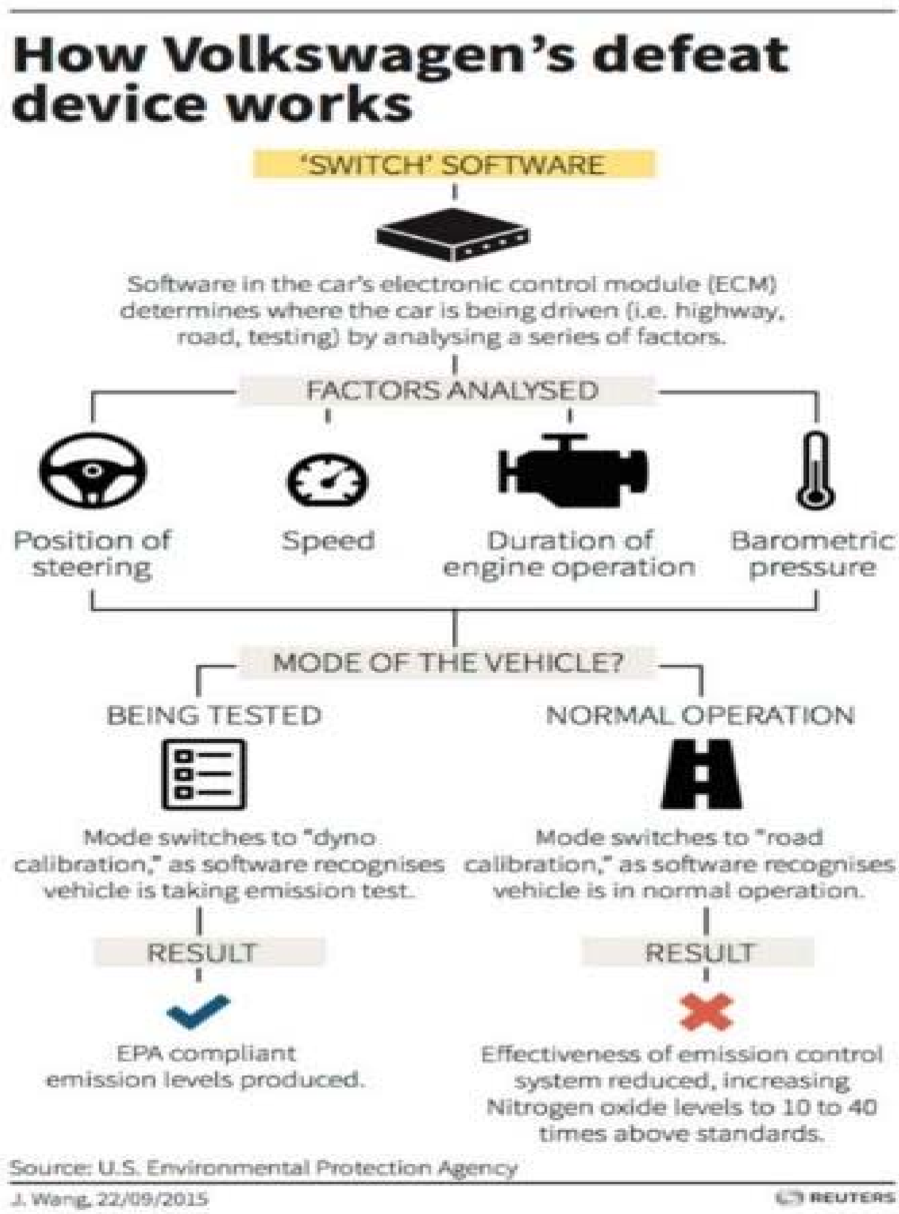
187. When carmakers test their vehicles against EPA emission standards, they place their vehicles on dynamometers (large rollers) and then perform a series of specific maneuvers prescribed by federal regulations. Bosch's EDC Unit 17 gave manufacturers the power to detect test scenarios by monitoring vehicle speed, acceleration, engine operation, air pressure, and even the position of the steering wheel. When the EDC Unit 17's detection algorithm detected that the vehicle was on a dynamometer (and undergoing an emission test), additional software code within the EDC Unit 17 downgraded the engine's power and performance and upgraded the emission control systems' performance by switching to a "dyno calibration" to cause a subsequent reduction in emissions to legal levels. Once the EDC Unit 17 detected that the

---

[31] *Id.*

[32] *Engine management*, Bosch Auto Parts, http://de.bosch-automotive.com/en/parts_and_accessories/motor_and_sytems/diesel/engine_management_2/engine_control_unit_1.

emission test was complete, the EDC Unit would then enable a different “road calibration” that caused the engine to return to full power while reducing the emission control systems’ performance, and consequently caused the vehicle to spew the full amount of illegal NOx emissions out on the road in certain conditions.[33] This process is illustrated in the following diagram, using Volkswagen merely for illustration, but applicable to the Affected Mercedes Vehicles:



---

33 Russell Hotten, *Volkswagen: The scandal explained*, BBC (Dec. 10, 2015), http://www.bbc.com/news/business-34324772.

188. Bosch developed, marketed, and sold the EDC-17 to evade U.S. and Arizona emissions requirements, including the Mercedes vehicles in this case. The Bosch entities participated not just in the development of the defeat device, but also in a civil conspiracy with Mercedes to use the EDC-17 as a cheat device to evade emissions requirements, and to prevent state and federal regulators from uncovering the device's true functionality.

189. Bosch marketed "clean diesel" in the United States and communicated directly or through trade organizations with the public and U.S. regulators about the benefits of "clean diesel." This promotional activity helped create the demand for diesel vehicles and the premium sum they commanded. These marketing efforts, together with evidence of each Bosch entities' actual knowledge that its software could be operated as a defeat device and participation in concealing the true functionality of the device from U.S. regulators, can be interpreted only one way under U.S. law: each Bosch entity was a knowing and active participant in a civil conspiracy with Mercedes (and many others) to defraud U.S. consumers, including diesel car purchasers or lessees.

G. The Damage From Excessive NOx

1. Environmental harm.

190. The State does not seek recovery for the harm to the environment, either through damages or otherwise. However, it is important to understand why (1) NOx is regulated and (2) why a reasonable consumer would not want his or her vehicle to dump NOx into the air.

191. NOx contributes to ground-level ozone and fine particulate matter. According to the EPA, "[e]xposure to these pollutants has been linked with a range of serious health effects, including increased asthma attacks and other respiratory illnesses that can be serious enough to send people to the hospital. Exposure to ozone and particulate matter has also been associated with premature death due to respiratory-related or cardiovascular-related effects. Children, the elderly, and people with pre-existing respiratory disease are particularly at risk for health effects of these pollutants."

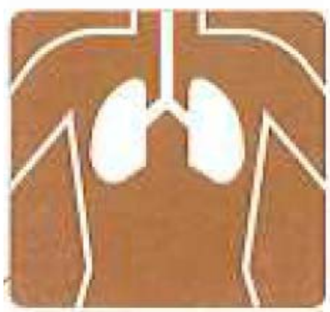
192. The EPA describes the danger of NOx as follows:

Acid Rain - NO_x and sulfur dioxide react with other substances in the air to form acids which fall to earth as rain, fog, snow, or dry particles. Some may be carried by the wind for hundreds of miles. Acid rain damages forests; causes deterioration of cars, buildings, and historical monuments; and causes lakes and streams to become acidic and unsuitable for many fish.

Water Quality Deterioration - Increased nitrogen loading in water bodies, particularly coastal estuaries, upsets the chemical balance of nutrients used by aquatic plants and animals. Additional nitrogen accelerates "eutrophication," which leads to oxygen depletion and reduces fish and shellfish populations. NO_x emissions in the air are one of the largest sources of nitrogen pollution to the Chesapeake Bay.

Toxic Chemicals - In the air, NO_x reacts readily with common organic chemicals, and even ozone, to form a wide variety of toxic products, some of which may cause biological mutations. Examples of these chemicals include the nitrate radical, nitroarenes, and nitrosamines.

Ground-level Ozone (Smog) - is formed when NO_x and volatile organic compounds (VOCs) react in the presence of heat and sunlight. Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are susceptible to adverse effects such as damage to lung tissue and reduction in lung function. Ozone can be transported by wind currents and cause health impacts far from the original sources. Millions of Americans live in areas that do not meet the health standards for ozone. Other impacts from ozone include damaged vegetation and reduced crop yields.



Particles - NO_x react with ammonia, moisture, and other compounds to form nitric acid vapor and related particles. Human health concerns include effects on breathing and the respiratory system, damage to lung tissue, and premature death. Small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and aggravate existing heart disease.

Global Warming - One member of the NO_x family, nitrous oxide, is a greenhouse gas. It accumulates in the atmosphere with other greenhouse gases causing a gradual rise in the earth's temperature. This will lead to increased risks to human health, a rise in the sea level, and other adverse changes to plant and animal habitat.

193. A recent study published in NATURE estimates that there are 38,000 deaths worldwide due to excess NOx emissions. And recently a study commissioned by the Federal Office for the Environment (Germany) concluded that 6,000 people died prematurely in 2014 from illnesses known to be caused or aggravated by NOx exposure.

194. As noted, NOx contributes to ozone. Ozone is a particular issue for Phoenix, which was recently rated the 8th most air polluted city in the United States.

2. Economic harm specifically alleged here.

195. As a result of Defendants' unfair, deceptive, and/or fraudulent business practices, and its failure to disclose that under normal operating conditions the Affected Mercedes Vehicles are not "clean" diesels, emit more pollutants than do gasoline-powered vehicles, and emit more pollutants than permitted under federal and state laws, owners and/or lessees of the Affected Mercedes Vehicles have suffered losses in money and/or property. Had Arizona consumers known of the higher emissions at the time they purchased or leased their Affected Mercedes Vehicles, or had they known of the effects on fuel economy if the emissions were not manipulated, they either (a) would not have purchased or leased those vehicles, or (b) would have paid substantially less for the vehicles than they did. Arizona consumers paid a premium for diesel vehicles as Defendants charged more for a diesel engine than a comparable gas engine based on features that were falsely advertised including the cleanliness of the emissions, fuel performance, and durability. Further, without improvements in fuel economy and emissions over gasoline vehicles, there is no reason for a consumer to purchase a diesel car over a gas-powered car.

V. CLAIM FOR RELIEF

COUNT I
(AGAINST ALL DEFENDANTS)

ARIZONA CONSUMER FRAUD ACT (A.R.S. § 44-1521, ET SEQ.)

196. The State re-alleges and incorporates by reference all preceding paragraphs.

197. Each Defendant is a "person" within the meaning of A.R.S. § 44-1521(6).

198. The Affected Mercedes Vehicles are "merchandise" within the meaning of A.R.S. § 44-1521(5).

199. The Arizona Consumer Fraud Act provides that "[t]he act, use or employment by any person of any deception, deceptive or unfair act or practice, fraud, false pretense, false promise, misrepresentation, or concealment, suppression or omission of any material fact with intent that others rely upon such concealment, suppression or omission, in connection with the sale or advertisement of any merchandise whether or not any person has in fact been misled, deceived or damaged thereby, is declared to be an unlawful practice." A.R.S. § 44-1522(A).

200. In the course of their business, Defendants systematically concealed the true operation of the Affected Mercedes Vehicles' emission system and fuel economy, as described herein and otherwise engaged in activities with a tendency or capacity to deceive. Defendants also engaged in unlawful practices by employing deception, deceptive or unfair acts or practices, fraud, false pretenses, false promises, misrepresentations, or concealment, suppression or omission of material facts with intent that others rely upon such concealment, suppression or omission, in connection with the sale and lease of the Affected Mercedes Vehicles.

201. Among other things, by failing to disclose and by actively concealing the true emissions and fuel economy of the Affected Mercedes Vehicles, Defendants engaged in deceptive and unfair acts and practices in violation of the Arizona Consumer Fraud Act.

202. Defendants conspired to conceal the true operating characteristics of the Affected Mercedes Vehicles, including their true emissions output and the fact that fuel economy and performance is only achieved by derating emissions controls. These unfair and deceptive practices, false statements, and material omissions violate the Arizona Consumer Fraud Act, and were made in connection with the sale and advertisement of the Affected Mercedes Vehicles.

203. Defendants' unfair and deceptive acts, practices, and material omissions had the tendency and capacity to deceive consumers, including Arizona consumers.

204. Defendants concealed, suppressed, and omitted material facts regarding Defendants' vehicles with an intent to mislead Arizona consumers.

205. Defendants' violations present a continuing risk to owners of Defendants' vehicles, as well as to the general public. Defendants' unlawful acts and practices complained of herein affect the public interest.

206. While engaging in the unlawful acts and practices alleged in this Complaint, Defendants were at all times acting willfully as defined by A.R.S. § 44-1531.

PRAYER FOR RELIEF

WHEREFORE, the State respectfully requests the Court to enter Judgment against Defendants as follows:

A. Order that each Defendant restore to any person in interest any monies or property, real or personal, which may have been acquired by means of any practice declared to be unlawful under the A.R.S., pursuant to A.R.S. § 44-1528(A)(2);

B. Enter an injunction against each Defendant permanently prohibiting it, and all others acting directly or indirectly on its behalf, from continuing and engaging in the unlawful acts and practices as alleged in this Complaint and from doing any acts in furtherance of such unlawful acts and practices, pursuant to A.R.S. § 44-1528(A)(1);

C. Order each Defendant to disgorge any profits, gains, gross receipts, or other benefit obtained after September 13, 2013, by means of any unlawful act or practice in connection with the sale or advertisement of each Affected Mercedes Vehicle as alleged in this Complaint, pursuant to A.R.S. § 44-1528(A)(3);

D. Order each Defendant to pay to the State a civil penalty of not more than $10,000 for each willful violation of the Consumer Fraud Act in connection with the sale or advertisement of the Affected Mercedes Vehicles;

E. Order each Defendant to pay its share of the State costs of investigation and prosecution of this matter, including its reasonable attorneys' fees, pursuant to A.R.S. § 44-1534;

F. Designate as a Tier 3 case under Rule 26.2(b)(3)(C) of the Arizona, subject to the State seeking discovery beyond those limits, as contemplated by Rule 26.2(g); and

G. Award the State such further relief the Court deems just and proper under the circumstances.

RESPECTFULLY SUBMITTED this 8th day of January, 2019.

By: ______________________________

MARK BRNOVICH
ATTORNEY GENERAL
Firm State Bar No. 14000

Brunn (Beau) Roysden (028698)
Assistant Attorney General
OFFICE OF THE ATTORNEY GENERAL
2005 North Central Avenue
Phoenix, Arizona 85004
Beau.Roysden@azag.gov
Telephone: (602) 542-3702
Facsimile: (602) 542-4377

Robert B. Carey (011186)
Leonard W. Aragon (020977)
Rachel E. Fitzpatrick (029125)
HAGENS BERMAN SOBOL SHAPIRO LLP
11 West Jefferson Street, Suite 1000
Phoenix, Arizona 85003
rob@hbsslaw.com
leonard@hbsslaw.com
rachelf@hbsslaw.com
Telephone: (602) 840-5900
Facsimile: (602) 840-3012

Steve W. Berman *(Pro Hac Vice pending)*
Sean R. Matt *(Pro Hac Vice pending)*
Jerrod C. Patterson *(Pro Hac Vice pending)*
HAGENS BERMAN SOBOL SHAPIRO LLP
1301 2nd Avenue, Suite 2000
Seattle, Washington 98101
steve@hbsslaw.com
sean@hbsslaw.com
jerrodp@hbsslaw.com
Telephone: 206) 623-7292
Facsimile: (206) 623-0594

Attorneys for Plaintiff State of Arizona