

# EPA's In-Use Emissions Testing and Volkswagen's "Defeat Devices"

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On September 18, 2015, the Environmental Protection Agency (EPA) issued Volkswagen (VW) a [notice of violation](#) of the Clean Air Act. The California Air Resources Board (CARB) also issued VW an ["in-use compliance letter."](#) According to EPA, VW has admitted to installing software in nearly half a million of its diesel vehicles which acts as a "defeat device." The software senses when the vehicle is tested and activates certain emissions controls that are inoperative during regular use. EPA noted that the vehicles' uncontrolled emissions exceed standards by 10 to 40 times. EPA began enforcement proceedings that may lead to a recall. The European Union (EU) is also examining the use of this software, which was reportedly installed in 11 million vehicles worldwide.

## Vehicle Emissions Standards

EPA establishes and updates emissions standards for pollutants that affect public health or welfare. Vehicles are regulated for greenhouse gases, particulate matter, and [nitrogen oxides \(NOx\)](#), among others. NOx is a key contributor to [ground-level ozone \("smog"\)](#) formation.

In 1999, EPA promulgated [tighter NOx standards](#) for passenger cars and light trucks. At the time, EPA estimated that passenger vehicles contributed roughly [21% of U.S. NOx emissions](#). For model year 2007 and later, EPA reduced allowable NOx by more than 90% from the prior standards.

## Diesel Emissions

All other things being equal, diesel engines produce more NOx than gasoline engines because of differences in combustion. [As noted by researchers at the University of California—Davis,](#)

Diesel emission reduction is hindered by the 'diesel dilemma.' Changes to reduce NOx emissions increase particulate emissions, and vice versa: high temperatures and additional oxygen reduce particulate levels, but increase NOx formation ... [and] adjusting the engine for greater economy results in higher NOx. The challenge for engine manufacturers is to reduce both NOx and particulates, and retain diesel's superior fuel efficiency.

Under earlier standards, diesel vehicles were permitted higher NOx emissions, as is the case in the EU and other

countries. However, in 1999, EPA adopted a "[fuel neutral](#)" approach. At the time, some stakeholders questioned whether diesel cars could meet the new standards, although EPA and some automakers believed that new emissions controls would be effective.

## "Defeat Devices"

[The Clean Air Act](#) prohibits manufacturers from installing or selling parts or components that "bypass, defeat, or render inoperative any [emission control] device." Since the 1970s, EPA has repeatedly found manufacturers using defeat devices in violation of the act.

When they determine that defeat devices have been installed, EPA begins enforcement proceedings. In response, automakers often voluntarily recall the vehicles and/or settle with EPA and the Department of Justice. For example, in 1998 the agencies [settled with Honda and Ford](#)—the automakers paid \$267 million and \$7.8 million, respectively, for fines and pollution mitigation. Other cases where EPA has accused manufacturers of installing defeat devices include automakers VW (1973), Chrysler (1973), General Motors (1995), and Hyundai/Kia (2014); [heavy-duty engine manufacturers](#) Caterpillar, Cummins, Detroit Diesel, Mack, Navistar, Renault and Volvo (1998); and parts manufacturers Casper's Electronics (2013) and Edge Products (2013).

## In-Use Testing

To receive a "certificate of conformity" and sell vehicles in the United States, automakers must certify that their vehicles will meet emissions standards. In addition to initial testing and certification, automakers must test vehicles after production through the [In-Use Verification Program \(IUVP\)](#). According to EPA, if the IUVP revealed problems, "EPA would work with the manufacturer to fix them, either through voluntary manufacturer action or, if necessary, through an ordered emissions recall."

In addition to the manufacturer-controlled IUVP, EPA also conducts limited ["surveillance testing"](#) at its laboratory in Ann Arbor, MI. EPA selects vehicles for such testing from IUVP data, EPA certification data, consumer complaints, and random selection. Each year EPA tests only a few dozen vehicles.

On September 25, 2015, EPA issued [new guidance to manufacturers](#) that they may require additional testing to investigate potential defeat devices.

## The VW Investigation

In the case of the current VW investigation neither the IUVP nor surveillance testing indicated a problem. Instead, EPA and CARB were alerted to problems by researchers at West Virginia University (WVU) under contract with the [International Council on Clean Transportation \(ICCT\)](#). As part of a study of on-road emissions from diesel vehicles, the [WVU researchers found](#) emissions levels for some vehicles far exceeded U.S. certification standards. The WVU study was part of a larger investigation by ICCT motivated by reports that some European diesel vehicles had passed emissions tests but had much higher real-world NOx emissions. (EU emissions standards apply only when the vehicles are produced; surveillance testing, mandatory emissions system warranties, and other features of U.S. rules are not incorporated in EU regulations.)

According to the EPA notice, VW initially indicated that the emissions resulted from a software problem and that a voluntary recall would address the problem. Ultimately, EPA found that software installed in the vehicles' computers sensed when the vehicles were tested, and activated a lower-emission mode. Thus, non-standard testing was necessary to reveal VW's actions. Such software could circumvent the "diesel dilemma" discussed above, and allow higher on-road performance and/or fuel economy than was otherwise attainable with fully active emissions systems. WVU's testing indicated a BMW diesel vehicle was able to meet emissions targets. Thus, VW's decision does not appear to be one of technical feasibility. It should also be noted that while ICCT has found other diesel vehicles that exceed European or U.S. NOx standards in real-world use, only VW so far has been accused of using defeat devices.

## Conclusion

VW's use of defeat devices, and similar past actions by other manufacturers, highlights the difficulty EPA and other regulators face in enforcing standards for vehicles with increasingly complex computer-controlled systems. Congress may consider whether current procedures to detect defeat devices are sufficient, or whether a system that largely depends on industry self-reporting may require additional controls. However, it should be noted that the EU system, which relies more on front-end government testing, did not uncover VW's actions—it took an independent investigation to alert regulators to the problem.