

# POLICY SOLUTIONS TO REDUCE VEHICLE EXHAUST EMISSIONS UNDER REAL-WORLD DRIVING CONDITIONS

On September 18, 2015, the United States Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) announced that Volkswagen Group (VW) had manufactured and installed defeat devices on 482,000 diesel vehicles sold between 2009 and 2015 in the U.S. market. Subsequently, VW announced that such a defeat device is present in some eleven million diesel vehicles with Type EA 189 engines globally.

Several governments around the world have now launched investigations related to defeat devices, and policymakers are looking for ways to address the challenge of controlling real-world emissions brought to forefront by the VW case. In this position brief, we propose a rapid and comprehensive policy response not only to deal with defeat devices but also to identify vehicle models with high real-world emissions relative to their test-cycle performance and to improve current compliance and enforcement programs. The ultimate goal of these suggested changes is to ensure that the policy objectives of reducing air pollutant and greenhouse gas emissions from vehicles are met not only in the laboratory during certification/type-approval testing but throughout the full useful life of vehicles across a wide range of operating conditions.

## Defeat Device Detection

On September 25, 2015, EPA and CARB announced their intention to expand their confirmatory test and in-use compliance program provisions to detect defeat devices.<sup>1</sup> These defeat device screening tests may make use of on-board diagnostics (OBD)

<sup>1</sup> [http://www.arb.ca.gov/newsrel/arb\\_iuc\\_2015\\_09\\_25\\_final\\_signed\\_letter.pdf](http://www.arb.ca.gov/newsrel/arb_iuc_2015_09_25_final_signed_letter.pdf) and <http://www3.epa.gov/otaq/cert/documents/cd-mfr-guid-ltr-2015-09-25.pdf>

information, portable emission measurement system (PEMS) tests, and special driving cycles and operating conditions. In North America, the EPA and Environment Canada have stated their intention to work closely together on such defeat device screening.

Regulatory certification and in-use compliance programs in much of the world currently lack defeat device screening mechanisms. The screening program against defeat devices announced by EPA and CARB can serve as one useful template for other regulatory agencies around the world. Other approaches could incorporate repeated (back-to-back) PEMS testing on a proving ground or on road, following various duty cycles involving low and high speeds, hard accelerations and decelerations, varying ambient temperatures and cold/hot start conditions. Countries with a significant diesel vehicle population, such as EU Member States, should start screening programs immediately. In the specific case of Europe, the European Commission (EC) could coordinate the testing programs to avoid duplication of effort and maximize the number of models screened each year.

## Beyond Defeat Devices: Reducing Real World Emissions

The defeat device deployed by VW has attracted a great deal of attention to the broader issue of real-world emissions. Unfortunately, as previous research has amply demonstrated, higher than expected emissions of NO<sub>x</sub> and CO<sub>2</sub> under everyday driving conditions are a common occurrence around the world. It should be noted that high in-use CO<sub>2</sub> emissions are not a diesel-specific issue. Outside of the VW case, there is no evidence at present of intentional attempts by vehicle manufacturers to calibrate the engine or aftertreatment differently for testing and on-road conditions. Instead, it appears that vehi-

cle manufacturers are simply able to comply with the letter of the law, if not its spirit, by exploiting flexibilities and limitations in the current testing procedures to achieve compliance on the test cycle only.

There are policy options to address the gap between real world and test emissions in the short term. Those regions that use the New European Driving Cycle (NEDC) can reduce high in-use  $\text{NO}_x$  and  $\text{CO}_2$  emissions by accelerating the adoption of the more realistic World Harmonized Light Vehicles Test Procedure (WLTP) and leapfrogging to Euro 6c emission standards. The WLTP represents a significant upgrade from the testing cycle and procedure used in the EU and much of the rest of the world. The accelerated adoption of the WLTP is a necessary, but not sufficient, step toward closing the gap between laboratory and road.

The European Commission is already deliberating on real driving emissions (RDE) requirements for light-duty diesel vehicles based on PEMS testing. Significant  $\text{NO}_x$  emission reductions could be achieved in Europe by holding vehicle manufacturers to a conformity factor (i.e. the ratio of real world emissions to test cycle emissions) as close to one as technically possible under RDE testing. Vehicles with in-use PEMS emissions that do not exceed the emissions standards could be granted a “certified clean” label, to foster the adoption of clean technologies and allow local authorities to build their own incentive programs.

In addition to incorporating RDE testing for type-approval, strengthening of in-use compliance programs, which include PEMS testing of randomly selected, independently sourced vehicles, is also

needed. Such programs should go beyond a narrow focus on detecting defeat devices to also ensure that vehicle emissions remain low under a broad range of real-world driving conditions and that emission control systems are durable. It should be noted that heavy-duty vehicles (trucks and buses) subject to the US 2010 and Euro VI emissions standards are already required to undergo in-use compliance testing with PEMS. Adoption of robust test protocols and in-use PEMS testing to detect high-emitting passenger vehicle models can complement existing compliance and enforcement efforts. By adding such provisions, vehicle manufacturers would be encouraged to deploy clean technologies that perform both in the laboratory and on the road, ultimately leading to improved air quality and lower climate impacts from transportation.

## Conclusion

The VW defeat device scandal is a reminder of the importance of strong in-use compliance and enforcement programs. Even though the defeat device in this case went unnoticed for several years in the United States, the regulatory agencies acted swiftly and decisively once the problem was brought to their attention. This was only possible because their compliance divisions have both strong technical teams and adequate legal authority and resources to enforce vehicle emission regulations. Governments that wish to reduce real-world vehicle emissions must allocate sufficient resources and authority to compliance and enforcement programs to improve the effectiveness of traditional efforts through adoption of more robust test cycles, effective in-use testing, and appropriate enforcement actions, including financial penalties and recall programs. The value of strong compliance programs in creating a level playing field for industry and earning consumer trust cannot be overstated.



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