

Workgroup Discussion Paper:
Heavy-Duty Vehicle Inspection and Maintenance

Note: This version of the Discussion Paper differs from the July 16, 2019, version primarily in organization and level of detail. Additional detail has been added mostly in the *Periodic Testing* and *Potential Use of an Implementation Contractor* portions of the VEHICLE TESTING section.

BACKGROUND

In California, heavy-duty diesel vehicles with a gross vehicle weight rating (GVWR) over 14,000 pounds represent one of the largest sources of mobile air pollution in California. Even with modern emissions controls and on-board diagnostics (OBD) monitoring systems, 2019 estimates indicate that these vehicles contribute approximately 58 percent of the statewide on-road mobile source oxides of nitrogen (NOx) emissions and about 82 percent of the statewide on-road mobile source particulate matter (PM 2.5) emissions(1). Some of these emissions are attributed to broken or failing emissions-related equipment. Currently, there is no smog check-type program to ensure non-gasoline(2) heavy-duty vehicles' emissions control systems are functioning properly and repaired in a timely manner. However, Governor Newsom recently signed Senate Bill 210(3), which directs CARB to develop and implement a heavy-duty vehicle inspection and maintenance (HD I/M) program, in consultation with the Department of Motor Vehicles and the Bureau of Automotive Repair.

CARB's existing heavy-duty inspection programs rely on random field inspections by CARB staff and annual self-inspections by truck owners to test for smoke opacity levels. However, these programs do not ensure that vehicle owners are regularly inspecting and repairing their vehicles' broken emissions controls. A well-designed HD I/M program that creates minimal operational disruption for owners could help ensure that vehicles' emissions control systems are operating as designed to meet California's public health protection goals, while at the same time, minimizing operational downtime for the end user. As an ancillary benefit, keeping vehicles tuned up and properly maintained may result in better fuel economy.

Through this HD I/M Workgroup, CARB staff is seeking input on a comprehensive strategy for implementing a cost effective and feasible HD I/M program within the

(1) CARB's on-road motor vehicle emissions inventory model, EMFAC2017, for calendar year 2019. [EMFAC 2107](#).

(2) BAR's Smog Check Program includes gasoline heavy-duty vehicles with gross vehicle weight ratings over 14,000 pounds.

(3) The full text of SB 210 is available from the California Legislative Information web site at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200SB210

framework of Senate Bill 2010. Such a program could be designed to incentivize vehicle owner and driver behavior to ensure that heavy-duty vehicles are well

maintained and properly repaired. A well-designed program would include mechanisms to measure program performance and effectiveness, and possibly offer compliance assistance. The Workgroup will discuss concepts for a program that ensures heavy-duty vehicles are inspected and maintained.

PROGRAM DESIGN CONSIDERATIONS

VEHICLE APPLICABILITY

- All on-road heavy-duty vehicles (non-gasoline) with a GVWR over 14,000 pounds operating in California could be subject to the HD I/M program.
 - Includes all in-state, out-of-state, and out-of-country vehicles that operate in California.
 - About 25 percent of heavy-duty vehicle miles traveled in California are from vehicles (over 14,000 pounds GVWR) that are registered out-of-state.

VEHICLE TESTING

- *Vehicle Testing:* There are a variety of ways to check heavy-duty vehicles to ensure their emission systems are properly maintained and repaired in a timely manner. One potential HD I/M program design concept couples periodic emissions systems checks as the primary test method with on-road emissions monitoring using remote sensing devices (RSD) and plume capture systems (CARB's Portable Emissions Acquisition System [PEAQS]) to identify high emitters and verify program effectiveness. Together, these complementary test methods have the potential to ensure that emissions control systems are properly functioning, even between periodic checks. RSD and PEAQS could flag potential high emitters for additional follow-up testing, as necessary. Figure 1 below illustrates how these two testing mechanisms could work together in a future HD I/M program for OBD-equipped vehicles, while Figure 2 illustrates how these two testing mechanisms could complement each other for non-OBD vehicles.

Figure 1: OBD-Equipped Vehicles

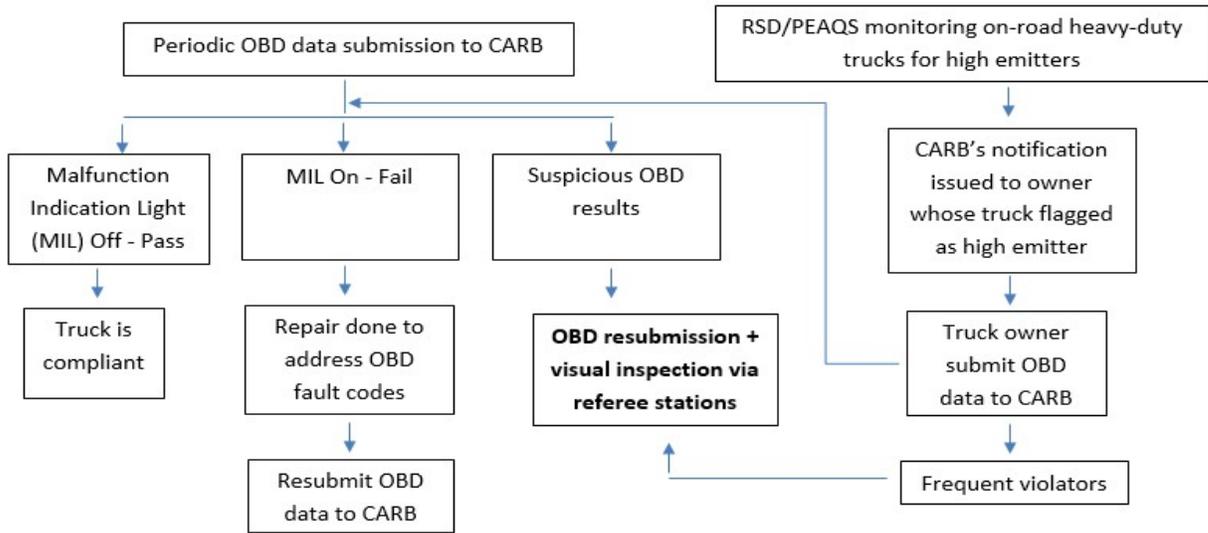
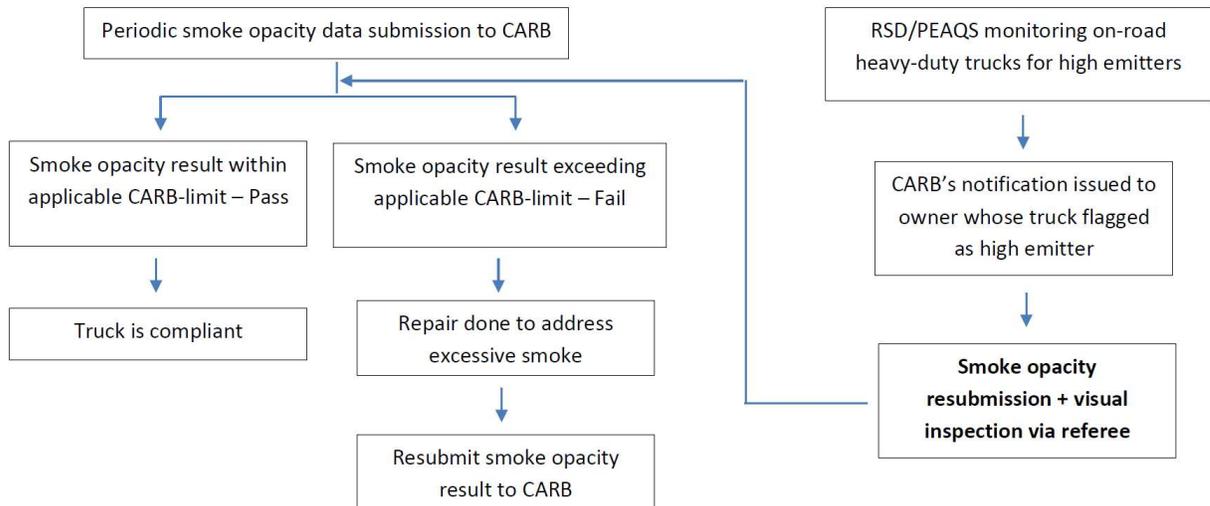


Figure 2: Non OBD-Equipped Vehicles



- Periodic Testing:** A HD I/M program does not have to follow the station-based model of the light-duty Smog Check program. Instead, the program concept could be based on the use of telematics and other data collection and submission tools to enable the inspection process to mainly be completed without affecting the vehicle’s daily operation. Additionally, the program should be designed to ensure both in-state and out-of-state vehicles have adequate methods to demonstrate compliance with program requirements and that these requirements are as unobtrusive as possible.

- For OBD-equipped(4) heavy-duty diesel vehicles, emissions data could be periodically submitted to the HD I/M database in a variety of ways.
 - Continuous OBD Telematics Submission: Many fleets already contract with OEM and third party telematics providers to monitor fleet logistics and vehicle maintenance needs. Such systems are already monitoring the vehicle's electronic control module (ECM) and could automatically submit OBD data to the HD I/M database on specified intervals. Periodic testing requirements could then be met without ever affecting a vehicle's normal operating schedule and without the need for fleets to purchase additional equipment.
 - Continuous OBD Submission through Electronic Logging Devices (ELD): Many fleets operating in California are also subject to federal ELD requirements. As with telematics, ELD's are also already monitoring a vehicle's ECM. Such systems could also automatically submit OBD data to the HD I/M database and offer fleets another way to comply with the periodic testing requirements without a need to affect normal operating practices or purchase additional equipment.
 - Kiosks: Testing kiosks could be placed at locations with high trucking throughput to allow vehicles without telematics or ELD capabilities a non-invasive option to submit OBD data. Such kiosks could be installed at major commercial vehicle CHP enforcement facilities throughout the State to allow vehicles to meet the periodic testing requirements without having to travel significant distances outside of their normal operating routes.
 - HD I/M Dongles: Dongles specifically designed to meet the data submission requirements of the HD I/M Program could be offered for sale, potentially by a HD I/M implementation contractor, to fleets that do not have a need to work with a telematics or ELD provider. Such a dongle would be able to automatically submit periodic testing data once plugged into a vehicle's OBD port and would not require the vehicle to travel to a specific location, such as a kiosk, to submit OBD data at specified time intervals.
 - Third party mobile inspectors: A contractor could be hired by fleets to perform OBD tests using a HD I/M compliant testing device to meet the periodic testing requirements. Such testers could come to a fleet yard to perform the testing on scheduled intervals so fleets do not have to schedule vehicles to be taken to a specific location for testing to be performed.
- Certification of Continuous OBD Data Collection/Submission Methods (e.g., telematics, ELDs): CARB could establish a procedure that

(4) 2013 and newer model year heavy-duty diesel engines and 2018 and newer model year alternative-fuel engines.

continuous OBD submission devices must go through to gain approval for use in the HD I/M program.

- OBD data collection requirements are likely to include OBD data required to be accessible under CARB's HD OBD regulation in sections 1971.1 and 1971.5, Title 13, California Code of Regulations(5).
- CARB could provide OBD data formatting and submission protocols that every approved device would need to meet in order to participate in the HD I/M program.
- Beta-testing requirements could be established that ensure a device's functionality for the HD I/M program before the device is approved for use.
- For non OBD-equipped heavy-duty diesel vehicles, periodic testing requirements could be met through periodic submission of vehicle opacity tests.
 - Such opacity tests could be done by a contractor using a Society of Automotive Engineers (SAE) J1667 certified testing device.
 - Testing results could be required to be electronically submitted to the HD I/M database at specified frequency intervals.
 - Alternatively, a newly developed vehicle emissions inspection mechanism could be developed for non-OBD vehicles engines for use as a periodic test in the HD I/M program.
- Repair: Vehicles failing the periodic emissions test would be required to repair the broken emissions-related components within a specified time interval and perform a retest to ensure the problem has been resolved.
 - The program should encourage durable and timely repairs to reduce harmful emissions, while at the same time, helping vehicles remain in revenue service with minimal downtime.
- *RSD/PEAQS Emissions Monitoring*: RSD and/or PEAQS technologies could be used to screen for potential high emitters between periodic inspection cycles. Such systems could be deployed along high-volume trucking corridors, near commercial vehicle enforcement facilities, locations frequented by out-of-state vehicles, and in disadvantaged communities unduly burdened by harmful vehicle emissions.
 - Vehicles flagged as potential high-emitters could be directed to conduct follow up emissions testing to ensure the vehicle's emissions control components are not malfunctioning.
 - OBD-equipped vehicles could be required to submit a passing OBD test using an approved periodic OBD submission device within a specified number of days to clear the flagging.
 - Non OBD-equipped vehicles could be required to successfully complete an opacity test performed by a contractor to clear the flagging.

(5) Heavy-Duty OBD Regulatory Documents.
<https://ww3.arb.ca.gov/msprog/obdprog/hdobdreg.htm>.

- Vehicles flagged frequently as high-emitters could be directed for a referee check where a visual inspection for tampering and an OBD test for OBD-equipped vehicles could be performed to ensure the vehicle is operating as designed.
- *Potential Use of an Implementation Contractor:* The State could hire a contractor to implement a majority of vehicle testing-related tasks. Such tasks could include, but may not be limited to, overseeing periodic testing efforts, running a referee-testing network, installing and maintaining any program related infrastructure as well as developing and maintaining a HD I/M database where testing data could be stored.
 - The hiring of an implementation contractor could enable the State to shift more resources to efforts related to reducing potential fraudulent activity and ensuring the HD I/M program is properly enforced. Such efforts would likely result in improved overall compliance for the HD I/M program.

ENFORCABILITY AND ENSURING COMPLIANCE

- *Improved Enforcement Tools:* The program should be designed in a way that is enforceable and encourages compliance. To ensure a level playing field, the program must include enforcement strategies for all vehicles operating in California, both in-state and out-of-state vehicles.
 - A Certificate of Compliance could be required for any vehicle to operate legally in California.
 - Certificate of Compliance renewals could be denied if the vehicle is not meeting program requirements.
 - Such criteria could include successful completion of periodic testing requirements, no unresolved high emitter flags, and no outstanding HD I/M related citations.
 - Tie to DMV registration: Similar to the light-duty smog check program, vehicle registration for California-registered vehicles could be tied to compliance with the HD I/M program.
 - Automated license plate recognition (ALPR) cameras could be used to identify non-compliant vehicles operating in California.
 - Cameras set up at border crossings could help monitor out-of-state vehicle traffic.
 - Cameras could be installed to capture both license plate and U.S. Department of Transportation registration numbers so both the specific vehicle and associated fleet could be readily identified.
 - Vehicles found operating in California without a valid Certificate of Compliance could be considered non-compliant and cited for the violation.
 - Both CARB enforcement staff and CHP could have the ability to check for a valid Certificate of Compliance during any vehicle inspection operation and cite non-compliant vehicles, increasing the

volume of vehicle inspections that could be performed compared to current practices.

- A certification fee could be charged to HD I/M participants in order to receive a vehicle's Certificate of Compliance.
 - Such fees could be used to support the hiring of an implementation contractor, statewide investments in HD I/M program infrastructure such as a RSD/PEAQS and ALPR network, and State resources needed to ensure robust enforcement of the program.

COMPLIANCE ASSISTANCE

- A compliance assistance program could help encourage program participation, especially among smaller fleets. Such a program might:
 - Encourage or incentivize participation in a telematics-based preventive maintenance program that helps minimize downtime and provide information to comply with OBD reporting requirements.
- Establish a HD I/M repair assistance program for low-income vehicle owners who need financial assistance getting their vehicles inspected and repaired.

PROGRAM VALIDATION AND AUXILIARY MONITORING BENEFITS

- The program should include mechanisms for tracking program performance. Continually assessing program performance could help highlight future improvements that may be needed to improve program effectiveness.
 - OBD data could be a powerful validation tool.
 - Long-term OBD tracking could show how effective the HD I/M program is at decreasing emissions control issues over time.
 - OBD data could be used detect patterns of failure. This could lead to improved repair strategies and reduced downtime.
 - OBD data could assess the frequency of emissions-related fault codes and be used to understand specific emissions control components that are experiencing durability and malfunctioning issues.
 - OBD tracking could highlight durability issues of specific emissions control components. Such issues could flag manufacturer issues resulting in potential recalls and/or improvements in the durability of emissions-related components.
 - RSD and PEAQS could play an important role in verifying program effectiveness by monitoring emissions while vehicles are in operation and during the intervals between periodic data submissions.
 - Tracking the percentage of high-emitting vehicles over time could help establish the effectiveness of the HD I/M program.
 - Assessing where high emitters are most prevalent could help better target enforcement efforts.

- ALPR cameras could help assess program effectiveness through the tracking of compliant and non-compliant vehicles traveling through the camera network.
 - As with RSD/PEAQS, using ALPR cameras to assess where non-compliance is most prevalent could help better target enforcement efforts.

PREVENTIVE MAINTENANCE

- Making training available to vehicle owners and operators on the value and importance of preventive maintenance could encourage owners to keep vehicles repaired. Preventive maintenance could reduce unexpected downtime and other repair costs.

SUMMARY

A program is needed to ensure heavy-duty vehicles are properly maintained in order to minimize air pollutant emissions during operation. A well-designed HD I/M program that creates minimal operational disruption for owners could help ensure that vehicles' emissions control systems are operating as designed to meet California's public health protection goals. CARB staff is seeking input on a comprehensive strategy for implementing a cost effective and feasible HD I/M program. A well-designed program would have effective enforcement tools to ensure compliance and include mechanisms to measure program performance to assess future needs of the program.