Bob Holycross
Manager, Regulatory Strategy & Planning
Sustainability, Environment & Safety Engineering

January 25, 2012

Clerk of the Board
Air Resources Board
1001 I Street
Sacramento, CA 95814

Subject: Ford Motor Company Comments on California's Proposed "LEV III" Amendments

Ford Motor Company (Ford) appreciates the opportunity to provide comments in response to California's proposed "LEV III" amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures, the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles. Ford supports the comments submitted by the Alliance of Automobile Manufacturers ("Alliance"). The comments provided herein supplement those of the Alliance.

Ford is a leader in innovation and we are committed to providing safer, cleaner, and more fuel-efficient automobiles that produce less greenhouse gas ("GHG") and criteria emissions. We are a full line manufacturer and are focused on implementing the most cost-effective fuel-efficiency technologies across a large volume of our vehicles, as well as on introducing new products that offer improved fuel efficiency without compromising style, utility, or performance.

The Advanced Clean Car regulations target aggressive reductions in GHG and criteria emissions to address climate change and ambient air quality challenges in California. During the 2015 to 2025 MY timeframe, these regulations require manufacturers to reduce GHG emissions by an average of 4.5 percent each year to achieve an average fuel economy of 54.5 miles per gallon, reduce criteria emissions by 75% or more, extend durability to 150,000 miles and ensure all vehicles meet zero evaporative emission standards. This suite of regulations will be resource intensive and will drive the innovation of a multitude of hardware solutions.

Ford commends staff for their efforts over the past few years to engage with industry throughout the development of these regulations. While the proposed GHG and criteria emissions reductions remain extremely aggressive, Ford believes that the lead time and compliance flexibilities provided in the proposal (e.g., combined NMOG+NOx standards, pooled S177-state compliance volumes, additional ULEV and SULEV standards, etc.) should allow for a technically feasible and cost-effective deployment of advanced technology vehicles. As explained in the attached comments, we request that staff continue to work with EPA to harmonize with the federal GHG and future "Tier 3" programs, to the greatest extent possible. Additionally, we are concerned with the 2022-2025 MY GHG standards and the 1 mg/mi PM

standard and request a midterm review to re-evaluate the assumptions supporting these standards. We request resolutions by the Board to direct staff to perform these actions.

We will be pleased to discuss this information with you or members of your staff. Should you wish to do so, please contact me at 313-845-8247 or Sara Rudy at 313-323-6587.

Sincerely,

/s/

Enclosure (1)

Attachment A

Notice of Public Hearing on Proposed "LEV III" Amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures, the On-Board Diagnostic System Requirements For Passenger Cars, Light-Duty Trucks, And Medium-Duty Vehicles, and to the Evaporative Emission Requirements For Heavy-Duty Vehicles

Supplemental Comments of Ford Motor Company

Introduction

Ford Motor Company (Ford) appreciates the opportunity to provide comments in response to California's proposed "LEV III" amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures, the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles. Ford supports the comments submitted by the Alliance of Automobile Manufacturers ("Alliance"). The comments provided herein supplement those of the Alliance.

Ford is a leader in innovation and we are committed to providing safer, cleaner, and more fuel-efficient automobiles that produce less greenhouse gas ("GHG") and criteria emissions. We are a full line manufacturer and are focused on implementing the most cost-effective fuel-efficiency technologies across a large volume of our vehicles, as well as on introducing new products that offer improved fuel efficiency without compromising style, utility, or performance.

The Advanced Clean Car regulations target aggressive reductions in GHG and criteria emissions to address climate change and ambient air quality challenges in California. During the 2015 to 2025 MY timeframe, these regulations require manufacturers to reduce GHG emissions by an average of 4.5 percent each year to achieve an average fuel economy of 54.5 miles per gallon, reduce criteria emissions by 75% or more, extend durability to 150,000 miles and ensure all vehicles meet zero evaporative emission standards. This suite of regulations will be resource intensive and will drive the innovation of a multitude of hardware solutions.

Ford commends staff for their efforts over the past few years to engage with industry throughout the development of these regulations. Our views on this proposal are summarized below and discussed in more detail in the body of our comments:

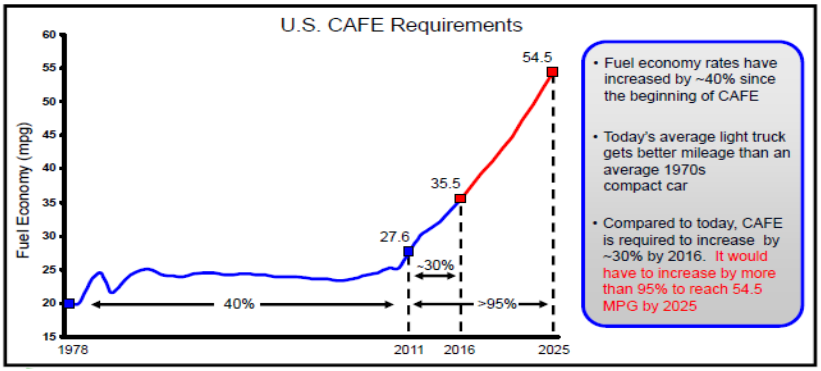
- Ford supports the harmonization of California and federal Greenhouse Gas programs. We request that staff include language to allow manufacturers to comply with the 2017-2025 MY One National Program for Greenhouse Gas / Fuel Economy (GHG/FE) in lieu of compliance with the California Greenhouse Gas program.
- Ford requests a resolution by the Board to direct staff to continue to work with manufacturers and the EPA to harmonize the California "LEV III" program with the anticipated federal "Tier 3"criteria emissions program, to the greatest extent possible, including standards, test procedures, certification requirements, and based on national compliance volumes.
- The lead time provided to phase-in the 3 mg/mi PM standard is a critical enabler of technically feasible and cost effective deployment of advanced technology vehicles. Ford requests that the Board maintain the phase-in percentages and timing proposed by staff.

- Ford requests that CARB conduct a midterm review completed no later than April 1, 2018 to re-evaluate the assumptions supporting the 2022-2025 MY GHG standards and the 1 mg/mi PM requirements.

Specific Comments

Harmonization

The 2012-2016 MY GHG/FE One National Program requires an approximately 30% increase in fuel efficiency relative to 2011 MY levels. In the 2017-2025 MY timeframe, staff has proposed additional fuel efficiency increases of 4.5 percent each year to achieve an average fuel economy of 54.5 miles per gallon, an over 95% increase from 2011 MY levels.



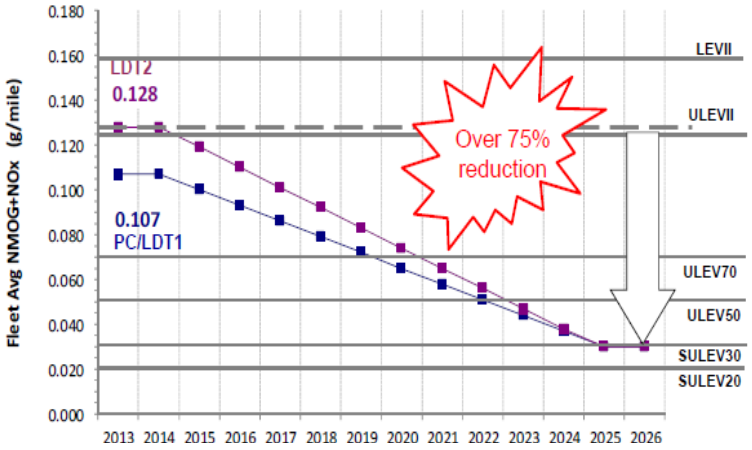
To meet the 2012-2016 MY GHG/FE standards and our climate change commitments, Ford is focused on implementing the most cost-effective fuel-efficiency technologies across a large volume of our vehicles, as well as on introducing new products that offer improved fuel efficiency without compromising style or performance. We are concentrating on affordable and near-term sustainable technology solutions that can be used not for hundreds or thousands of cars – but for millions of cars, because that is how Ford can truly make a difference.

We are introducing a wide variety of new engine and transmission technologies, as well as electrical system improvements, weight reductions and aerodynamic improvements that will deliver significant fuel-economy benefits for millions of drivers in the near term. Between the 2008 and 2013 calendar years, we expect to introduce 60 new or significantly upgraded engines, transmissions and transaxles globally to help us improve fuel economy and reduce carbon dioxide (CO2) emissions across our global fleet.

Developing and implementing a plan to comply with the additional efficiency increases proposed for the 2017-2025 MY timeframe will require considerable resources. We are committed to addressing this challenge but request that staff make every effort to eliminate unnecessary complexities by allowing manufacturers to comply with the 2017-2025 MY One National Program in lieu of compliance with the California GHG program. A One National Program approach minimizes the unnecessary complexities associated with the management of state-by-state variations in sales mix, which at these levels should result in negligible differences in climate change impact. It also avoids potential conflicts in state-by-state compliance status that could results from multiple programs designed to control emissions of the same constituent.

Recommendation: Ford requests that staff include language to allow manufacturers to comply with the 2017-2025 MY One National Program in lieu of compliance with the California GHG program.

To address ambient air quality challenges in California, staff has proposed aggressive reductions in criteria emissions for 2015-2025 MY vehicles. Reductions include an over 75% reduction in fleet averaged emissions of smog-forming constituents, 90% reduction in particulate matter emissions, and a requirement that all light- and medium-duty vehicles meet zero-evaporative emission standards.



At these near-zero emission levels, state-by-state variations in sales mix should result in negligible differences in emissions inventory impact. To reduce complexity and allow for 50-state solutions, Ford believes staff should continue to work with manufacturers and EPA to develop a harmonized criteria emissions program.

Recommendation: Ford requests a resolution by the Board to direct staff to continue to work with manufacturers and the EPA to harmonize the California "LEV III" program with the anticipated federal "Tier 3"criteria emissions program, to the greatest extent possible, including standards, test procedures, certification requirements, and based on national compliance volumes.

Particulate Matter

To address concerns of PM emissions increases due to growing penetration of gasoline direct injection ("GDI") vehicles, staff has proposed a 3 mg/mi light-duty PM standard with a phase-in beginning in the 2017 MY. While the proposed standard is aggressive (representing a 70% reduction from the LEV II PM standard), Ford believes that it should be technically feasible to develop GDI vehicles that robustly meet this standard with the lead time and phase-in percentages proposed.

Sufficient lead time to meet the 3 mg/mi *LEV III* standard is critical for two reasons: 1) GDI engine development and 2) PM measurement method and facility upgrades. The gasoline direct injection engine technology developed by Ford to improve fuel economy meets current *LEV II* PM emissions standards,

but at levels above those of current port fuel injection technology. The direct injection of fuel into the engine cylinder introduces a number of additional degrees of freedom relative to PFI technology, such as injection timing, injector mounting, spray angle, injection pressure, and number of fuel pulses. Engineering knowledge is progressing daily on how to minimize PM formation while maintaining engine torque, driveability and other necessary engine attributes. Whereas adding a particulate filter would provide a relatively quick solution to PM emissions, it would do so at a price of decreased fuel economy and increased cost. Lead time, such as that proposed by *staff*, is needed to devise engine solutions to reduced PM that preserve the improved fuel economy provided by GDI technology.

Equally important, sufficient lead time is required to verify the best path forward to enable gravimetric PM measurement at 3 mg/mi and to upgrade emissions measurement facilities to achieve this capability. It has been known for about the past 8 years that low level PM emissions measurements are subject to artifacts and higher variability not seen in gaseous emissions measurements. Measurements performed by CRC to study the EPA 2007 method, peer reviewed papers, and recent work by industry / EPA / ARB all demonstrate that Teflo filter measurement of PM is subject to an approximately 0.5 to 1 mg/mi artifact for the FTP emissions cycle. This represents 5 – 10% of the *LEV II* PM standard, as well as 5 – 10% of the HD 10 mg/hp-hr standard. As such it was a concern, but not a major issue in development of the 2007 standards and the Part 1065 measurement method. However, the same artifact / variability exists today and represents a 16 – 33% uncertainty at the proposed 3 mg/mi standard. Ford measured about 34 thousand filters in 2011 and expects this level to increase. Fulfilling its regulatory obligations therefore requires extensive additions to its weighing capability. But increasing capacity with current PM methods (Part 1066) will mean undertaking considerable expense to install underachieving methodology. A longer lead time will instead allow research into improvements of the gravimetric method and subsequently provide the auto manufacturers an optimum solution to the challenge of measuring 3 mg/mi of PM. In addition, it is requested that the regulations incorporate a compliance margin tied to the state of the art in PM measurement accuracy. At present this would represent a 16 – 33% margin. As the gravimetric method is refined to meet the 3 mg/mi standard and measurement uncertainty decreases, this margin can decrease accordingly. Presently there is discussion of allowing measurement of the artifact and its subtraction from filter weights. This would potentially eliminate the artifact, but not decrease measurement variability. The effectiveness of this artifact correction is presently unknown and is another element of gravimetric PM measurement that needs study.

At the proposed 1 mg/mi standard for 2025 the artifact/variability discussed above climbs to 50 – 100% error. This makes the gravimetric method untenable at this level, a conclusion reached as well by the European Union. It is expected that refinements to the gravimetric method may reduce the artifact / variability by perhaps a factor of 2 or 3. While this would make the gravimetric approach viable at 3 mg/mi, the uncertainty would remain unacceptably high at 1 mg/mi. As mentioned below this is an important reason to hold a midterm review to assess the state of the art in PM measurement and explore alternative methodologies.

Introduction of a PM standard for the Supplemental FTP US06 cycle poses a different challenge. At 10 mg/mi, this standard is less susceptible to the gaseous adsorption artifact discussed above but the high exhaust temperatures characteristic of US06 operation can lead to "storage / release" artifacts where PM and / or gaseous precursors condense onto the walls of the transfer hose connecting the vehicle tailpipe to the dilution tunnel and are released by exhaust heat in subsequent tests. While this artifact has been reported in the published literature it is highly dependent on the exhaust handling methods employed in individual emissions test cells. Adequate lead time is necessary for the auto manufacturers to understand the extent of this issue and to address it via suitable test cell modifications.

Recommendation: The lead time provided to phase-in the 3 mg/mi PM standard is critical to enable technically feasible and cost effective deployment of advanced technology vehicles. Ford requests that the Board maintain the phase-in percentages and timing proposed by staff.

Midterm review

Ford is concerned with the aggressive GHG standards proposed in the 2022-2025 MY timeframe, and the 1 mg/mi PM standard in the staff proposal. While standards extending that far in to the future provide manufacturers with certainty regarding compliance targets, they also increase the uncertainty associated with the underlying assumptions supporting these standards – e.g., marketplace conditions, cost and availability of improved vehicle and measurement technology, etc. The technical feasibility and cost effectiveness of these requirements can only be assessed based on today's assumptions, which may prove to be incorrect. As you know, under the One National Program framework, EPA has proposed to undertake a mid-term evaluation of the MY 2022-2025 GHG standards, and ARB has committed to participate in that process. Consistent with that commitment, we believe ARB should also conduct a midterm review of its own GHG standards to re-evaluate the assumptions underlying those standards. Likewise, a mid-term evaluation of the proposed 1 mg/mi PM standard for MY 2025 is also appropriate because of the considerable uncertainty regarding the technical feasibility of this proposal.

Recommendation: Ford requests that CARB conduct a midterm review completed no later than April 1, 2018 to re-evaluate the assumptions supporting the 2022-2025 MY GHG standards and 1 mg/mi PM standards and test procedures.

Conclusion

Ford appreciates the opportunity to comment on the agency's proposed LEV III amendments for 2015 - 2025 MY vehicles. We recognize the air quality and climate change challenges faced by the state and commend staff on an aggressive proposal that provides sufficient lead time and flexibilities to facilitate a technically feasible and cost-effective deployment of advanced technology vehicles. We encourage the agency to carefully consider our comments as it finalizes this rulemaking. Ford is willing to work with CARB staff and provide support as required to finalize this rule by the end of the year.