

# CARB ON ROAD MOTORCYCLE (ONMC) WORKSHOP



## Updates to the November 2020 CARB Staff's ONMC Proposal

January 12, 2022

# PRESENTATION OUTLINE

- Review CARB Staff's ONMC Regulatory Proposal Presented at the Nov. 2020 Workshop
- Discuss Key Changes to the Staff's Proposal Based on Stakeholder Feedback
- Evaporative Emissions Proposal Based on CARB's Testing and Other Research Efforts
- Proposed Effective Dates and Rulemaking Timeline

# NOV. 2020 WORKSHOP - NEED FOR ONMC REGULATION UPDATE

- CARB has reduced harmful emissions from a wide variety of sources, but further reductions are needed to meet California's air quality goals.
- As emissions from other sources decrease, ONMCs become a relatively larger contributor to overall emissions
- CARB ONMC emission standards have not been updated since 1998
  - Effective starting with MY2006
- Technological advances make lower standards feasible and cost effective for ONMCs

California's 35 Local Air Districts Are Not All Meeting Federal Ozone Standards



# NOV 2020 WORKSHOP – MORE STRINGENT GLOBAL ONMC STANDARDS

- New “Euro 5” standards and procedures for ONMC
  - Effective in the European Union starting in 2020
  - Basis for United Nations Global Technical Regulation (GTR)
  - Far more stringent than CARB ONMC regulations

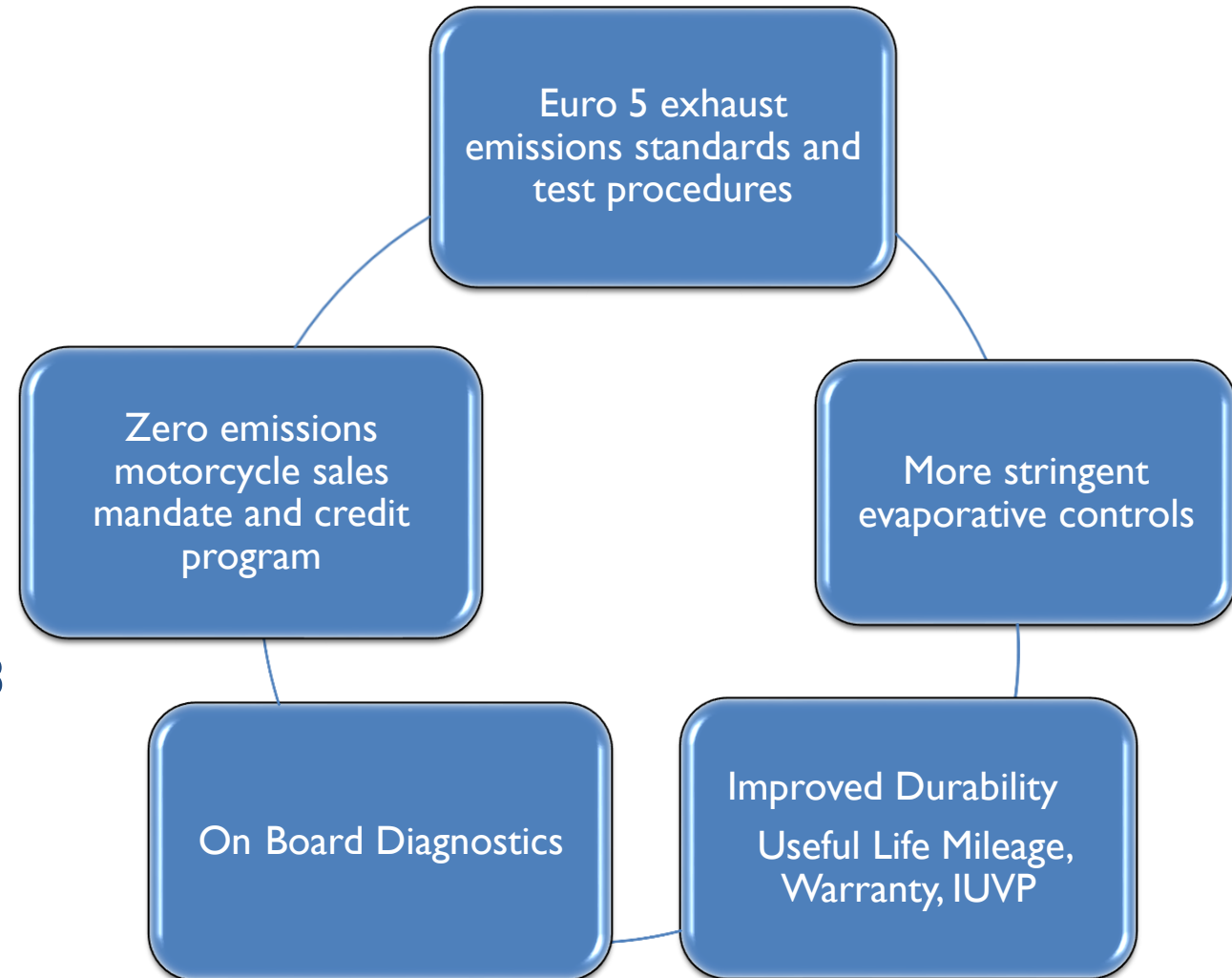
Parameter	Euro 5	Current CARB
HC	0.100 g/km	0.8 g/km HC + NO <sub>x</sub>
NO <sub>x</sub>	0.060 g/km	
CO	1 g/km	12 g/km
NMHC	0.068 g/km	NA
Drive Cycle	WMTC	FTP
OBD	Required	Not Required
Evaporative Emissions	1.5 g/test	2 g/test (1.8 g/test if no CARB fill pipe)

# NOV 2020 WORKSHOP – STAFF PROPOSAL (1 OF 2)

- Bring lower emissions motorcycles to the California market as quickly as possible
- Minimize costs by aligning standards with other jurisdictions where possible
- Require additional cost-effective reductions in subsequent years
  - Focus on evaporative emissions, which make up the majority of ONMC ROG
- Ensure compliance with emissions standards over the vehicle's useful life
- Transition towards zero emissions motorcycles (ZEMs) as technology improves and costs decrease

# NOV 2020 WORKSHOP – STAFF PROPOSAL (2 OF 2)

- CARB staff proposed comprehensive amendments to existing ONMC regulations
- Proposal based on Euro 5
  - Some requirements go beyond Euro 5
- Proposed an ambitious timeline that would quickly reduce emissions
  - Euro 5 harmonization starting in MY 2023
  - More stringent requirements would phase in multiple steps through MY 2030.



# RULEMAKING ACTIVITIES SINCE NOVEMBER 2020 WORKSHOP

- Exhaust testing
  - WMTC and FTP testing of several motorcycles using CARB, EPA, and EU certification fuels
  - Includes Euro 5 certified models and low-emissions CARB certified models
  - Testing conducted by CARB, Environment and Climate Change Canada (ECCC), and manufacturers
- Evaporative testing
- Feedback from ONMC manufacturers
  - June 2021 workgroup with manufacturers to discuss ZEM proposal
  - Written comments and one-on-one meetings with several manufacturers
- Cost benefit analysis
  - Manufacturer survey on estimated costs of the proposal
  - Market analysis
  - Emissions modeling

# CHANGES TO NOV 2020 PROPOSAL - OBD

- Staff initially proposed 7 additional monitors beyond Euro 5 OBD:
  - Evaporative System Monitoring, Cold Start Emission Reduction Strategy Monitoring, Crankcase Ventilation Monitoring, Engine Cooling System Monitoring, Variable Valve Timing (VVT) Monitoring, Fuel System Monitoring, and Catalyst Removal Monitoring with correction inducement
- After reviewing technical feasibility, costs, and benefits, staff is now proposing only one additional monitor beyond Euro 5 OBD: Fuel System Monitoring
  - Refer to CARB LDV OBD requirements – CCR, Title 13, section 1968.2(e)(6)
  - Proposed Malfunction Criteria for section 6.2.1(C) = 3x the applicable standard
- Fuel System Monitoring can be met using existing sensors and hardware
  - Software may already be present in ONMC OBD systems derived from LDV OBD systems
  - Some recalibration of OBD thresholds would likely be required



## CHANGES TO NOV. 2020 PROPOSAL - IUVP

- Staff initially proposed requiring in-use testing of all Class III engine families with sales >300/year that were certified using catalyst bench aging.
- Staff is now proposing to increase annual sales limit to >1000/year.
- Helps manufacturers to find suitable vehicles for testing
- Reduces testing burden, improves cost effectiveness
- Still provides data needed to evaluate effectiveness of catalyst bench aging

# CHANGES TO STAFF PROPOSAL – CLASS IA MOTORCYCLES

- Staff proposed harmonizing with Euro 5 standards for Class IA motorcycles for MY 2024-2027, followed by full ZEM in MY 2028+
- After reviewing costs and benefits, staff is now proposing to continue deferring Class IA certification to U.S. EPA through MY 2027
  - Full ZEM will still be required in MY 2028+
- Reduces product development and testing/certification costs
- Allows manufacturers to focus on transitioning smaller ONMC to zero emissions
  - Consistent with global market trends and regulations

## CHANGES TO NOV. 2020 PROPOSAL – EFFECTIVE DATES

- Staff initially proposed harmonization with Euro 5 starting in MY2023, with additional requirements phasing in gradually through MY2028.
- Staff has revised the proposal to provide more time for development and certification of compliant models and minimize required redesigns

Requirement	Proposed Effective Date
Euro 5 exhaust and OBD for <b><u>NEW</u></b> engine families	MY 2024
Euro 5 exhaust and OBD for <b><u>Carryover</u></b> engine families	MY 2025
All requirements beyond Euro 5: OBD fuel system monitoring, extended useful life mileage, in-use verification, and evaporative requirements	MY 2028

\* Refer to June 2021 staff presentation for proposed effective dates for ZEM requirements

# CARB ON ROAD MOTORCYCLE (ONMC) WORKSHOP



## CARB Staff Updated Proposal for ONMC Evaporative Emissions Standards and Test Procedure

January 12, 2022

# EVAPORATIVE EMISSIONS TESTING COLLABORATION

- Manufacturers of Emission Controls Association<sup>1</sup> (MECA), United States Environmental Protection Agency<sup>2</sup> (U.S. EPA), and CARB collaborated to assess feasibility of ONMC emissions control for meeting a multiday diurnal standard
  - MECA followed light-duty vehicle regulations when testing the bleed emission test procedure (BETP) over multiple days and adapted it to ONMCs
  - CARB/U.S. EPA conducted 3-day diurnal evaporative emissions SHED tests on multiple ONMCs
- The objectives of the studies included (but not limited to):
  - Define appropriate design criteria for ONMC canisters to achieve low evaporative emissions out to vehicle useful life
  - Evaluate correlation between butane working capacity (BWC) / fuel tank volume and 3-day diurnal emissions
  - Evaluate ONMC to quantify emissions from canisters, leaks, and other sources
  - Evaluate feasibility of emissions control over multiple days

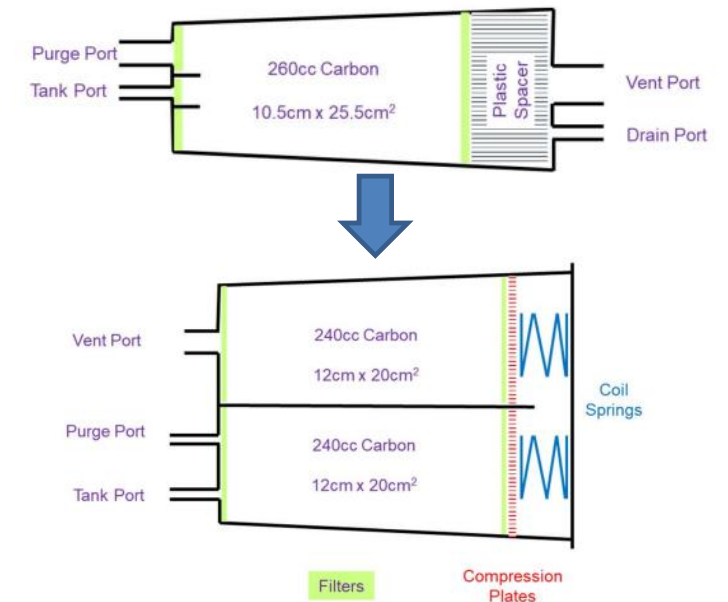


<sup>1</sup>-Evaluation of Motorcycle Evaporative Canisters – Final Report, July 15, 2021

<sup>2</sup>-EPA-420-R-21-016, Evaluation and Development of an On-Highway Motorcycle Evaporative Emission Reduction Strategy, August, 2021

# MECA/U.S. EPA OBSERVATIONS AND RECOMMENDATIONS

- Improving the canister design ensures canister emissions can be significantly reduced to less than 1 g/day
- Reductions in evaporative emissions from ONMC carbon canisters were dependent upon:
  - Increasing carbon capacity
    - Evaluation of 7 ONMC canisters found carbon volume ranged from 34% - 54% of canister volume
    - Increased carbon volume can improve performance without significantly increasing canister size
  - Improving carbon quality
    - Using carbon with higher BWC and enhanced durability
  - Increasing L/D ratio
- However, carbon canister design criteria are only effective if leaks are controlled
  - Additional design improvements, other than improved canisters are needed to meet 1 g/day
  - Complete fuel system leak test, with carbon and canister durability standard are needed to ensure emissions control over useful life of motorcycle
  - Hot soak emissions should be accounted for to achieve comprehensive emission control



# ADDITIONAL KEY TAKEAWAYS FROM CARB TESTING

- Multiday diurnal is necessary to account for representative emissions from ONMCs
  - WMTC is more representative test cycle, and generally provides greater purge volume than FTP
- Carbon canisters/fuel system components need to be durability tested to ensure emissions control over the lifetime of the ONMC
- Hot soak provides additional metric for controlling leakage emissions
- A 1 g/day standard can be achieved with durable gas cap that seals properly and modest increase in canister working capacity



# PROPOSED ONMC EVAPORATIVE STANDARDS

- **Phase I:** For MY 2024-2027, all motorcycles must meet either Euro 5 or current CARB evaporative system requirements (heat blanket test)
  - Euro 5
  - Current CARB standards
- **Phase II:** For MY2028 and later, all ONMCs must meet diurnal performance and hot soak standards

Model Year Effective Date	Diurnal Standard*	Hot Soak Standard	Test Procedure
2028 and later	1.0 grams HC/day	0.1 grams HC	TP-934 3-day diurnal SHED test

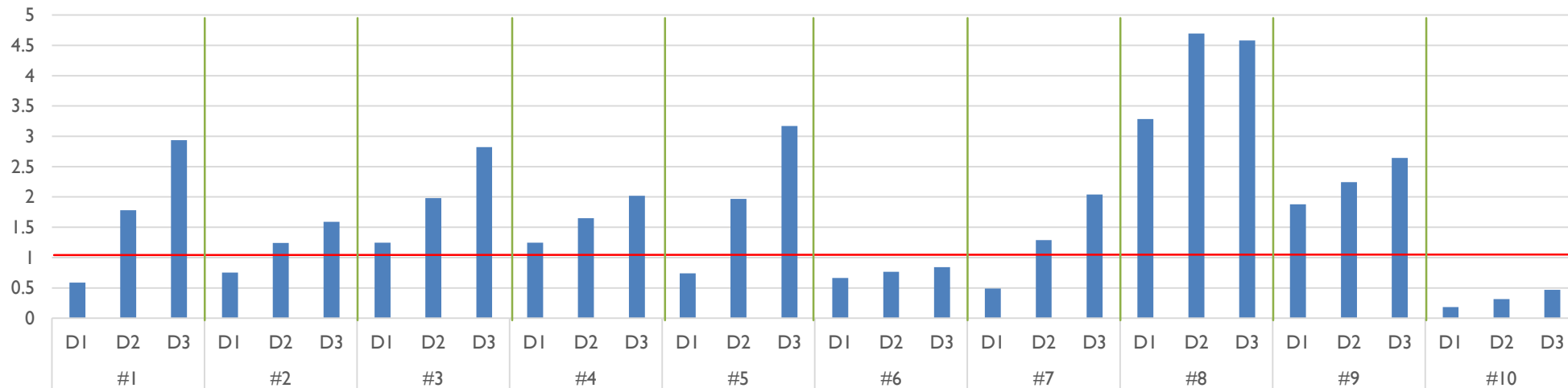
\*- Highest 24-hour diurnal test result over three consecutive 24-hour diurnal test periods



# WHY IS A 3-DAY SHED TEST NEEDED?

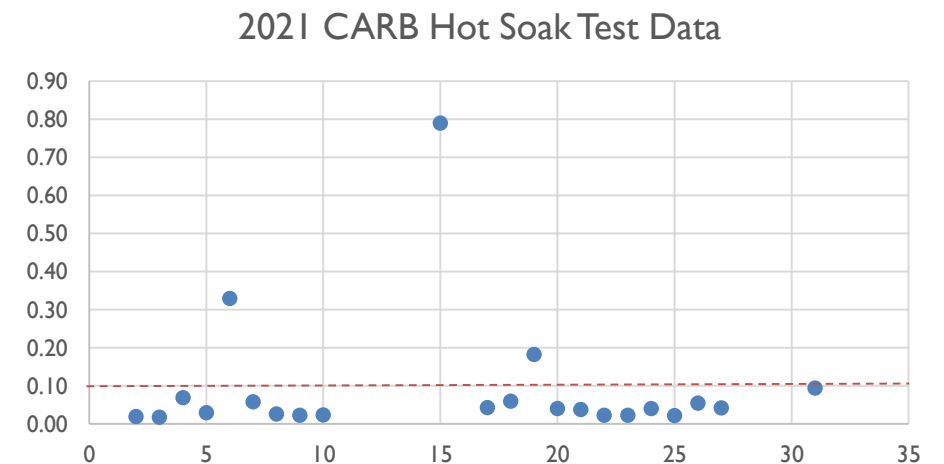
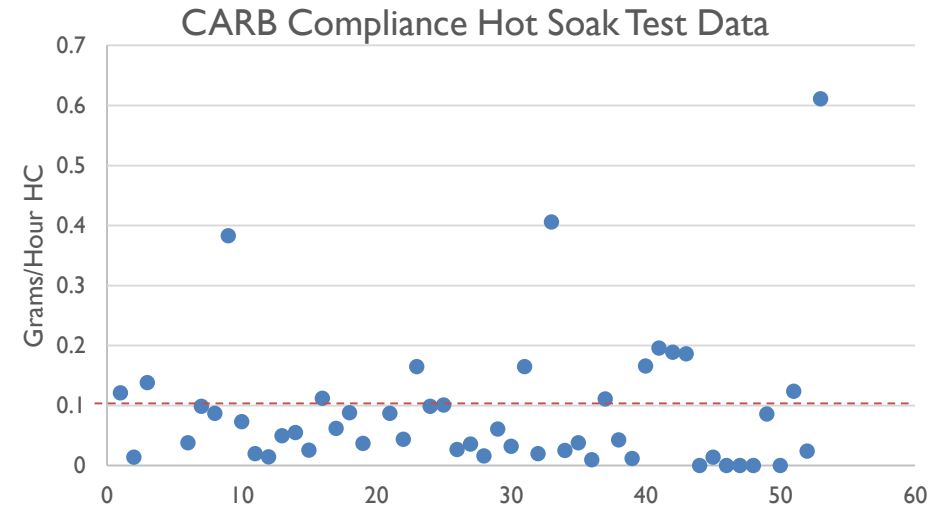
- CARB tested 10 ONMCs over 3 days
  - FTP prep cycle, 65-105-65 summertime temperature profile, LEV III fuel
- Results indicated that single day testing does not reflect emissions on days 2 and 3
  - Gradient varied between manufacturers and bikes (different canister sizes, fuel tank size, etc)
  - Third day emissions are more representative of storage emissions over longer periods

ONMC Evap 3-day results



# WHY IS HOT SOAK TESTING NEEDED?

- Review of hot soak data from compliance testing
  - Data from fuel injected motorcycles tested 2010-2019
  - Hot soak conducted at 68-86F
  - High hot soak emissions from some motorcycles that meet current evaporative standard
- 2021 CARB hot soak testing
  - Most tests passed the proposed hot soak standard
  - Leakage from fuel caps was distinct
  - Change in temperature affects leakage



# SUMMARY OF PROPOSED TP REVISIONS

- Add fuel cap/carbon performance durability procedures
  - Fuel cap – Installation cycling
  - Carbon Performance – Durability typically conducted by the carbon manufacturer
- Change hot soak conditioning to hot soak test
- Harmonize LDV preconditioning drive soak and test temperature from 86 +/- 3 to 68 to 86
- Allow alternative to the carbon canister contamination tip test
- Harmonize 40 CFR Part 1066 procedures where applicable
- Modify canister purge rates to be more representative
- Additional minor edits and reference updates



Carbon Canister Conditioning System



Variable Volume SHED

# UPDATED PROJECT TIMELINE

- February 7<sup>th</sup> – Deadline for comments on today’s workshop
- Spring 2022 – Final public workshop(s) of staff proposal
  - Underline-strikeout version of draft proposed regulatory text
  - Cost estimates and projected emissions benefits
- August 2022 – Publish Notice of Proposed Rulemaking
  - Includes final proposed regulatory text, Staff Report, and instructions on how to submit formal comments
  - Start of 45-day formal public comment period
- October 2022 – Board Hearing
- Spring 2023 – Amendments officially incorporated into Code of Regulations

# FEEDBACK

- CARB welcomes public input on the ONMC proposal
- If you need a copy of the Draft TP-934, MECA, or the U.S. EPA Test Report please send an email to:  
[Scott.Monday@arb.ca.gov](mailto:Scott.Monday@arb.ca.gov)
- Please submit any comments or changes by February 7, 2022



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