ONROAD MOTORCYCLE (ONMC) RULE-MAKING KICKOFF
OUTLINE

• ONMC Background and Standards
• Supporting Data
• Recent CARB Activity
• Potential Path Forward
NEED FOR EMISSIONS REDUCTIONS

• Over 90% of Californians Breathe Unhealthy Levels of Air Pollutants During Some Part of the Year

• A Major Source of These Pollutants is Transportation Related Combustion
  - Nitrogen Oxides (NOx)
  - Reactive Organic Gases (ROG)
  - Carbon Monoxide (CO)

• Together NOx and ROG form Ozone in Sunlight
  - Ground level ozone is a major component of smog

• CARB’s Mission Involves Protecting the Public Health by Providing Safe Clean Air to All Californians
NEED FOR EMISSIONS REDUCTIONS

- CARB Mobile Source 2030 Emission Reduction Goals
  - 80% NOx for South Coast
  - 45% Green House Gas (GHG) emissions Statewide

- 2016 Zero Emission Vehicle (ZEV) Action Plan
  - Consider regulations that would create or expand upon emissions based credit programs for zero-emission motorcycles

- Governor’s 2018 Zero-Emission Vehicle Executive Order
  - 5 million ZEVs in California by 2030
  - 250,000 vehicle chargers installed in California by 2025
ONMC EMISSIONS INVENTORY IN CA

• 2016 ONMC Emissions
  o ~ 27 TPD of ROG
  o Population ~ 688,000

• 2035 ONMC ROG Emissions Near Parity with LDV ROG Emissions

• ONMC Emissions are Significant when Considering VMT
  o Passenger Car Miles ~100x Greater than ONMC
  o ~ 0.5% ONMC vs. ~52% for Passenger Cars
CARB MOTORCYCLE REGULATION HISTORY

• CARB First Motorcycle Emissions Standards Adopted in 1975

• Most Recent CARB ONMC Standards Amendments in 1998
  o Evaporative emissions effective in 2007
  o Tail pipe emissions effective in 2008

• Many Other Countries Adopting More Stringent ONMC Emission Standards
  o Europe, Brazil, China, Japan, South Korea, Chile, Indonesia, India, etc.
  o Many adopting in part/whole European Union Standards (EU)
**WHAT ARE THE THE EURO 4 AND EURO 5 STANDARDS?**

- **Regulation (EU) No 168/2013 Applies to ONMCs in Europe**
  - Euro 4 (EU 4) is the current standard in effect since 2016
  - Euro 5 (EU 5) is the latest standard going into effect in 2020

- **Key Features of EU 5 Regulation:**
  - Stringent exhaust emissions limits
  - Uses World Motorcycle Test Cycle (WMTC) for emissions testing
  - OBD II required
ONMC EXHAUST EMISSION STANDARDS

HC + NOx Standards

- CARB / USEPA: 0.17 g/km HC, 0.09 g/km NOx
- EU4: 0.1 g/km HC, 0.06 g/km NOx
- EU 5
- CARB SULEV 30
ONMC EXHAUST EMISSION STANDARDS

CO Standards

<table>
<thead>
<tr>
<th>Standards</th>
<th>g/km</th>
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<tr>
<td>CARB / USEPA</td>
<td>13.0</td>
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<tr>
<td>EU 4</td>
<td>1.0</td>
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<tr>
<td>EU 5</td>
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<tr>
<td>CARB SULEV 30</td>
<td>0.1</td>
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</tbody>
</table>
ONMC EVAP EMISSION STANDARDS

EVAP SHED Standards

- CARB ONMC: 2.0
- EU 4: 2.5
- EU 5: 1.5
- CARB OHRV: 1.0
- LDV: 0.5

HC g/test
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AVAILABLE ONMC EMISSIONS DATA

• European Rule Development Data
  o EU 5 technical feasibility and cost effectiveness study

• CARB Data (2007-2017)
  o Certification data: 1,251 bikes
  o In-house research testing: 58 bikes
MANY CARB CERTIFIED ONMC MEET EU 4 STANDARDS

Certification THC+NOx By Year

- Lowest Cert Value
- Year Average
- CARB ONMC Limit
- EU4 Nominal Limit

ON ROAD MOTORCYCLE WORKSHOP
MANY CARB CERTIFIED ONMC MEET EU 4 STANDARDS

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- **EU4 Nominal Limit**
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TAMPERING SURVEY

• 2017 CARB Surveyed 1000 Motorcycles for Evidence of Tampering
  o Survey was an analysis of classified ads

• Key Findings
  o 34% tamper rate of Class III ONMC
  o 93% of sample population was Class III ONMC
  o Exhaust tampering was most common type of tampering
PORTABLE EMISSIONS MEASUREMENT SYSTEM (PEMS)

• CARB Deployed and Verified an Axion PEMS Unit Performance Against a Standard

• Planned PEMS Work:
  o Before-and-after tampering tests

• Potential Future PEMS work:
  o Screening tool to assess real world performance
ZERO EMISSIONS MOTORCYCLES (ZEMs)

- Key Obstacles to ZEM Adoption
  - Cost
  - Range
  - Charging Availability and Time

- Costs of Batteries Continue to Drop

- Many ZEMs Over 100 Miles Range
  - ISR rider survey: 77% ride < 100 miles per day

- 2011 to 2016 EV Stations Increase > 10 Times
  - Source: U.S. Dept of Energy

Lithium-ion Battery Price Survey ($/kWh)

Source: Bloomberg New Energy Finance
ZEMs: CVRP

- Clean Vehicle Rebate Program (CVRP) has Given Over $600K in ZEM Rebates
  - $900 per ZEM
  - Increased Number of Eligible ZEMs
  - New funds awarded to expand program

- Staff Working on CVRP Motorcycle Surveys to Collect User Data

- CVRP Web Site:
  - https://cleanvehiclerebate.org/eng
ZEMs: LCFS UTILITY REBATES

- ZEMs Proposed Eligible for Low Carbon Fuel Standard (LCFS) Program Utility Rebates Program in 2019
  - Proposal to Board April 2018

- Rebates Vary by Utility up to One Time $600

- Web Site:
  - https://www.arb.ca.gov/fuels/lcfs/electricity/utilityrebates.htm
CARB OUTREACH

• 2017 Staff Met with Motorcycle Manufacturers to Discuss Needed Reductions
  o Manufacturers represented over 90% of CA Sales

• Key Takeaways
  o California is a small portion of global ONMC sales
  o Expensive to produce models for a small market
  o Most produce Euro 4 compliant motorcycles
  o Most prefer CARB harmonization with EU standards over separate new CARB and EU standards
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HARMONIZATION BENEFITS

- Manufacturer Euro 5 ONMC Design Underway
  - CARB 2020 proposal will be after EU 5 implementation

- Building for Larger Market Lowers Emissions Reduction Costs
  - Elimination of duplicative design and testing resources

- EU 5 Standards Would Significantly Reduce Emissions from California ONMC
  - Tail pipe nominal emissions reduction near a factor of 10
  - Evaporative nominal emissions 25% reduction
HARMONIZATION CHALLENGES

Example of Differences Between CARB and EU Standards that Must be Understood

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<thead>
<tr>
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<th>EU 5</th>
<th>CARB</th>
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<tbody>
<tr>
<td>Fuel</td>
<td>E5, RVP ~ 8.4</td>
<td>E10, RVP ~ 6.9</td>
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<tr>
<td>Drive Cycle</td>
<td>WMTC</td>
<td>FTP</td>
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<td>Evaporative Tests</td>
<td>1 hour test</td>
<td>OHRV TP 933 a 24 hour test</td>
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<tr>
<td>OBD</td>
<td>Stage II</td>
<td>No OBD</td>
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<tr>
<td>Reg and Category Definitions</td>
<td>L cat: power, speed and displacement</td>
<td>ONMC class I, II , and III by displacement</td>
</tr>
<tr>
<td>Certification</td>
<td>Ensure vehicles certification documentation can be accepted across jurisdictions</td>
<td></td>
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BEYOND HARMONIZATION

• Need Verification Procedures to Ensure Real World Performance

• Potential In-Use Performance Monitoring
  - OBD-based inspection and maintenance requirements
  - Tamper resistant designs and education

• Need to Consider ZEM Incentives
  - Rebates
  - Credits
  - Fleet averaging
NECESSARY TESTING AND RESEARCH

• Perform CARB Testing to Better Understand Difference in Existing CARB and EU Protocols

• Perform PEMS Testing to Assess Real World Performance and the Emissions Impacts of Tampering

• Other Research for Inventory Update
  - Population
  - VMT
  - Sales
  - Useful Life
  - Activity
• Technical Workgroup Purpose
  o Engage technical expertise of stakeholders to address complex areas of harmonization

• Begin Technical Working Groups with Stakeholders
  o Testing Protocols - Fuels, Drive Cycles, Evap Test Procedures, etc.
  o Procedural - Certification Streamlining and Jurisdictional Definitions, etc.
  o Verification - Assess Real World Performance, OBD, Tampering, etc.
  o ZEM Incentives - Fleet Averaging, Rebates, Credits, etc.
TECHNICAL WORKING GROUPS (CONTINUED)

• Who Can Participate?
  - Motorcycle Manufacturers
  - Motorcycle Parts Manufacturers
  - Regulators
    - CARB Program Staff
    - EPA
    - Section 177 States
  - Standards Organizations
  - Motorcycle and Component Emissions Testing Groups
  - Dealer and Maintenance Groups
  - Rider Groups
• How Technical Working Groups Will Operate?
  o Led by CARB Staff
  o Regular meetings
    ➢ Monthly or as needed
    ➢ 1 to 2 years
  o Participants contribute as necessary
    ➢ Relevant expertise and input
    ➢ Testing samples/resources
  o Meeting summaries detailing issues resolved and issues yet to be resolved
  o Final summary write-up of issues group resolved and rationales
• Technical Working Groups Kicking Off in May 2018

• Contact CARB Staff to Participate
  o See Technical Work Group Flyers

• Stakeholder Participation is the Road to Success!
• Manufacturers should plan for new standards for all motorcycles starting in MY2024
• Potential for optional phase-in and/or early adoption provisions to start in MY2021
CONTACTS

• Please Contact Us With Any Questions or Concerns About Potential Harmonization with EU ONMC Emissions Standards

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