



HEAVY-DUTY LOW NOX PROGRAM PUBLIC WORKSHOP

CALIFORNIA AIR RESOURCES BOARD

**JANUARY 23, 2019
SACRAMENTO, CALIFORNIA**

AGENDA

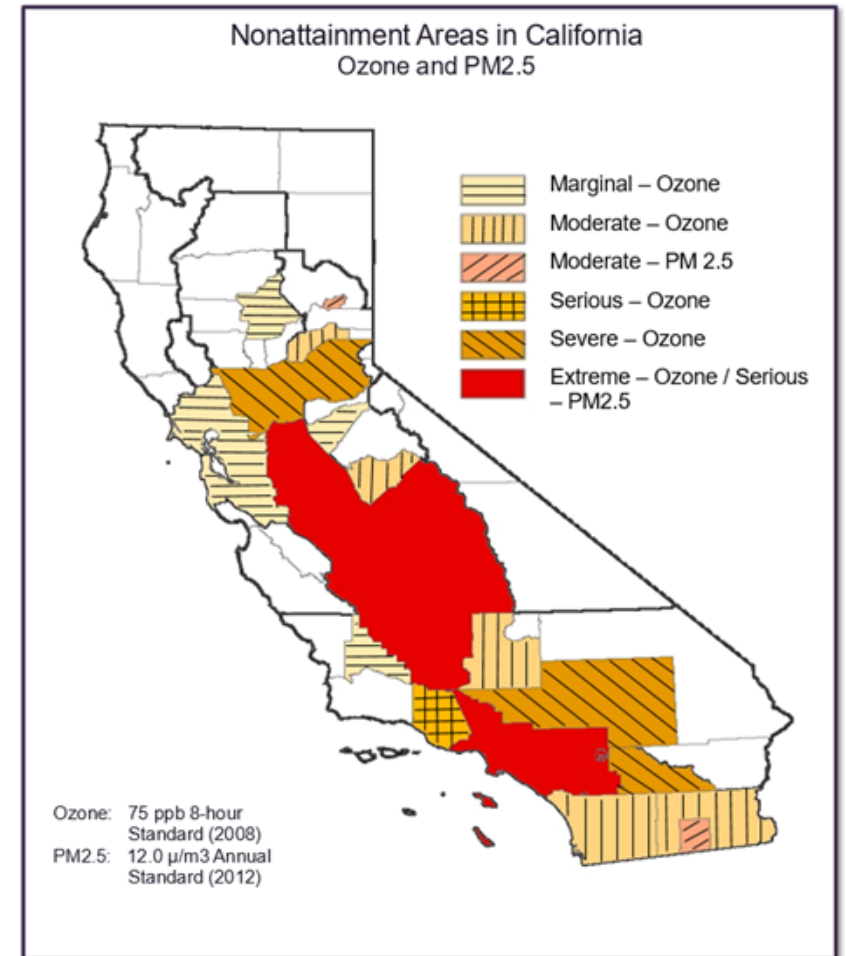
- I. Introductions
- II. Background: Need for NO_x Emission Reductions
- III. Heavy-Duty Low NO_x Program Elements
 1. Status Update on SwRI Low NO_x Demonstration Efforts
 2. Low Load Cycle Development
 3. Revised Heavy-Duty In-Use Testing
 4. Warranty Step 2 and Lengthened Useful Life
 5. Emission Warranty Information Requirements (EWIR)
 6. Revised Durability Demonstration Procedures and Credit Provisions
- V. Timing and Next Steps



Background: Need for NOx Emission Reductions

AIR QUALITY CHALLENGES

- **Over 12 million Californians breathe unhealthy air**
- **Key challenges:**
 - South Coast ozone
 - San Joaquin Valley PM2.5

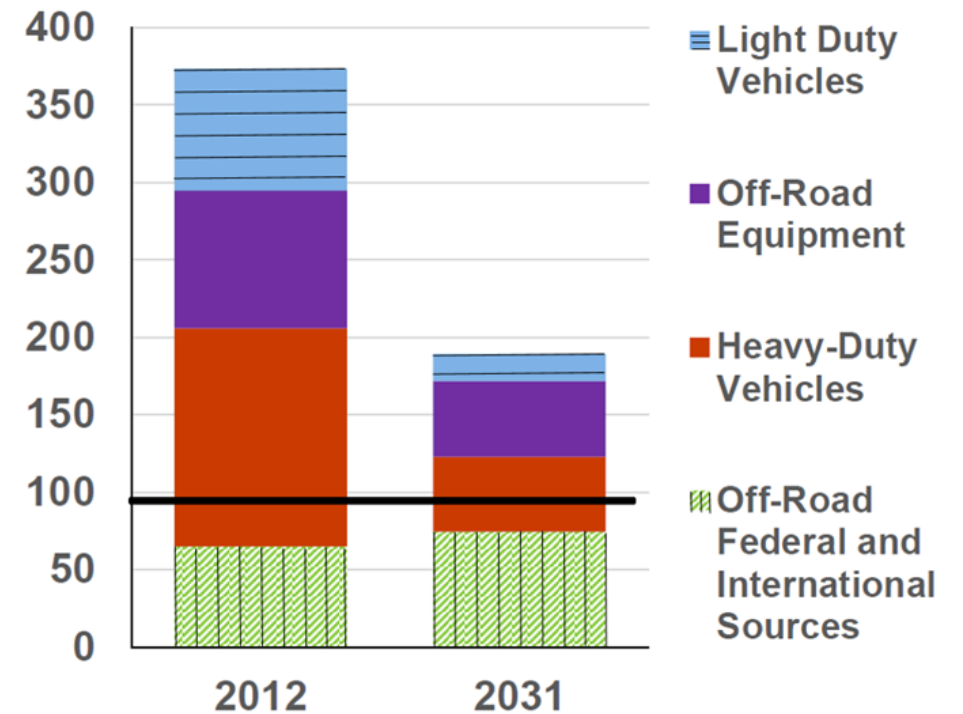


SOUTH COAST EMISSIONS INVENTORY

KEY SOURCES

- **NOx benefits by 2031 with current program**
 - Mobile source emissions reduced over 50 percent
 - Heavy-duty vehicle emissions reduced by nearly 70 percent
- **Heavy-duty trucks and off-road equipment remain largest contributors**
- **Heavy-duty trucks emit ~ one third of statewide NOx**
- **Additional reductions needed from all mobile sources to meet attainment**

South Coast Mobile Source NOx Emissions (tons per day)



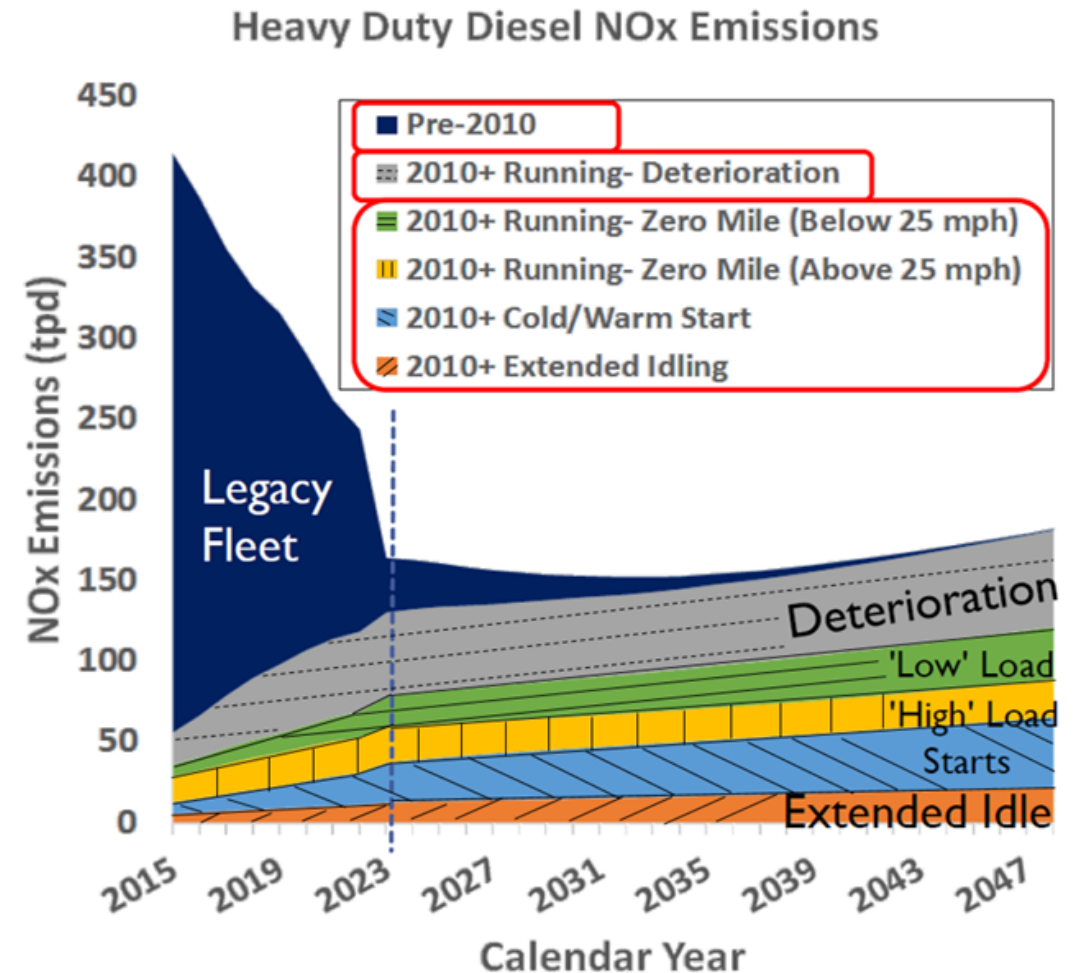
WHERE EMISSIONS ARE COMING FROM?

'til 2023:

- Pre-2010s dominate NOx
 - Ensuring Truck and Bus Rule compliance/SBI critical

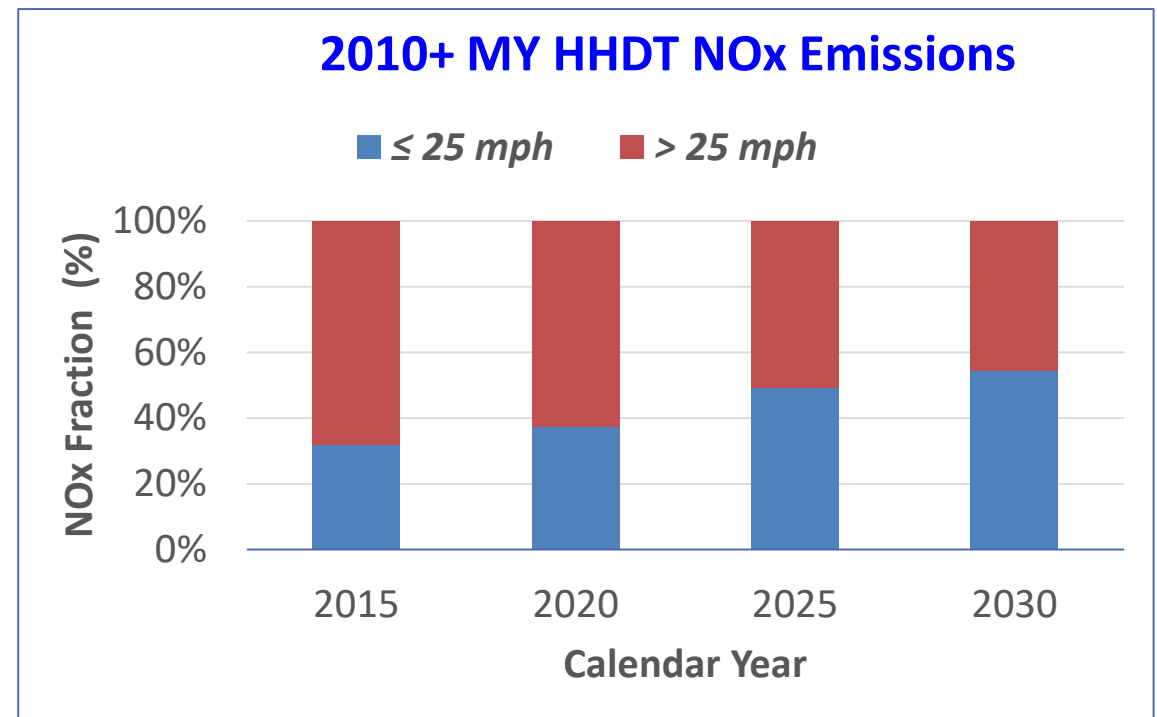
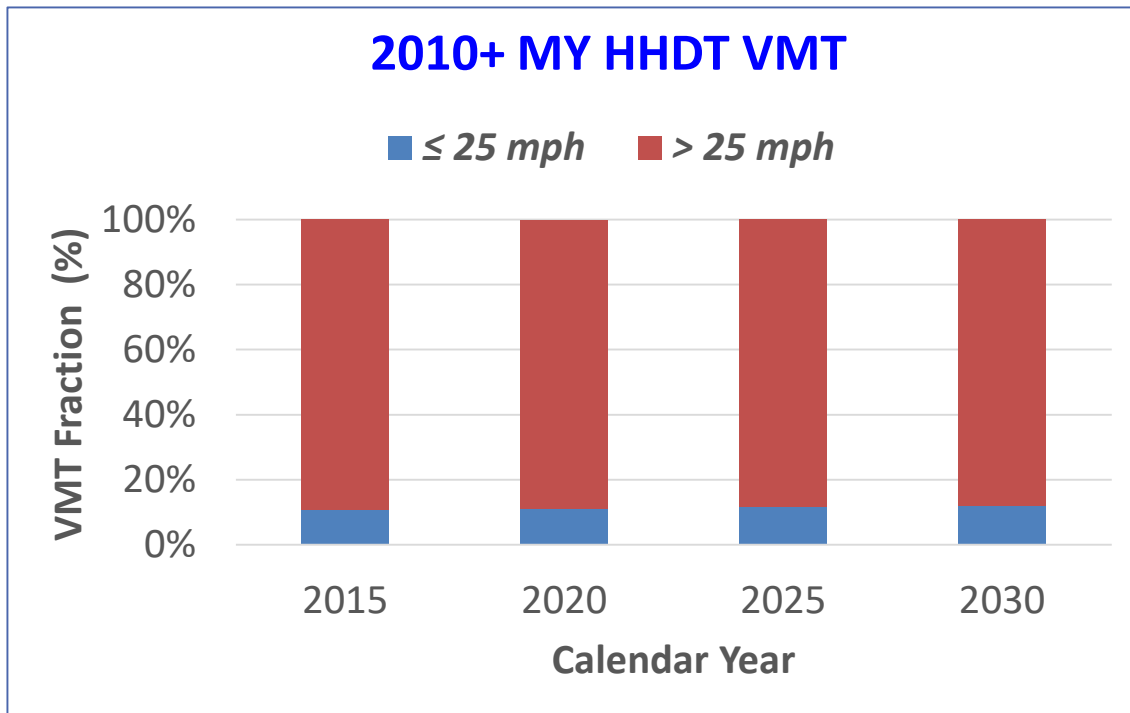
Beyond 2023:

- Deterioration-related emissions largest
 - Need HD I/M and Extended Warranty
- Running, start and idling emissions also significant
 - Need lower standards, low-load cycle, improved in-use testing
- Multi-pronged holistic approach required



IMPORTANCE OF NOx CONTROL UNDER LOW LOADS

- NOx emissions from low-speed operation to become increasingly significant, due to SCR inefficiency at low loads



HD LOW NOX PROGRAM CURRENT CONCEPTS: OVERVIEW

- Implementation to begin in 2023
- Lower NOx standards for heavy-duty engines – 0.0x g/bhp-hr standard (as demonstrated by SwRI demonstration program)
- New low load certification cycle (LLC)
- Lengthened useful life and warranty period (Step 2)
- Strengthen the current durability demonstration program
- Strengthen the in-use testing program (HDIUT)
- Credits: Sunset existing credits, offer zero emission powertrain credits



Timing and Next Steps

U.S. EPA'S "CLEANER TRUCKS INITIATIVE"

■ U.S EPA's "Cleaner Trucks Initiative"

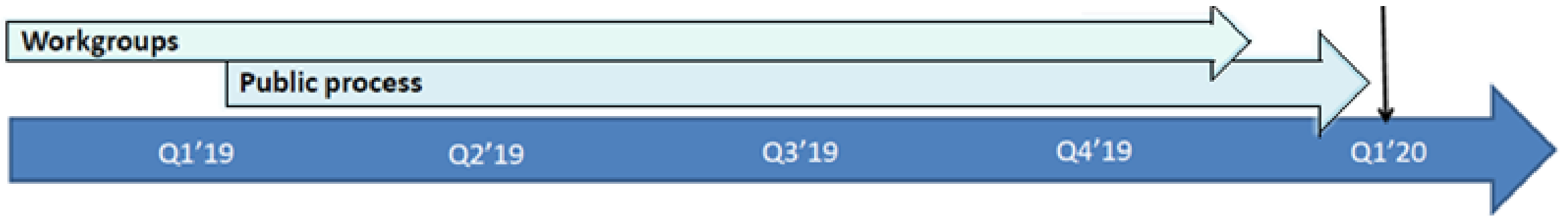
(<https://www.epa.gov/newsreleases/epa-acting-administrator-wheeler-launches-cleaner-trucks-initiative>)

- Announced on Nov 13, 2018
- Initiate HD low NOx rulemaking
- Plans to publish a proposed rule in 2020
- CARB will work collaboratively with U.S EPA to develop as much as possible harmonized national requirements

UPCOMING MILESTONES

Upcoming Meetings:

- February 2019: Workgroup Meeting: HD In-Use Testing/Low Load Metrics
- March 2019: Workgroup Meeting: Stage 2 Proposed LLC and LLC Optimization Results
- May 2019: Public Workshop



Stage 1B Re-age parts

Stage 2–Develop/ assess LLC/Low load metrics

Stage 3 – Demonstrate low NOx on 2nd engine

Stage 3b – Explore additional engine hardware options that can simultaneously reduce NOx and GHG on stage 3 engine

NREL HD Low-NOx Technology Cost Study

CONTACTS

- **Stephan Lemieux, Manager**
On-Road Heavy-Duty Diesel Section
stephan.lemieux@arb.ca.gov
(626) 450-6162

Lead:

- Lower NOx Standard
- Low Load Cycle
- Heavy-Duty In-Use Testing
- Durability Demonstration Program
- Credit Provisions

- **Ronald Haste, Manager**
Off-Road Control Section
Ron.Haste@arb.ca.gov
(626) 575-6676

Lead:

- Warranty Step 2 and Lengthened Useful Life

- **Jeff Wong, Manger**
Field Operations Warranty Section
jwong@arb.ca.gov
(626) 575-7009

Lead:

- Emission Warranty information Reporting (EWIR)