SAE International **Thermal Management Systems Symposium**
Denver, Colorado, September 22-24, 2014

CARB Activities to Reduce Mobile Refrigerant Emissions

Tao Zhan, Ph.D.

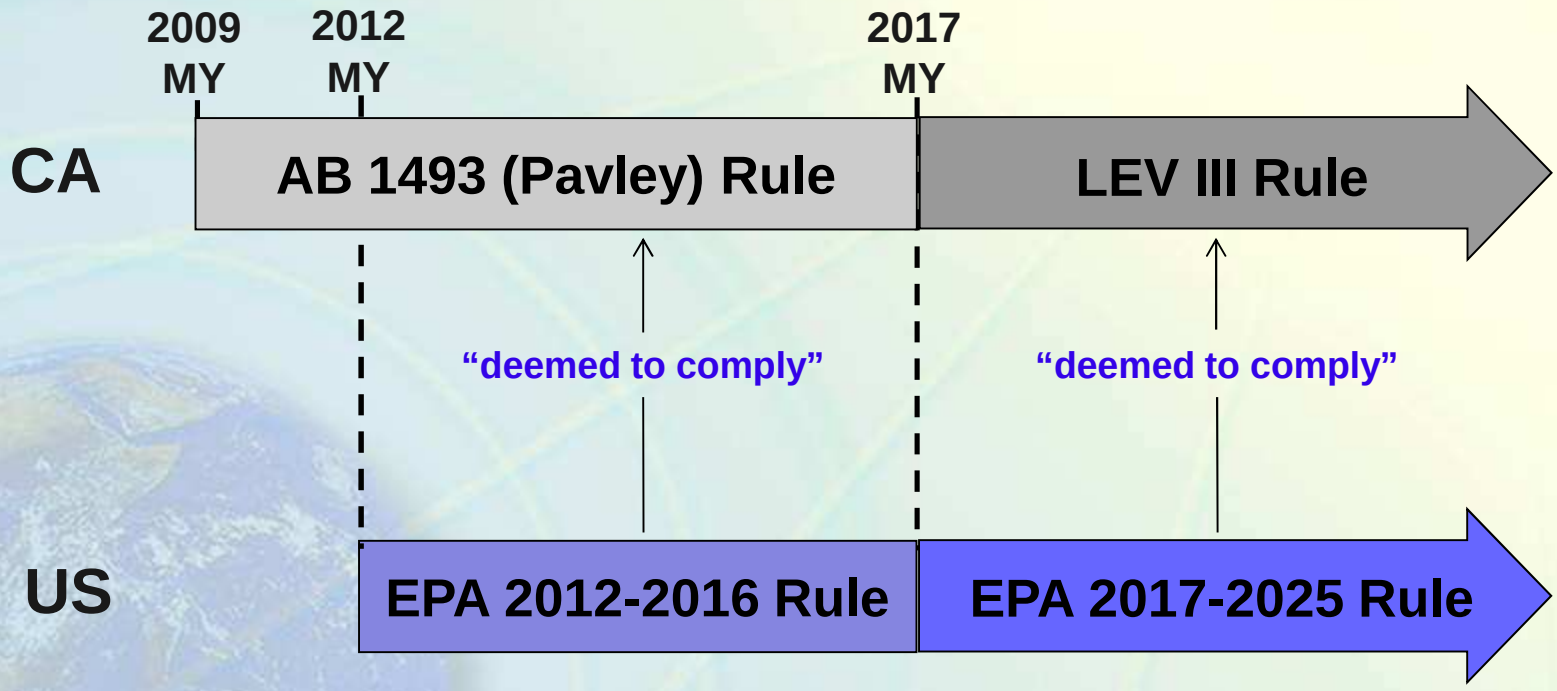
California Air Resources Board

California Environmental Protection Agency
AIR RESOURCES BOARD

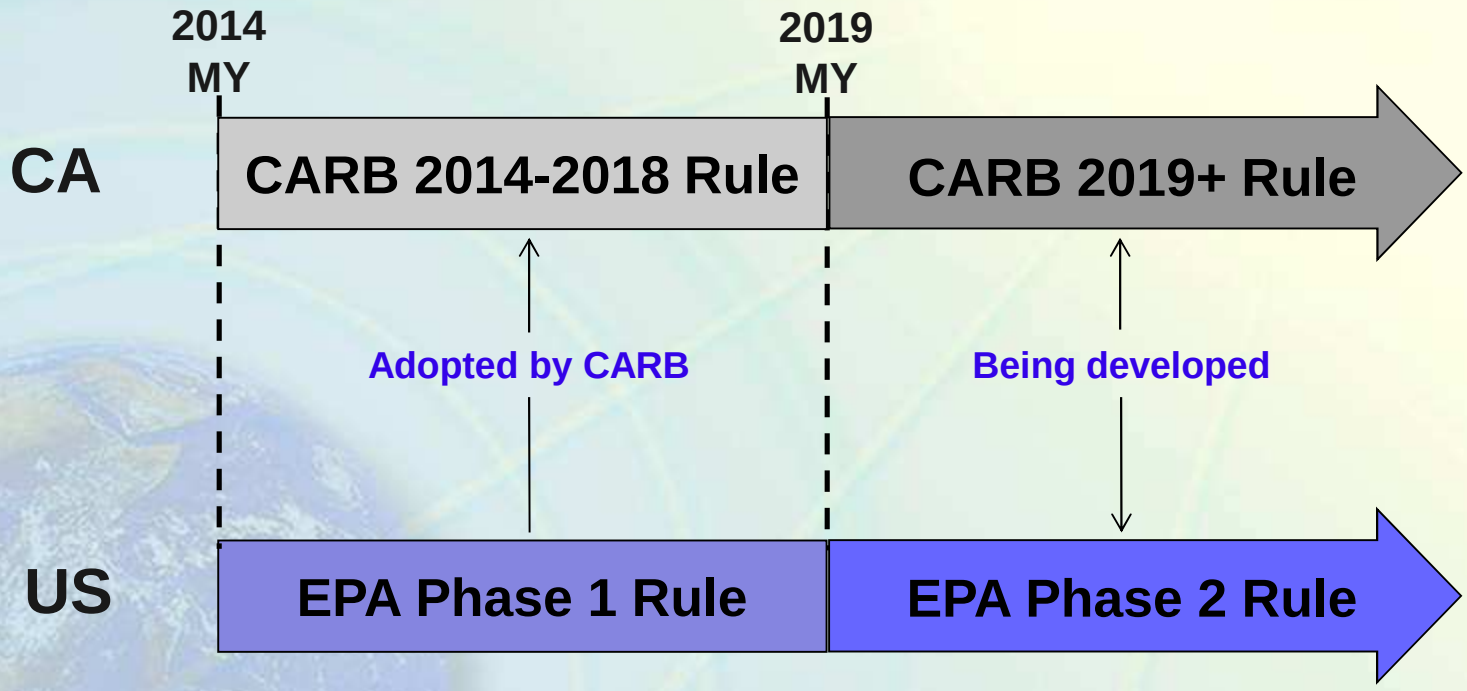
Outline

- Review of existing programs
- Regulatory activities for motor vehicle air conditioning (MVAC, AC) systems in light-duty (LD) vehicles
- Regulatory activities for mobile refrigerants in heavy-duty (HD) vehicles and equipment
- Research activities
- Summary

Review of Existing Programs - LD MVAC Credit Programs



Review of Existing Programs - HD MVAC Leak Rate Limits



Regulatory Activities for LD MVAC

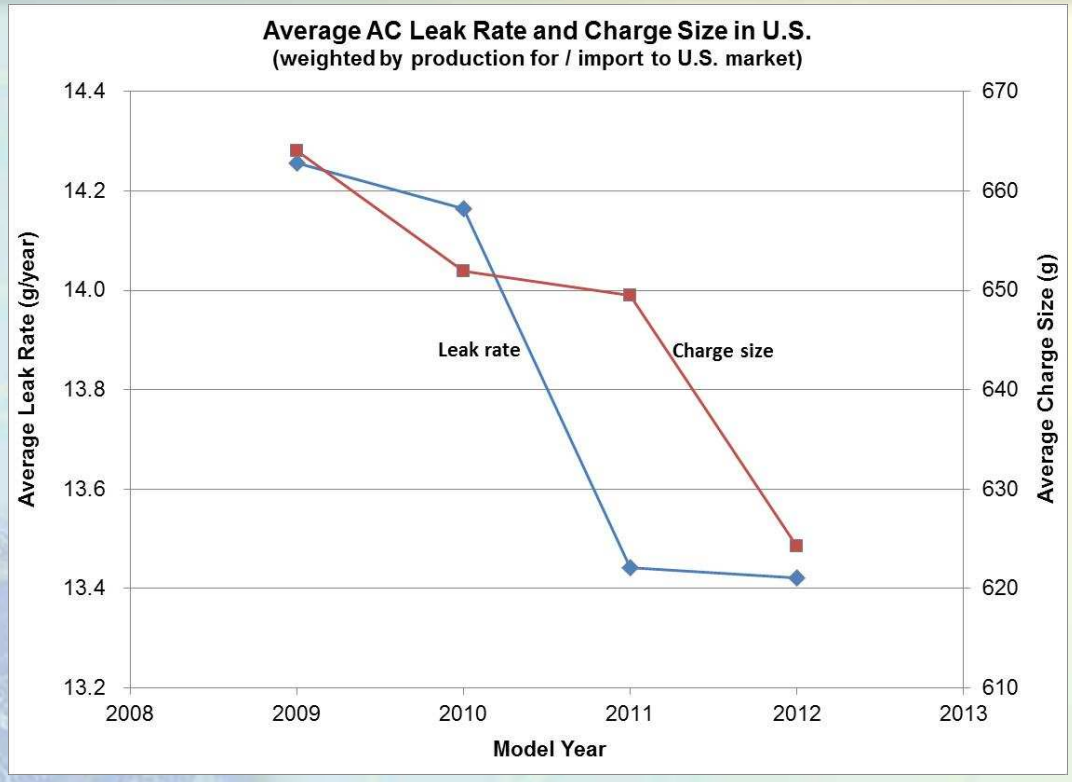
In August, 2014, U.S. EPA issued a proposed rule to change the status of HFC-134a from acceptable to unacceptable for use in new LD MVAC.

- CARB intends to provide supportive comments to U.S. EPA on the proposed rulemaking.

Regulatory Activities for HD Mobile Refrigerants

- Context: baseline HFC emissions from HD AC = ~3 $MMTCO_2e$/year nationwide in 2030 (CARB staff estimate based on information in EPA HD GHG Phase 1 rulemaking)
- CARB is exploring opportunities to further reduce refrigerant emissions from HD sectors (e.g. via switch to low-GWP refrigerants).
- CARB seeks stakeholder input to:
  - Refine CA refrigerant emission inventory for HD on- and off-road vehicles and equipment, buses, and transport refrigeration units (TRUs)
  - Identify effective emission reduction technologies or strategies

Research Activities
- Tracking Initial Leak Rate for New MVAC



Data sources:

- AC leak rates are from Minnesota Pollution Control Agency's MAC Leakage Reporting Rule database.
- Domestic production for and import to U.S. market are from WardsAuto Group's Factory-installed Equipment database.

Research Activities
- Real-world AC Leak Rate for In-use Fleet

CARB plans to conduct a field study to collect air samples at both ends of one bore of Caldecott Tunnel near Berkeley, CA.

- Air samples will be analyzed for HFC-134a, CO_2, and CO concentrations.
- Average AC leak rate of passing vehicles will be estimated from:
  - HFC-134a concentration enhancement through tunnel
  - CO_2/CO concentration enhancement through tunnel
  - Carbon content of fuels
  - Average fuel economy of passing vehicles
  - Average speed of passing vehicles
- Pilot study in 2004 validated the method and established a baseline.
- Currently planned study is expected to show:
  - Trend of average AC leak rate of in-use fleet over a decade
  - How reduction in initial AC leak rate of new vehicles translated into improvement in real-world usage

Summary

- CARB is supportive of the change in status of HFC-134a in new LD MVAC being proposed by U.S. EPA.
- CARB is exploring opportunities to further reduce refrigerant emissions from HD mobile sectors.
- Average initial AC leak rate for new vehicles in U.S. has been decreasing between MY 2009 and MY 2012.
- CARB is planning a field study on real-world average AC leak rate for in-use fleet.

CARB Contacts

For questions or comments, please contact:

- Dr. Tao Zhan (staff lead), (916) 445-9495, tao.zhan@arb.ca.gov
- Dr. John Collins (manager), (916) 327-8097, john.collins@arb.ca.gov

For more information, visit

http://www.arb.ca.gov/cc/hfc-mac/hfc-mac.htm