

# Diesel On-Road Private Fleet Emissions Inventory Development

July and August 2007

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Air Resources Board

# Overview

- Proposed In-Use Heavy Duty Diesel Vehicle Regulation
- Proposed Emissions Inventory Methodologies
- Preliminary Results
- Next Steps

# On-Road Heavy Duty Diesel Vehicle Control Measure

- Need for Emission Reductions
  - Diesel Risk Reduction Plan (diesel PM)
  - Statewide Implementation Plan (NO<sub>x</sub>, PM<sub>2.5</sub>)
- All heavy duty diesel vehicles (>14,000 lbs gross vehicle weight rating), except vehicles covered by
  - Public/Utilities Fleets Rule
  - Solid Waste Collection Vehicle Rule
  - Drayage Truck Rule
  - Transit Bus Rule
  - School Bus Program

# Regulation Timeline

- 4 workshops/workgroup meetings since April, 2006
- **July and August workshop – preliminary emissions inventory**
- August workshop – regulatory proposal
- Board Meeting – Spring/Summer 2008

# Overall Goal of the Control Measure

- By 2014, emissions no higher than a 2004 model year engine with a diesel particulate filter
- By 2020, emissions no higher than a 2007 model year engine

# Current Truck Emissions Inventory Status

- EMFAC2007 (released 11/06)
  - Heavy Duty Diesel Truck (HDDT) emissions based upon new emissions testing, DMV registration and prior studies
- Currently updating inventory methods
  - On-going process
    - Collecting and analyzing new DMV and Census data
  - Presenting initial draft today
  - Continuing to work with stakeholders to obtain more data/information

# HDDT Inventory Update Goals

- Reflect our understanding of truck activities
- Support regulatory development
- Assess cost effectiveness of control measures
- Estimate HDDT emissions contribution to statewide and regional inventories
- Longer term: incorporate into a future version of EMFAC

# How are truck emissions calculated?

- Emissions are the product of:
  - Population by model year
    - Typically derived from DMV registration data
  - Annual miles traveled (accrual) by model year
    - Typically derived from surveys and studies
  - Emission rates by model year
    - Typically derived from chassis dyno testing
    - Base emission rate (emission factor)
    - Deterioration (increase in emission factor with lifetime mileage accrual)
    - Speed correction

# EMFAC2007: Current Truck Overview

- Fleets defined by weight class and fuel
  - Population, age distribution, accrual rate
- Populations derived from DMV registration
- Accrual rates based on 1992 Census data
- Added additional 33% heavy-heavy duty diesel truck population for out-of-state trucks
- Updated heavy-heavy duty diesel truck emission rates

# Proposed Inventory Updates: Overview

- Focus on Medium-heavy (14,001–33,000 GVWR) and Heavy-heavy (>33,000 GVWR) diesel trucks
- Differentiate fleets within vehicle classes
- Update populations and model year distribution by fleet
  - Integrate International Registration Plan (IRP) data
- Derive fleet-specific accrual rates from new Census data
  - Account explicitly for fraction of annual mileage accrual in California by IRP jurisdiction

# Proposed Inventory Method

- **$EMS = \sum (\text{Pop} \times \text{Accrual} \times Fr_{CA} \times ER)$** 
  - Summed across all fleets
    - In-state, CA interstate, out-of-state
  - EMS: emission (tons/year)
  - Pop: annual number of vehicles
  - Accrual: miles traveled per vehicle-year
  - $Fr_{CA}$ : fraction of miles traveled in California
  - ER: emission rate (g/mile)

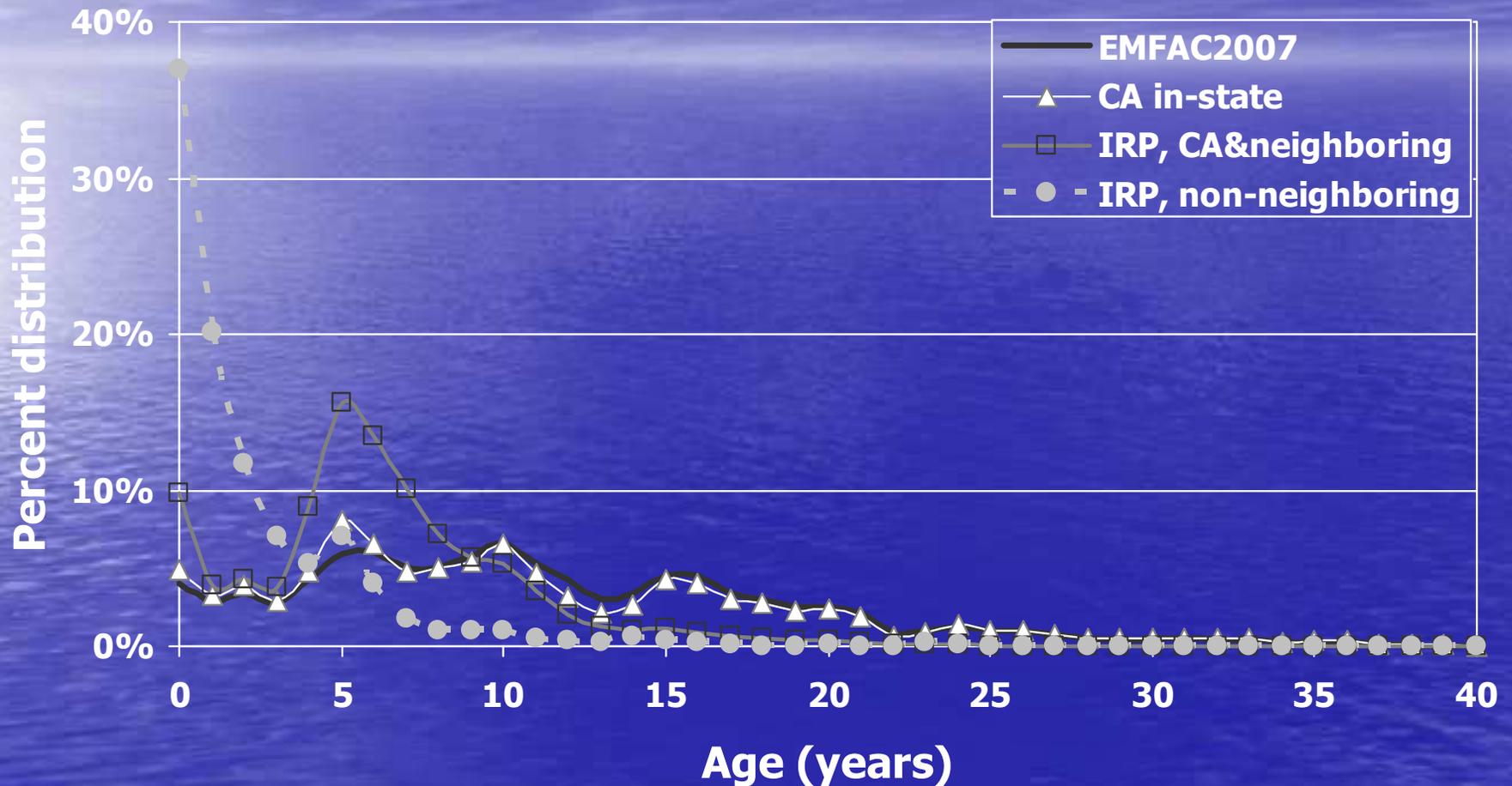
# Fleet Differentiation

	Heavy-heavy Duty Diesel Trucks	Medium-heavy Duty Diesel Trucks
EMFAC 2007	<ul style="list-style-type: none"> <li>● CA registered in-state and IRP</li> <li>● Out-of-state trucks</li> </ul>	<ul style="list-style-type: none"> <li>● CA in-state only</li> </ul>
Proposed	<ul style="list-style-type: none"> <li>● CA in-state</li> <li>● CA interstate (IRP)</li> <li>● Out-of-state trucks                             <ul style="list-style-type: none"> <li>– Neighboring states</li> <li>– Non-neighboring</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● CA in-state</li> <li>● CA interstate (IRP)</li> <li>● Out-of-state truck</li> </ul>

# Age Distribution

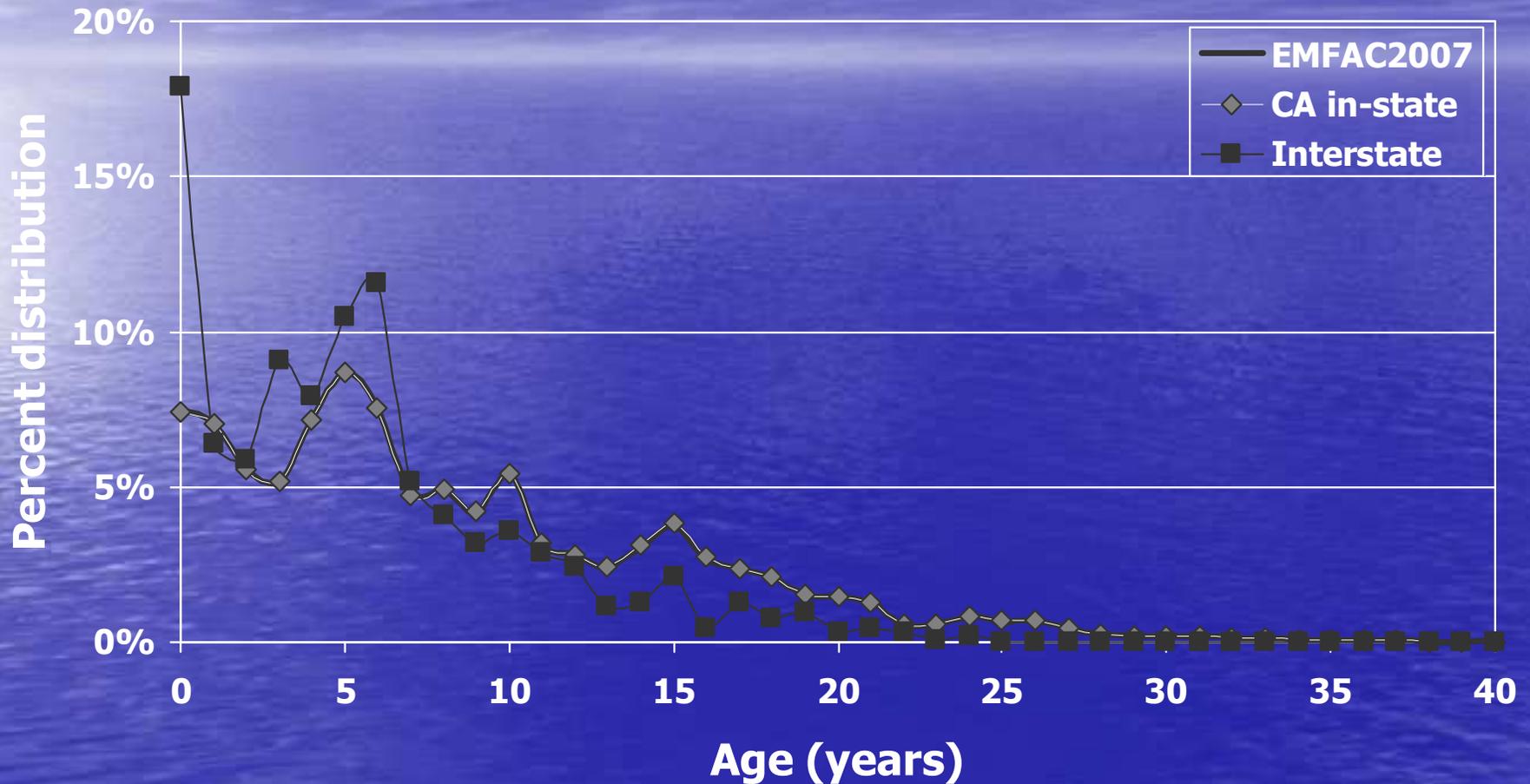
EMFAC 2007	<ul style="list-style-type: none"><li>● Based on DMV registration data</li></ul>
Proposed	<ul style="list-style-type: none"><li>● CA in-state trucks<ul style="list-style-type: none"><li>– DMV registration data</li></ul></li><li>● Interstate trucks<ul style="list-style-type: none"><li>– IRP databases<ul style="list-style-type: none"><li>● CA IRP</li><li>● Sample of out-of-state IRP</li></ul></li></ul></li></ul>

# Age Distribution - HHDDT



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# Age Distribution - MHDDDT



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# Average Age

	Fleet	HHDDT	MHDDT
EMFAC 2007	CA in-state	12	9
	Out-of-state trucks	12	
Proposed	CA in-state	11	9
	CA IRP	6	6
	IRP from neighboring states	6	
	IRP from non-neighboring states	2	

**\* Based on DMV registration and IRP datasets**

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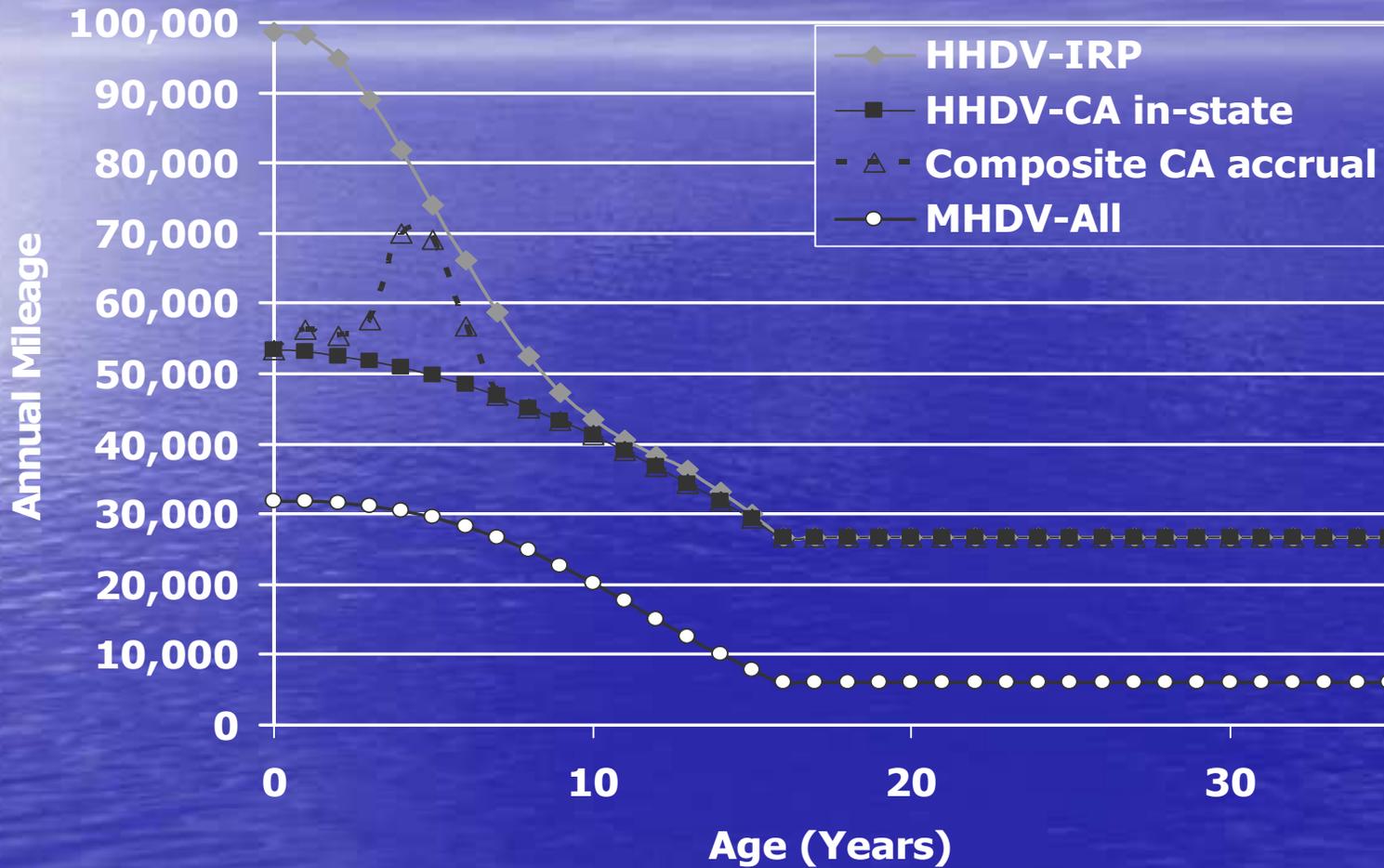
# Population

	Heavy-heavy duty diesel trucks	Medium-heavy duty diesel trucks
2007 EMFAC	<ul style="list-style-type: none"> <li>• CA registered – DMV</li> <li>• Add additional 33% to account for out-of-state trucks</li> </ul>	<ul style="list-style-type: none"> <li>• DMV registration data</li> <li>• No out-of-state trucks</li> </ul>
Proposed	<ul style="list-style-type: none"> <li>• Fleet specific                             <ul style="list-style-type: none"> <li>– Based on DMV registration and IRP data</li> <li>– 1 million out-of-state trucks in 2005, derived from IRP data</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Fleet specific                             <ul style="list-style-type: none"> <li>– Based on DMV registration and IRP data</li> <li>– 8,000 out-of-state trucks in 2005</li> </ul> </li> </ul>

# Annual Mileage Accrual Rate

EMFAC 2007	<ul style="list-style-type: none"><li>• Annual accrual rate<ul style="list-style-type: none"><li>– 1992 US Census Data</li><li>– One accrual schedule for each vehicle class and fuel</li></ul></li></ul>
Proposed	<ul style="list-style-type: none"><li>• Annual accrual rate<ul style="list-style-type: none"><li>– 2002 US Census Data</li><li>– One accrual schedule for each fleet</li></ul></li></ul>

# Annual Mileage Accrual Rates



# Fraction of Mileage Accrued in California

EMFAC 2007	<ul style="list-style-type: none"><li>● Assume all mileage accrued in CA</li></ul>
Proposed	<ul style="list-style-type: none"><li>● Interstate truck<ul style="list-style-type: none"><li>– International Registration plan datasets<ul style="list-style-type: none"><li>● CA IRP</li><li>● Sample of out-of-state IRP</li></ul></li></ul></li></ul>

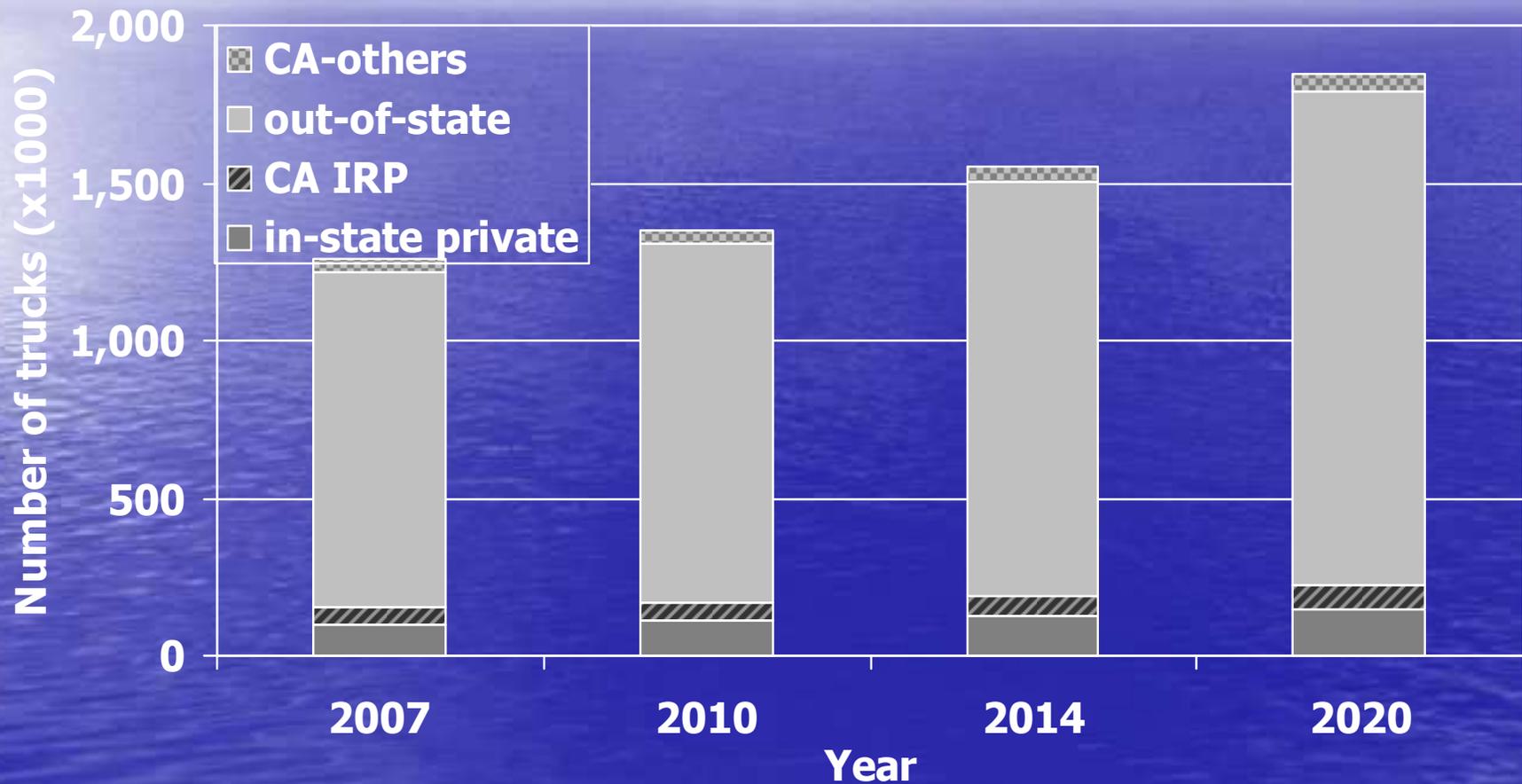
# Fraction of Mileage Accrued in California (HHDDT)

	Fleet	Fraction of Mileage	
EMFAC 2007	All fleets	100%	
Proposed	CA in-state	100%	
	CA registered IRP	59%	
	Interstate trucks from neighboring states	20%	Overall 6.5%
	Interstate trucks from non-neighboring states	3%	

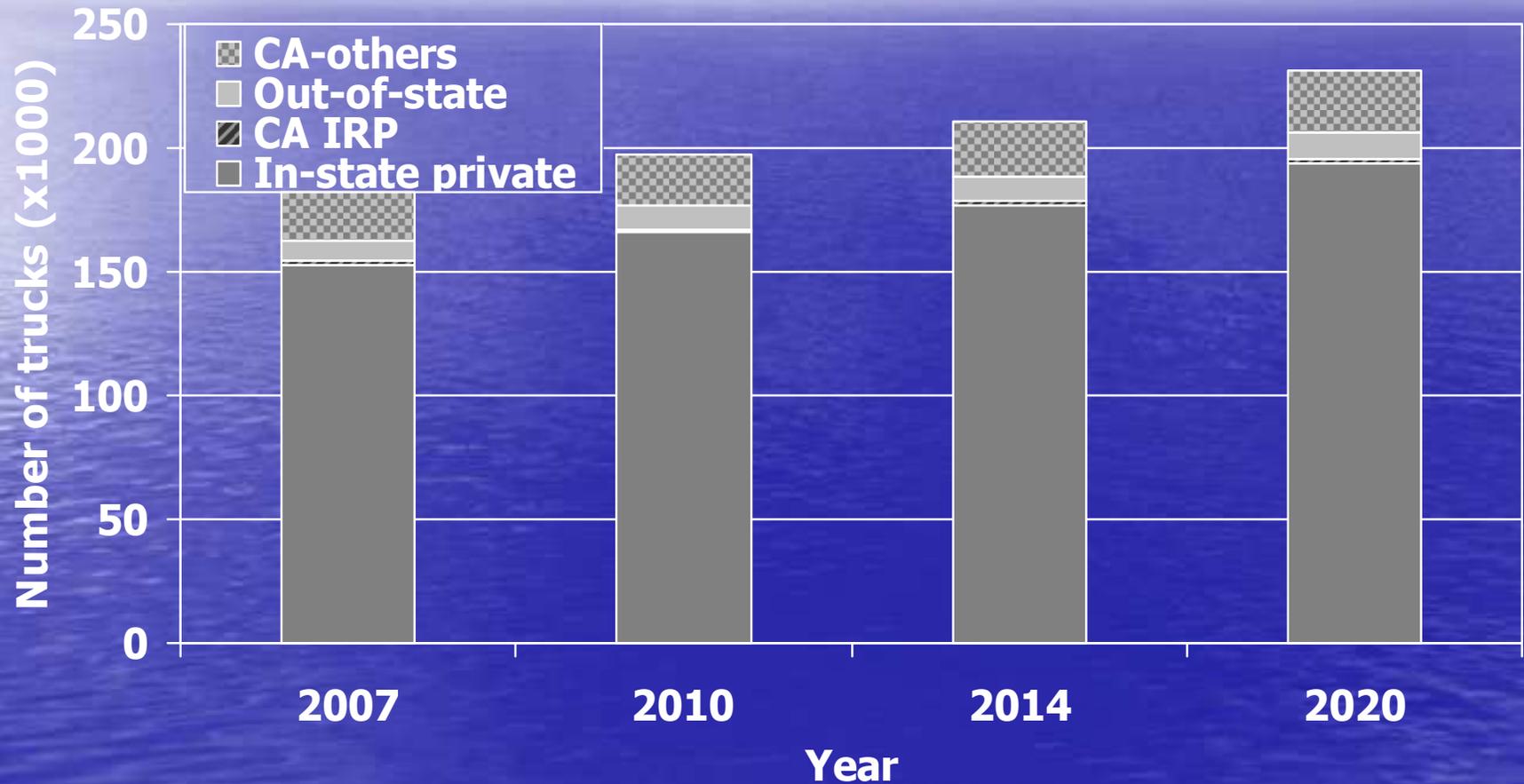
# Emission Rates

	Heavy-heavy duty diesel trucks	Medium-heavy duty diesel trucks
2007 EMFAC	<ul style="list-style-type: none"> <li>• Most current test data (CRC E55/59)</li> <li>• Based on accrual rate from 1992 US Census</li> </ul>	<ul style="list-style-type: none"> <li>• Prior studies</li> </ul>
Proposed	<ul style="list-style-type: none"> <li>• Same test data as in EMFAC2007</li> <li>• Reflect fleet specific lifetime mileage                             <ul style="list-style-type: none"> <li>– Fleet specific accrual</li> <li>– Migration from interstate to in-state fleet</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• New data source (CRC E55/59); analysis methodology consistent with HHDDT EMFAC2007 update</li> </ul>

# Preliminary Results – Statewide Annual HHDDT Population



# Preliminary Results – Statewide Annual MHDDT Population



# Preliminary Results – Statewide HHDDT VMT

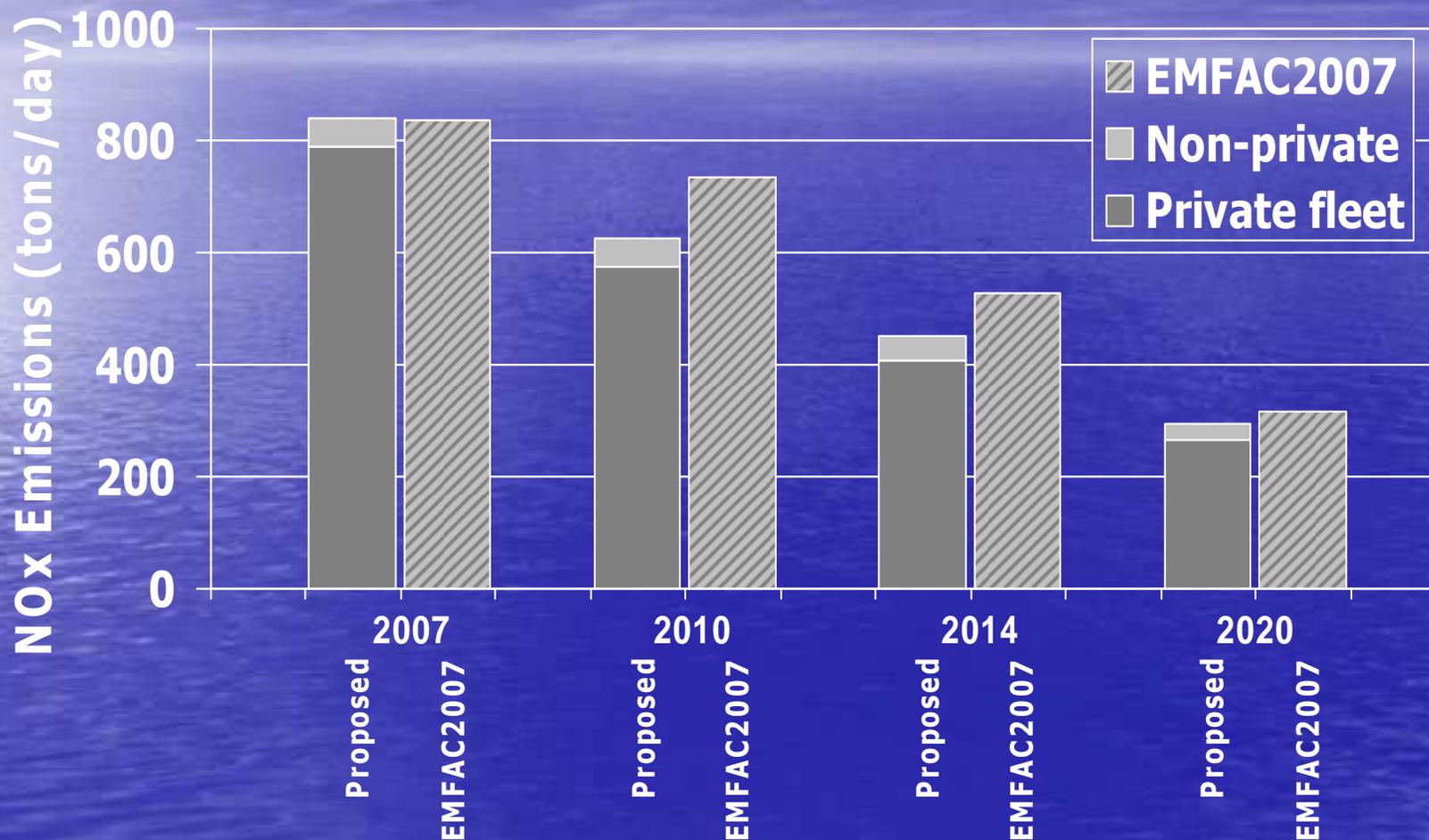


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# Preliminary Results – Statewide MHDDT VMT

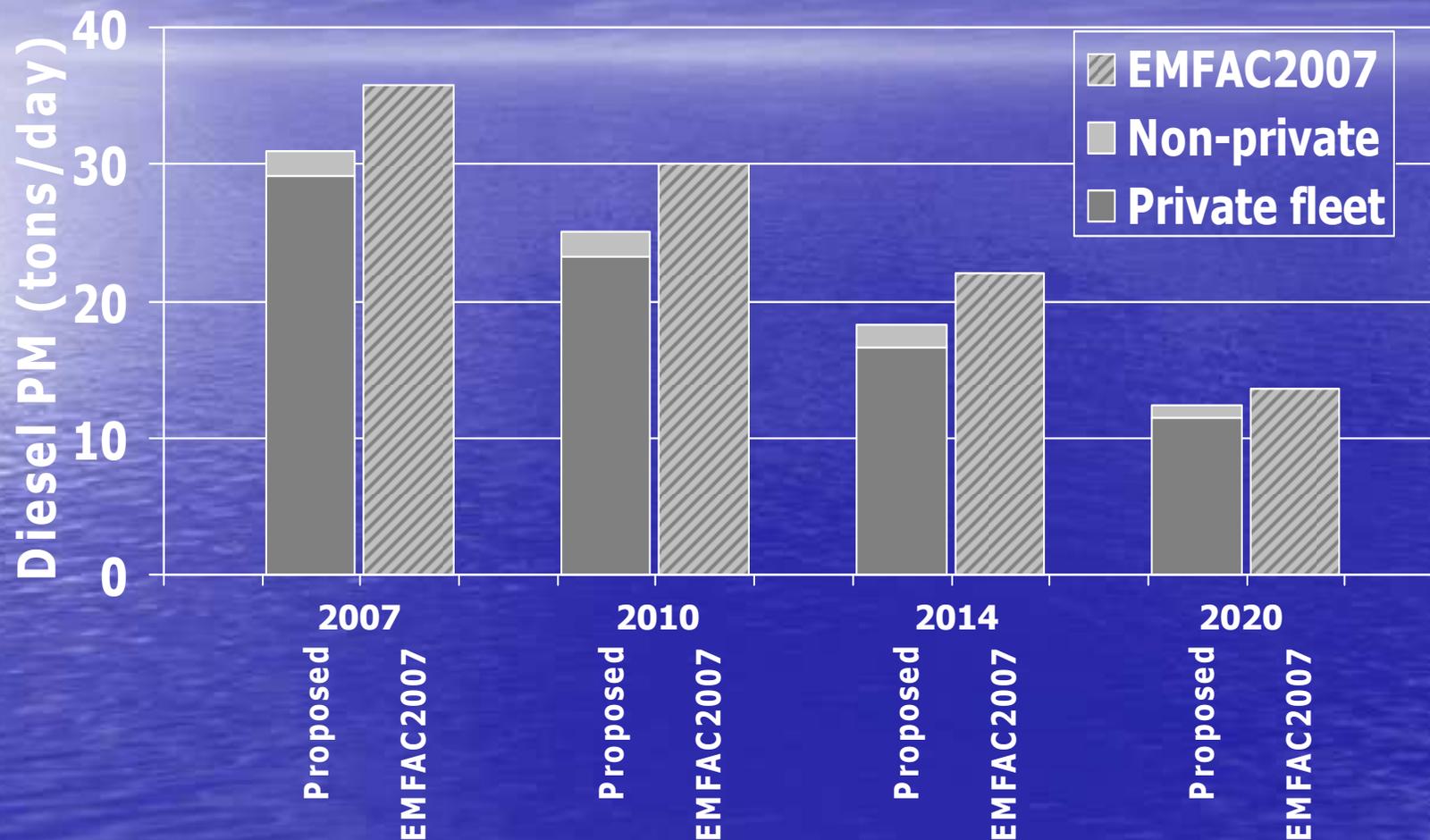


# Preliminary Results – Statewide HHDDT& MHDDT NOx



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# Preliminary Results – Statewide HHDDT & MHDDT DPM



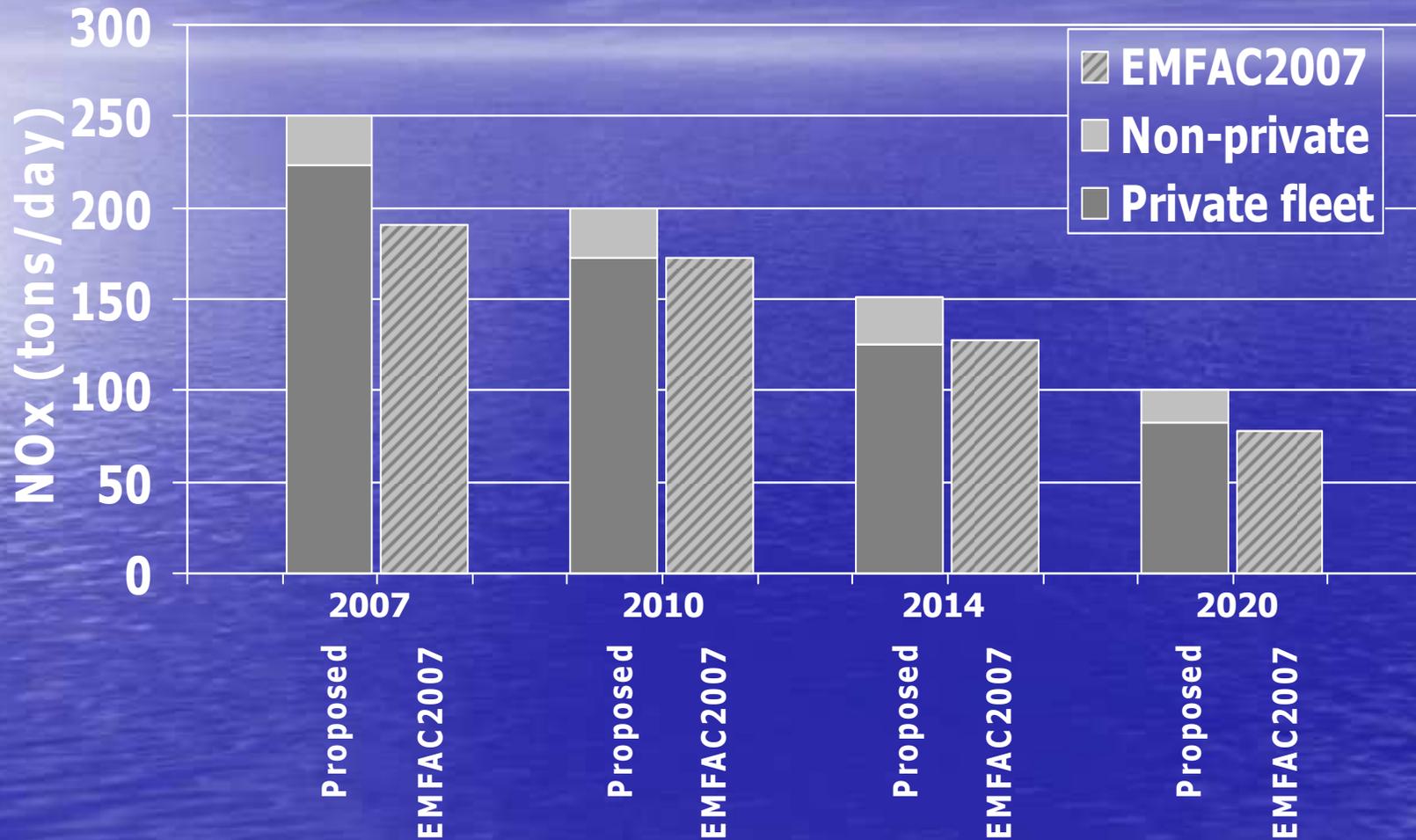
# Vehicle Miles Traveled: Spatial Allocation

	Heavy-heavy duty diesel trucks	Medium-heavy duty diesel trucks
EMFAC 2007	<ul style="list-style-type: none"><li>● Based on VMT survey analysis</li></ul>	<ul style="list-style-type: none"><li>● Allocate to air basin where registered</li></ul>
Proposed	<ul style="list-style-type: none"><li>● Fleet specific allocation<ul style="list-style-type: none"><li>– In-state: allocate to air basin where registered</li><li>– Interstate: VMT survey based</li></ul></li></ul>	<ul style="list-style-type: none"><li>● Allocate to air basin where registered</li></ul>

# Preliminary VMT Allocation

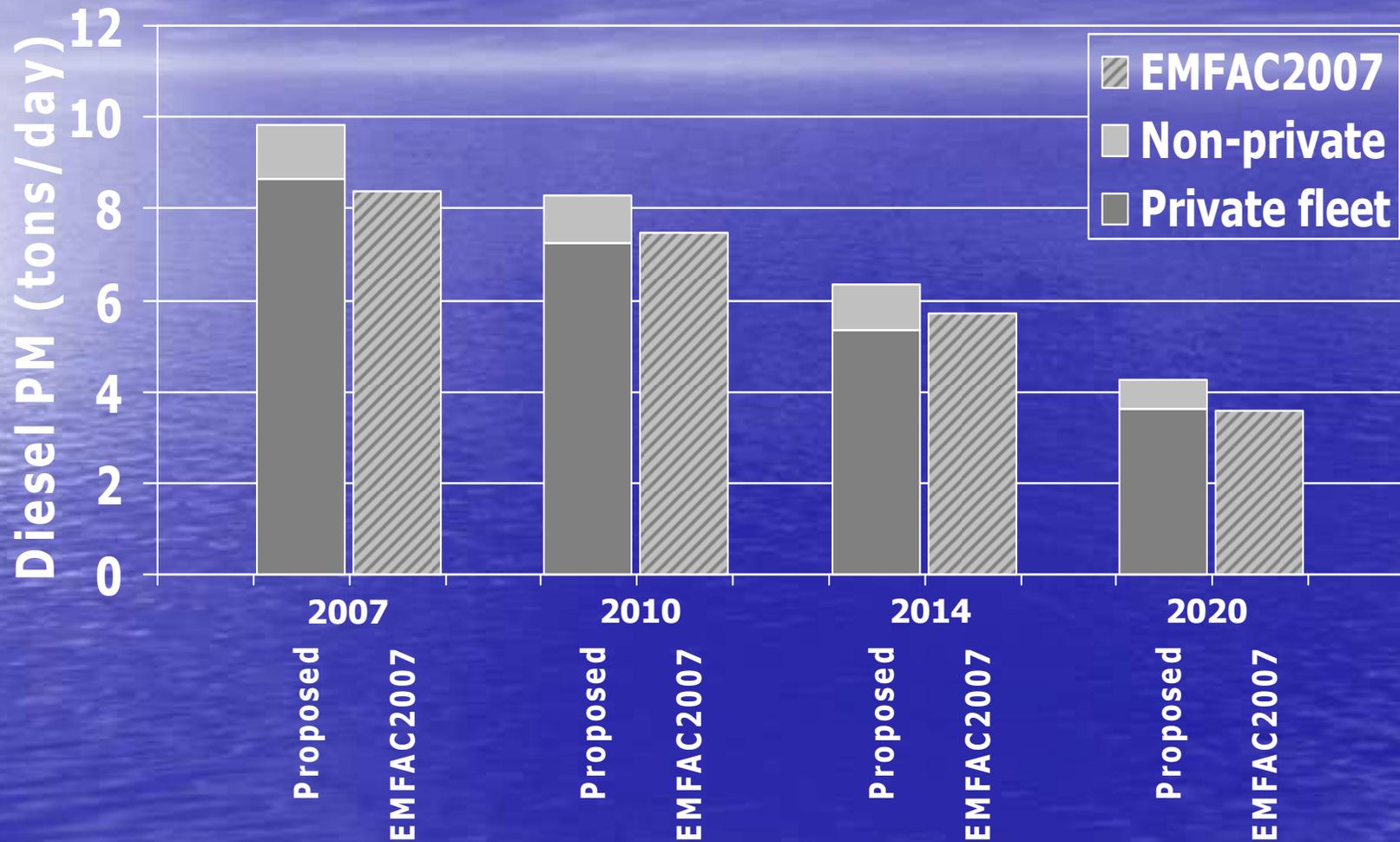
		South Coast	San Joaquin Valley
EMFAC 2007	Percent of Statewide HHDDT VMT	20%	30%
	Average HHDDT Age (Year)	11.5	11.5
Proposed	Percent of Statewide HHDDT VMT	27%	24%
	Average HHDDT Age (Year)	9.7	7.7

# Preliminary Results – South Coast HHDDT&MHDDT NOx

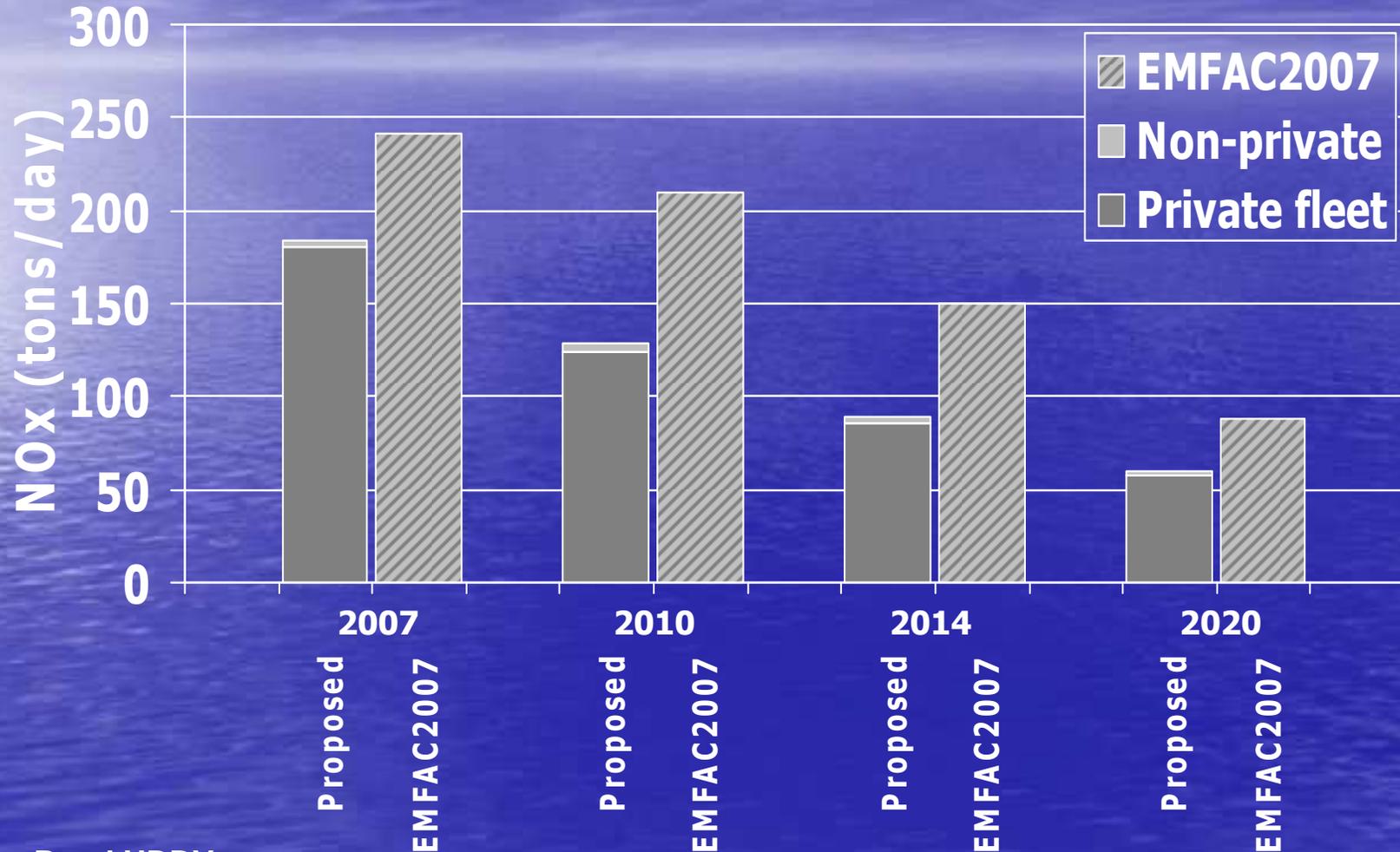


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# Preliminary Results – South Coast HHDDT&MHDDT DPM

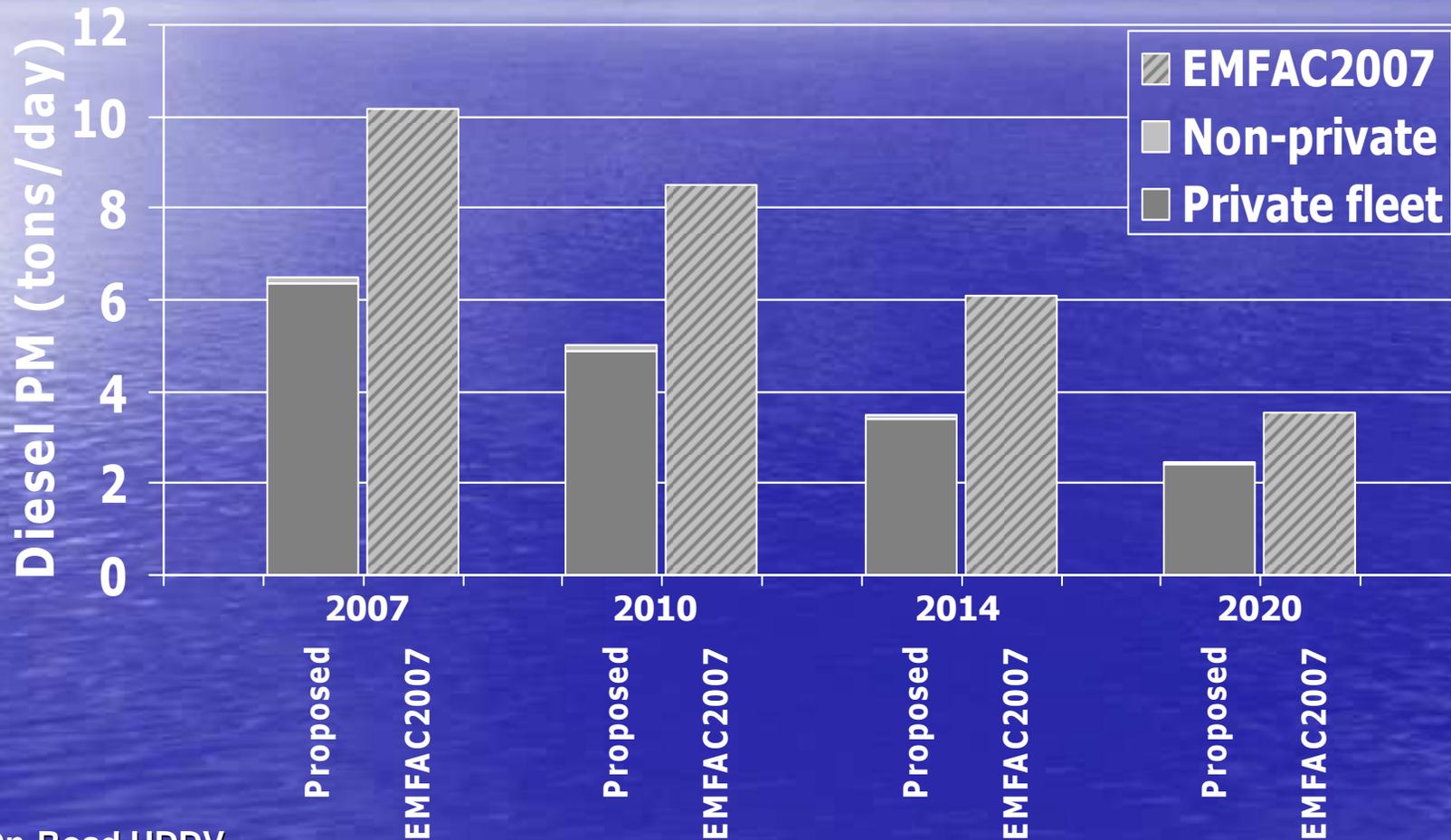


# Preliminary Results – San Joaquin Valley HHDDT&MHDDT NOx



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# Preliminary Results – San Joaquin Valley HHDDT&MHDDT DPM



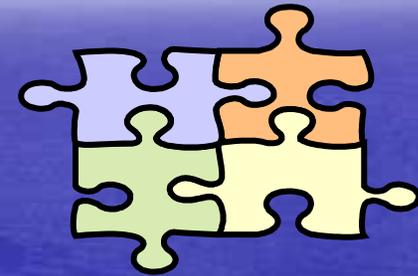
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# Next Steps in Refining Inventory

- Obtain additional IRP data
  - Refine population estimates
  - Re-evaluate fraction of miles driven in California
- Assess additional data sources
  - International Fuel Tax Agreement (IFTA) data
- Continue to evaluate spatial allocation
- Integrate additional vehicle types into the Private Fleet inventory
  - Special equipment (e.g. special construction)
  - Buses (tour buses, etc.)
  - Privately owned school buses
- Conduct new fleet/industry-specific surveys

# On-going and Upcoming Surveys

- On-going
  - Dump trucks
  - Agricultural trucks
- Upcoming
  - Broad on-line survey to be posted in August:  
[www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm](http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm)



# Contact Information

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# Questions

