

EMFAC2014



November 7, 2014

Outline

- Introduction
- Major Model Changes
- Current Version v0.3.4
- VMT comparison
- Emissions Comparison – Default models
 - Statewide emissions EMFAC2011 vs. EMFAC2014 default
- Emissions Comparison Using Equivalent VMT
 - Emissions, EMFAC2011 vs. EMFAC2014 SG (Same VMT)
- Next Steps
- Demo

Introduction – Purpose of EMFAC

- Supports Air Quality Planning & SIPs
 - 2008 Ozone standard
 - PM2.5 plans
- Supports Rulemaking
 - Rules to set emission standards for new vehicles
 - Programs to control in-use vehicle emissions
- Supports Analyses that need to be Consistent with GHG inventory
 - New EMFAC “default” uses VMT estimates calculated such that the associated fuel use matches historical fuel sales, similar to GHG inventory

Introduction – Previous Workshops

- June 2013
 - Model Architecture
 - Methodologies
 - Socio-econometric model to forecast VMT and new sales
 - Survival Rates
 - VMT spatial allocation
- October 2013
 - Changes made to light duty emission rates
 - Approach to reflect ACC and Truck & Bus Rule
 - Heavy duty emission rates
 - Heavy duty activity
 - Preliminary results

Introduction – On-Going Public Process

- EMFAC2014 released to expert beta testers
 - Alpha versions, July 9 & Aug. 8
 - Beta version, Oct. 16
- Expert Beta Testers – Thanks!
 - SCAQMD, SJVAPCD, SACAQMD, BAAQMD, SCAG, SACOG, and CALTRANS
- Initial public release, Nov. 14th
- Official Release of EMFAC2014 by Dec. 31st
- In early 2015, submit to USEPA for action

Introduction – SIP Development 2015

- SIP-related work in late 2014
 - Request 2015 FSTIP or more recent data from MPOs/RTPAs
 - Process MPO/RTPA data for use in EMFAC2014
- SIP-related work in 2015
 - Early 2015 - Submit EMFAC2014 to USEPA
 - April 2015 - San Joaquin Valley annual PM_{2.5} SIP
 - EMFAC2014-based inventory w/ latest SJV MPO/RTPA data
 - Request for ARB approval in April 2015
 - Late 2015
 - USEPA Approval of EMFAC2014
 - Request USEPA action on SJV annual PM_{2.5} SIP by Dec.

EMFAC2014 Major Model Changes

- One model with new programming architecture
- Incorporates user feedback from alpha-beta testing
- Emission estimates through 2050
- Support for SB375 analyses
- Provides users capability to calculate hourly emissions

EMFAC2014 Major Model Changes (Continued)

- EMFAC2011 'Default' was based on MPO data
- EMFAC2014 'Default' model supports conducting analyses that need to be consistent with GHG inventory
 - Fuel based activity model that uses VMT estimates calculated such that the associated fuel use matches historical fuel sales, similar to GHG inventory
- New forecast methods involve socio-econometric modeling of new vehicle sales and VMT growth
- Vehicle population from DMV2012 and earlier

EMFAC2014 Major Model Changes (Continued)

- Data Updates to the 'Default' Model
 - Diesel emission factors
 - Based on new ARB & AQMD test data from 2007+ MY trucks
 - Current EPA and ARB regulations and standards:

Regulation	EMFAC2011	EMFAC2014
Advanced Clean Cars	No	Yes
Truck & Bus Rule	2010 Amendment	2014 Amendment
TTGHG&Phase 1	No	Yes

- Iterative approach for modeling HD population and Truck & Bus Rule compliance

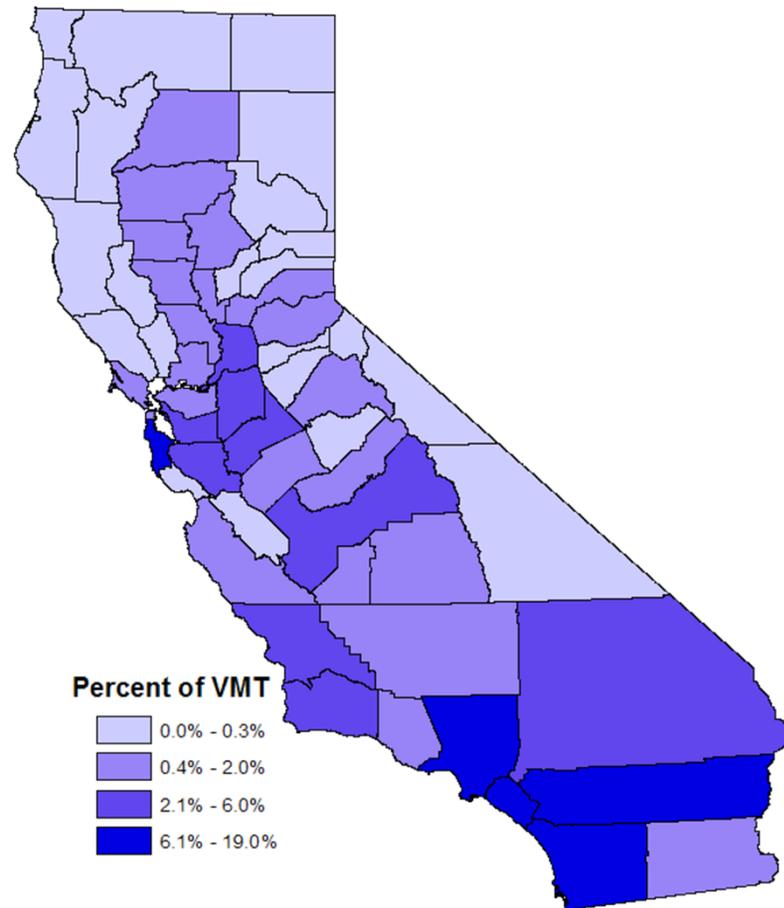
'Default' VMT Comparison

VMT Comparison between
EMFAC2011 default (MPO VMT) &
EMFAC2014 default (Fuel Matching VMT)

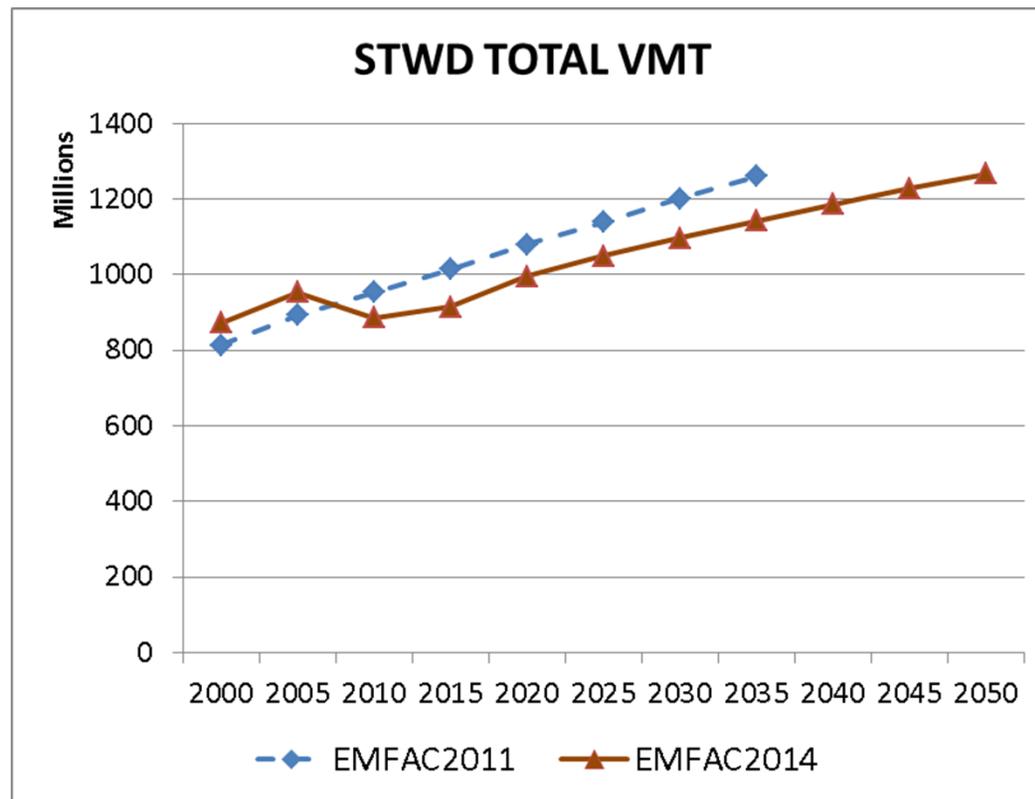
VMT Comparison

- Overall VMT growth trends are similar at statewide level
 - EMFAC2014 default model reflects recession and accounts for non-taxable diesel fuel
 - VMT in EMFAC2014 is mostly lower beyond 2015
- In general, EMFAC2014 has higher VMT in SC and lower in SJV relative to EMFAC2011
 - Spatial allocation for LDV based on National Transportation Atlas Database(NTAD) and vehicle category specific growth for HD may differ from MPO VMTs

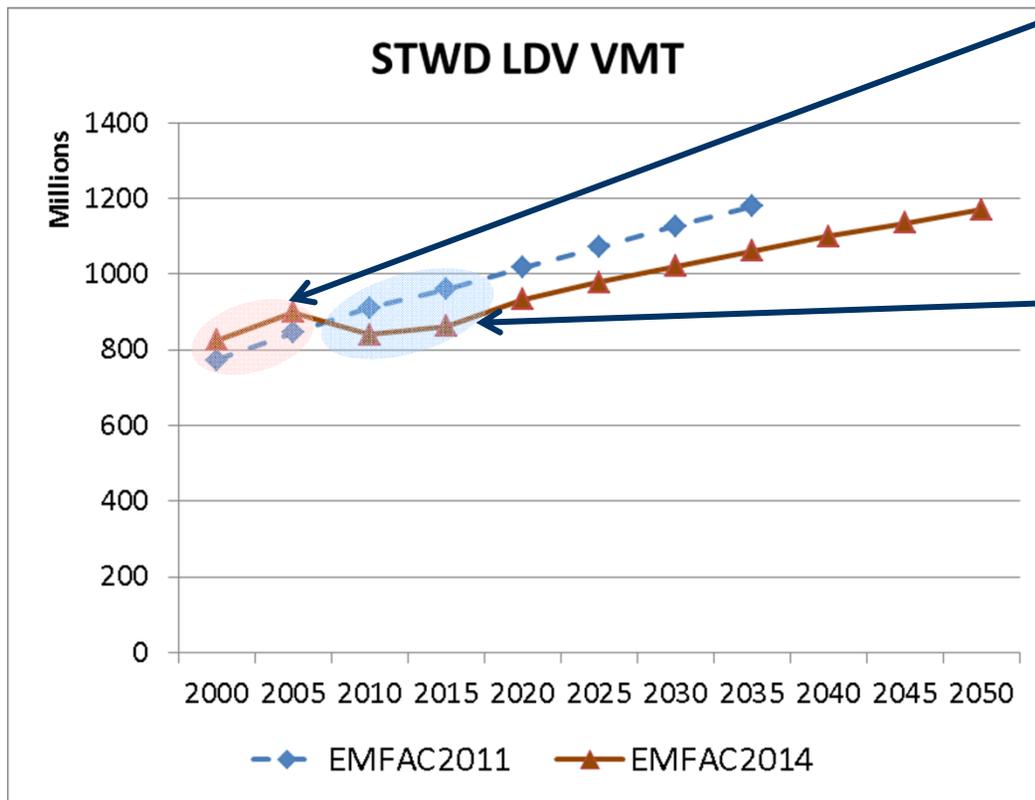
EMFAC2014 On-Road VMT Distribution



EMFAC 2014 Default VMT - Statewide



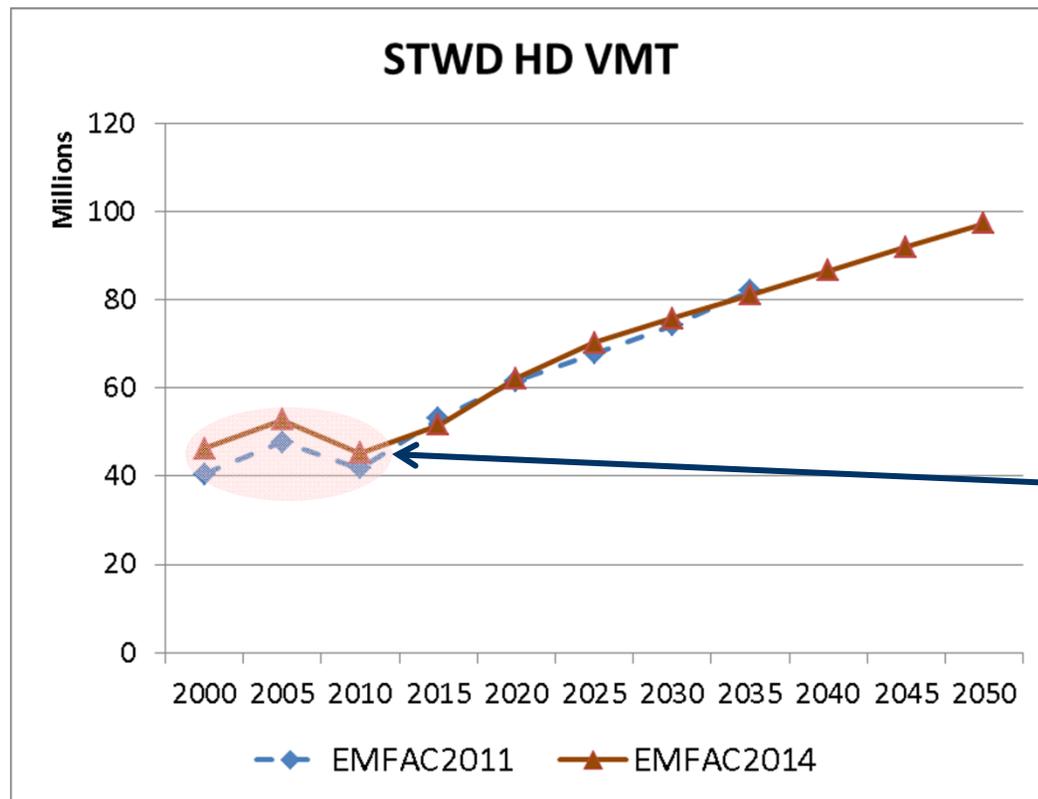
EMFAC 2014 Default VMT - Statewide



- EMFAC2011 underestimated fuel use in 2000&2005

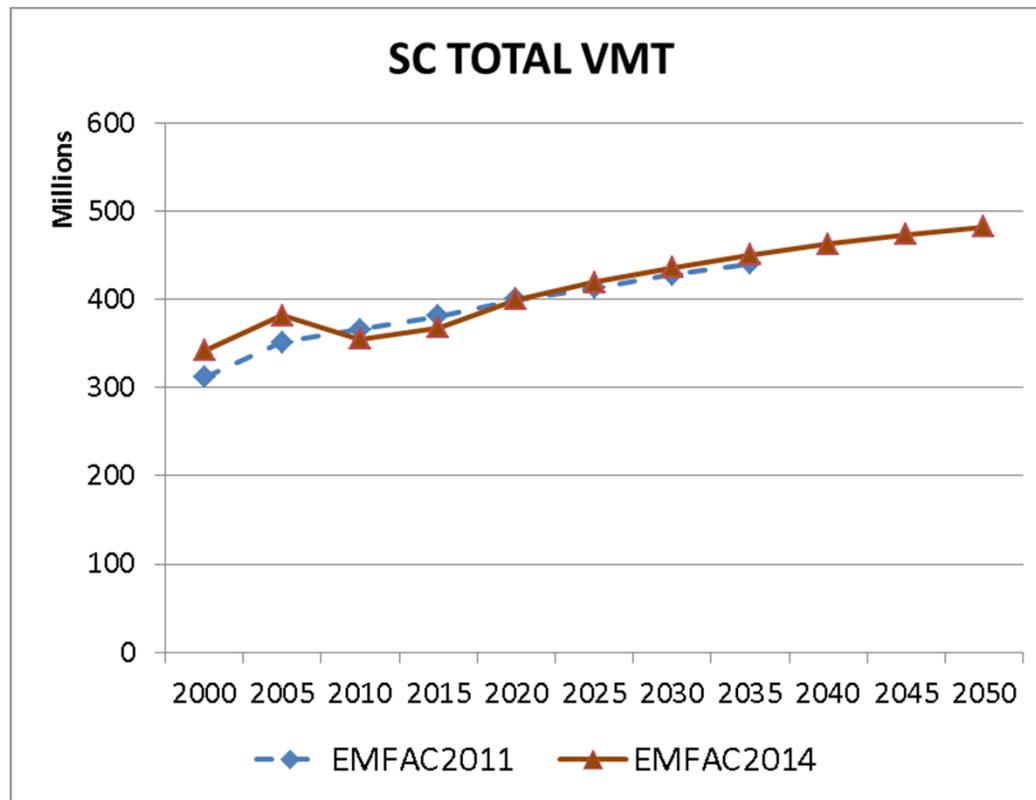
- Reflect lower taxable gasoline sales during recession(2010)

EMFAC 2014 Default VMT - Statewide

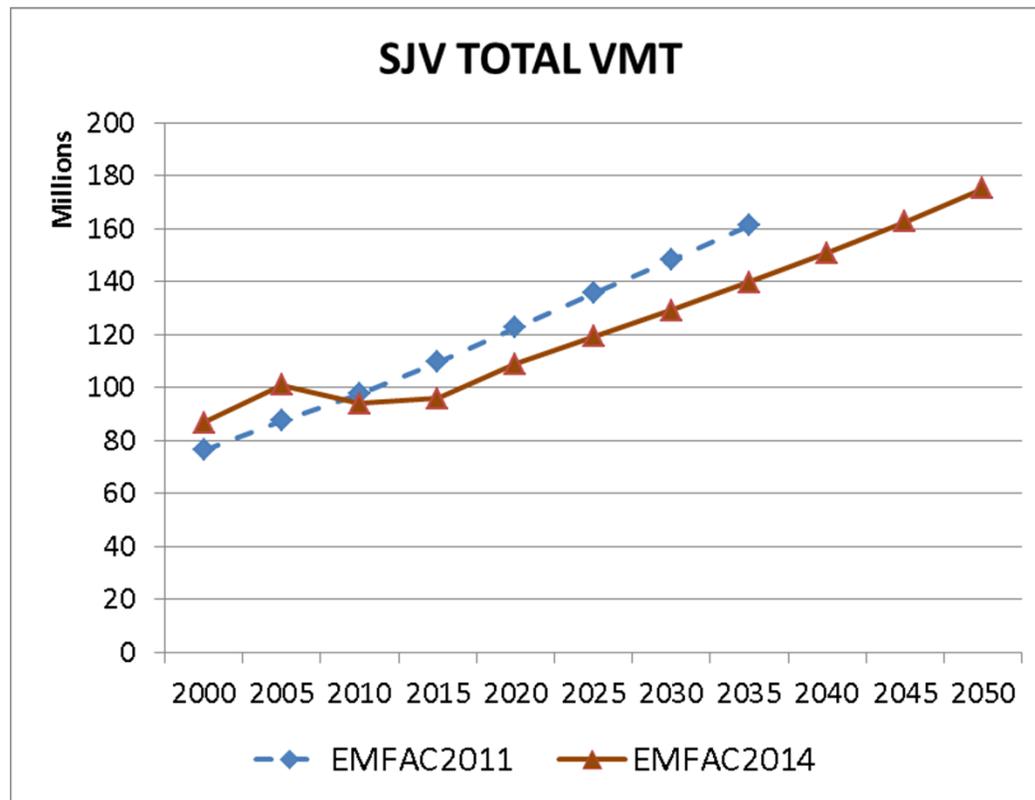


- Difference in Fleet mix
- Matching fuel use
- Updated Fuel economy assumption

EMFAC 2014 Default VMT - SC



EMFAC 2014 Default VMT - SJV



EMFAC2014 “Default” Emissions

Emissions Comparison of
EMFAC2011 default (MPO VMT) &
EMFAC2014 default (Fuel Matching VMT)

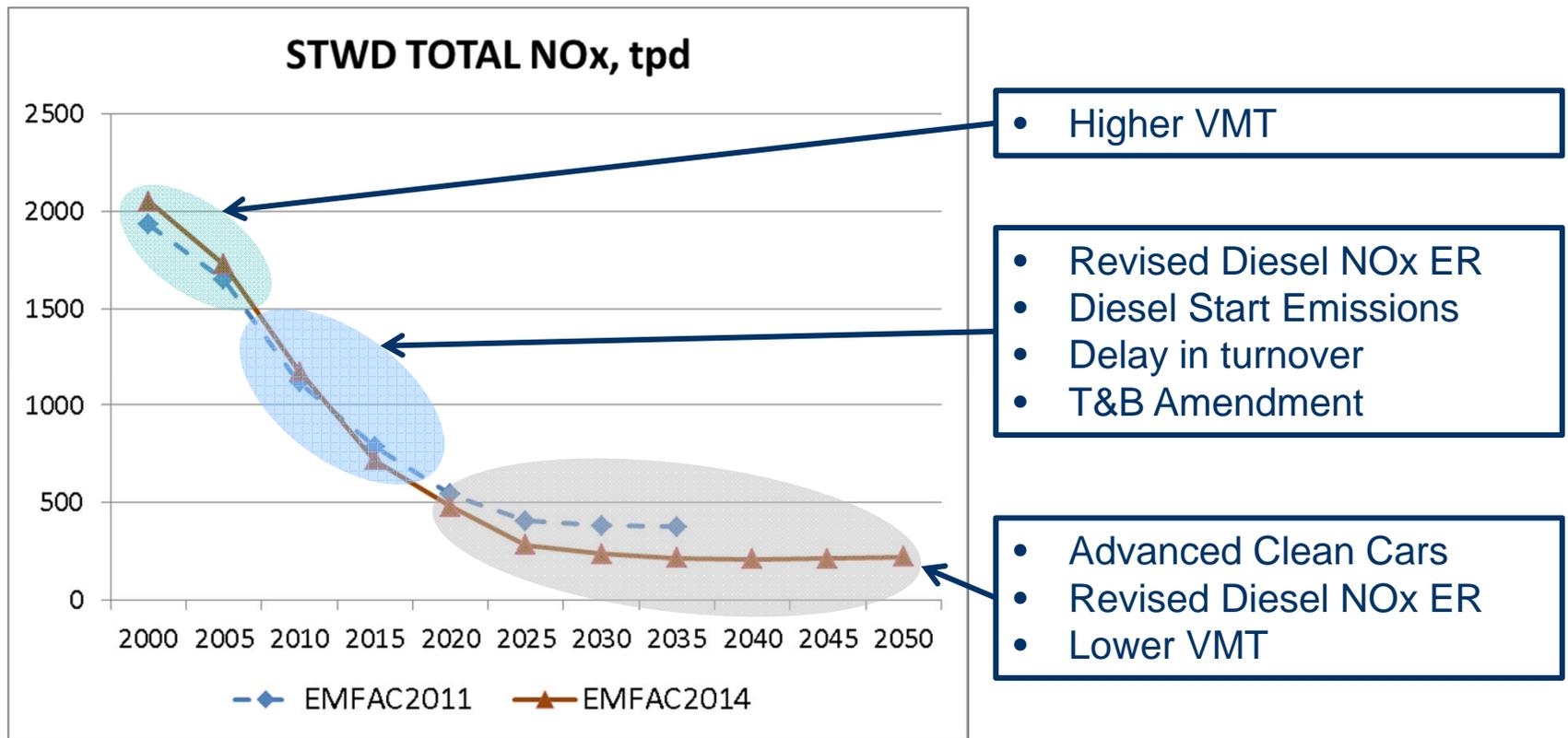
EMFAC2014 Default 'Recap'

- EMFAC2014 Default Supports Analyses that need to be Consistent with GHG inventory
 - New EMFAC “default” uses VMT estimates calculated such that the associated fuel use matches historical fuel sales, similar to GHG inventory ('Fuel Matching VMT')
- As indicated in the prior slides...
 - Reflects recession & non-taxable diesel fuel
 - VMT in EMFAC2014 is mostly lower beyond 2015
 - National Transportation Atlas Database (NTAD) based spatial allocation for LDV and vehicle category specific growth for HD may differ from MPO VMTs

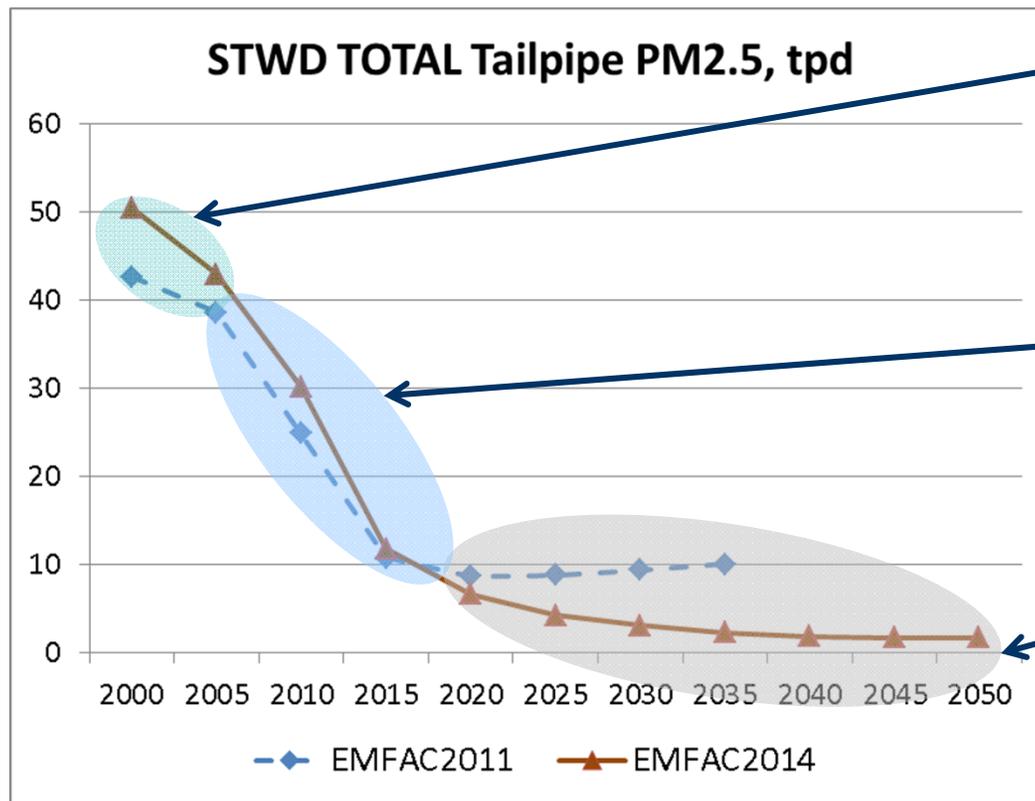
EMFAC2014 Default Emissions

- EMFAC2014 default statewide emissions are...
 - In general, higher in the 2000 & 2005
 - Higher VMT to match taxable and non-taxable fuel
 - Inclusion of crankcase emissions
 - In general, lower beyond 2025
 - Lower VMT
 - New vehicle standards
 - Updates to Heavy Duty Diesel Emission Factors
 - In-use regulations

EMFAC2014 Default Emissions- Statewide



EMFAC2014 Default Emissions- Statewide

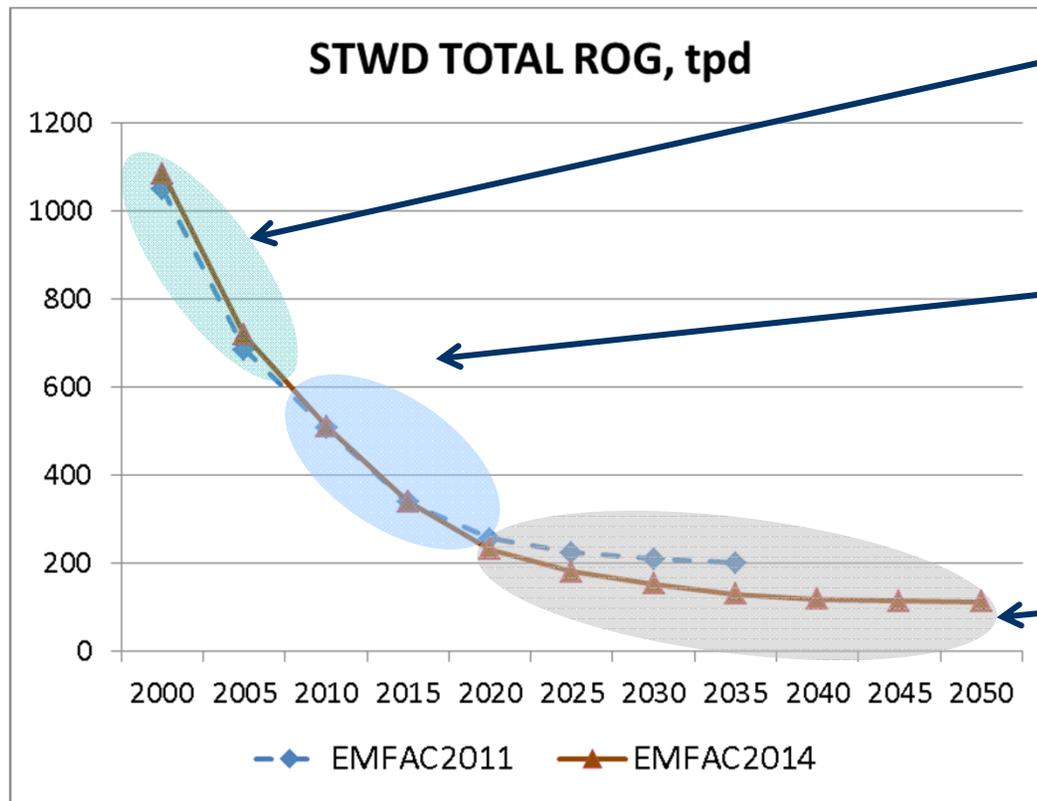


- Higher VMT
- Inclusion of crankcase emissions

- Revised LDV PM ER
- Revised Diesel PM ER (MY mismatch)
- T&B Amendment

- Lower VMT
- Advanced Clean Cars
- Diesel PM filter more effective than projected

EMFAC2014 Default Emissions- Statewide

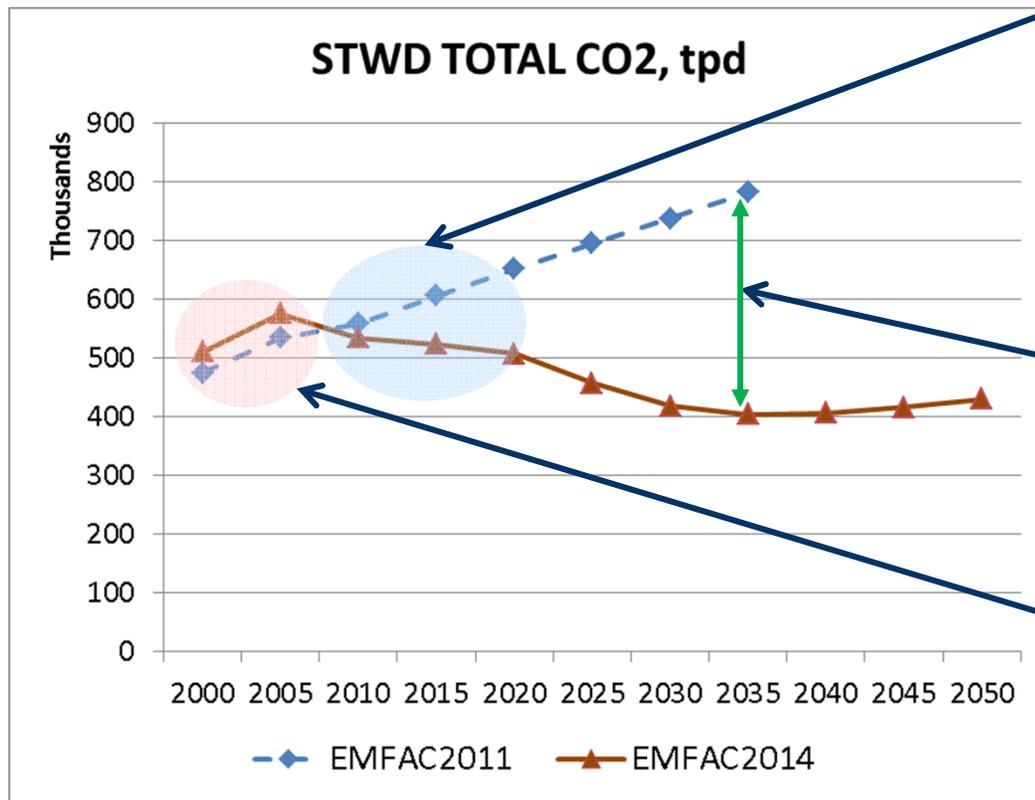


- Higher VMT
- Inclusion of crankcase emissions

- Change in zero-evap technology penetration
- Inclusion of crankcase emissions
- Lower VMT

- Lower VMT
- Advanced Clean Cars
- ZEV Requirements
- Improved crankcase emission control on trucks
- Updated HC speciation

EMFAC2014 Default Emissions- Statewide



- Pavley I federal Standard for model year 2012-2016

- Advanced Clean Car for model year 2016+
- Phase 1
- Tractor-Trailer Regulation
- Lower default VMT

- Higher VMT to match fuel
- Revised CO2 emission rates



Comparison EMFAC2014 SG vs. EMFAC2011

Comparison of inventories from EMFAC2011 vs.
EMFAC2014 SG Using EMFAC2011 VMT

EMFAC2014 SG vs. EMFAC2011 - Approach

- EMFAC2011 VMT at the vehicle class level is used as “user defined” inputs for EMFAC2014 SG
- EMFAC2011 VMT is the latest complete set of MPO VMT
- Once new regional VMTs are available, the same approach will be used for SIP and conformity purposes

EMFAC2014 SG vs. EMFAC2011- Results

- Beyond 2025, lower emissions in EMFAC2014 SG for most pollutants, except ROG, due to in-use regulations, newer, more stringent standards, and updates to heavy duty diesel emission factors
- The reduction of ROG from ACC was off-set by a revision to the assumptions for evap. control technology penetration and HC speciation. The impact of this revision in EMFAC2014 is:
 - For pre-2020 models, fewer zero evap vehicles and more near-zero evap vehicles; and
 - An increase in ROG/HC ratio

EMFAC2014 SG vs. EMFAC2011- Results

(continued)

- Since the same set of VMT was used, differences in emissions are due to fleet average emission rates
 - Age distribution from new sales and survival rates
 - HD emission rates revisions
 - Reflecting Advanced Clean Car
- Regional differences for light duty vehicles due to the region specific new sales and survival rates while heavy- and medium-heavy's age distributions are highly influenced by the Truck & Bus Rule

EMFAC2014 Major Model Changes ‘Recap’

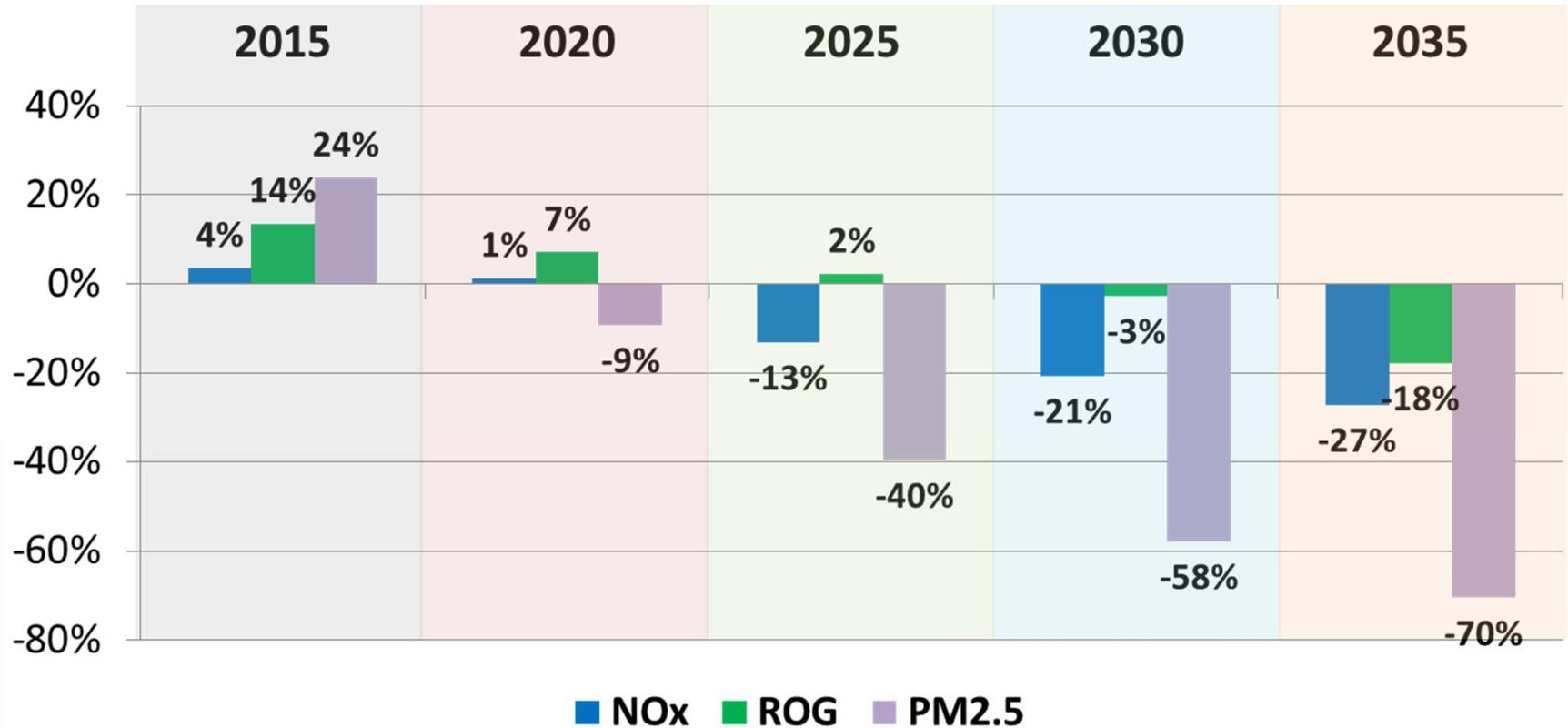
- Data Updates to the EMFAC2014 Model
 - Diesel emission factors
 - Based on new ARB & AQMD test data on 2007 and 2010 standards Class 8 trucks
 - Current EPA and ARB regulations and standards:

Regulation	EMFAC2011	EMFAC2014
Advanced Clean Cars	No	Yes
Truck & Bus Rule	2010 Amendment	2014 Amendment
TTGHG&Phase 1	No	Yes

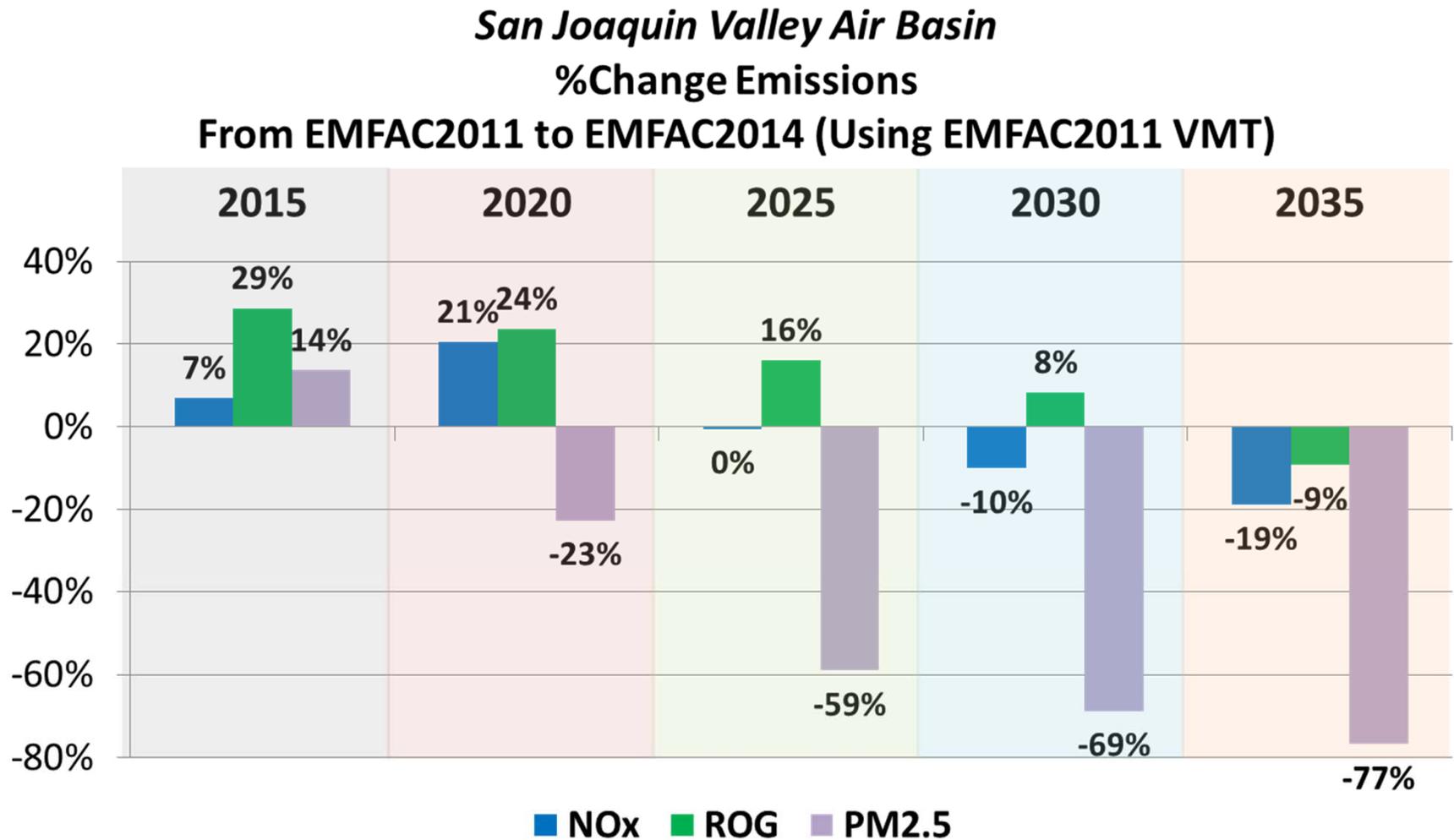
- Iterative approach for modeling HD population and Truck & Bus Rule compliance

Emission Changes – SC

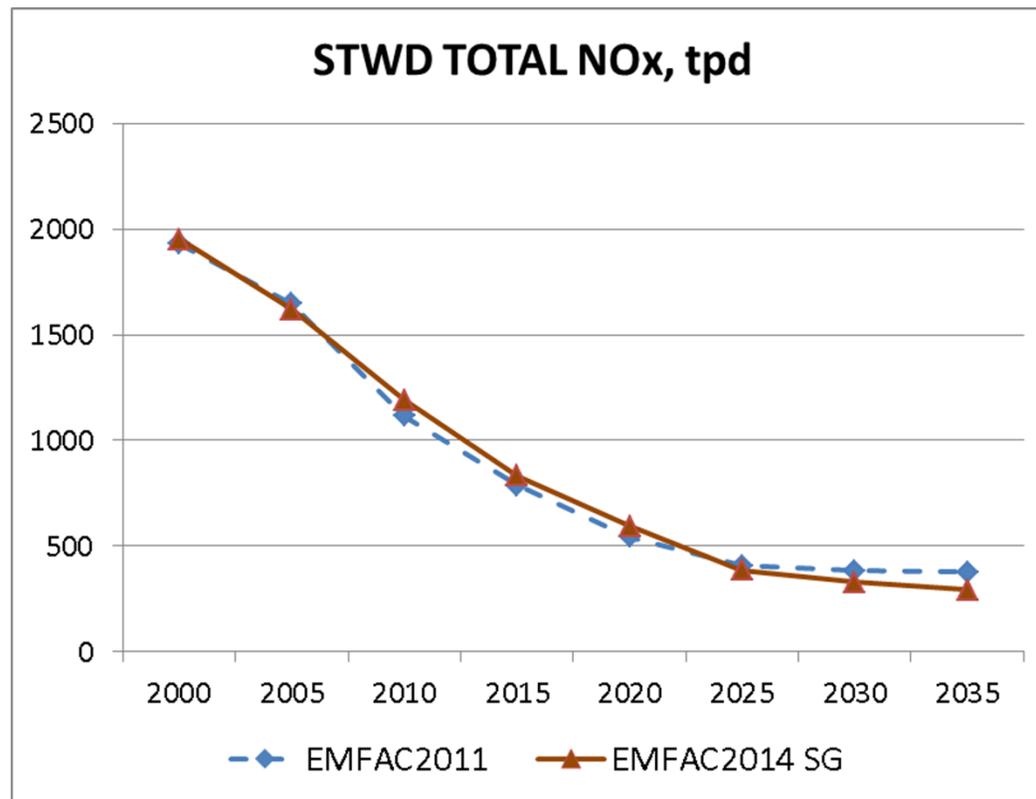
South Coast Air Basin
%Change in Emissions
From EMFAC2011 to EMFAC2014 (Using EMFAC2011 VMT)



Emission Changes – SJV

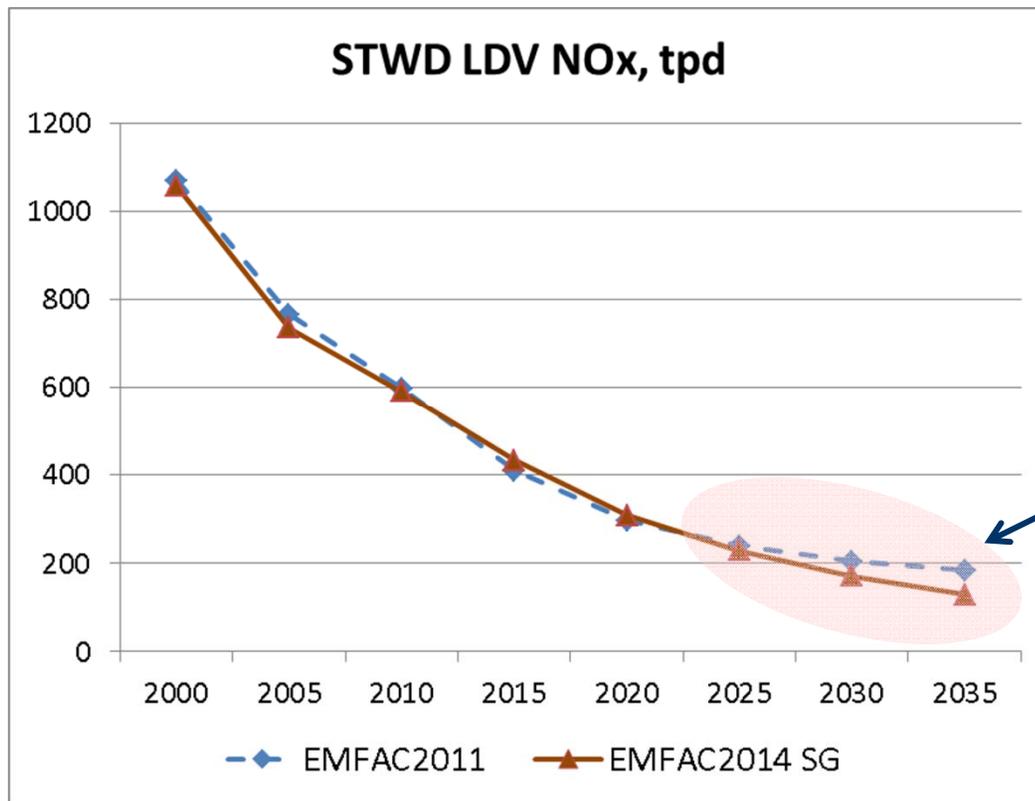


EMFAC2014 SG vs. EMFAC2011- Statewide



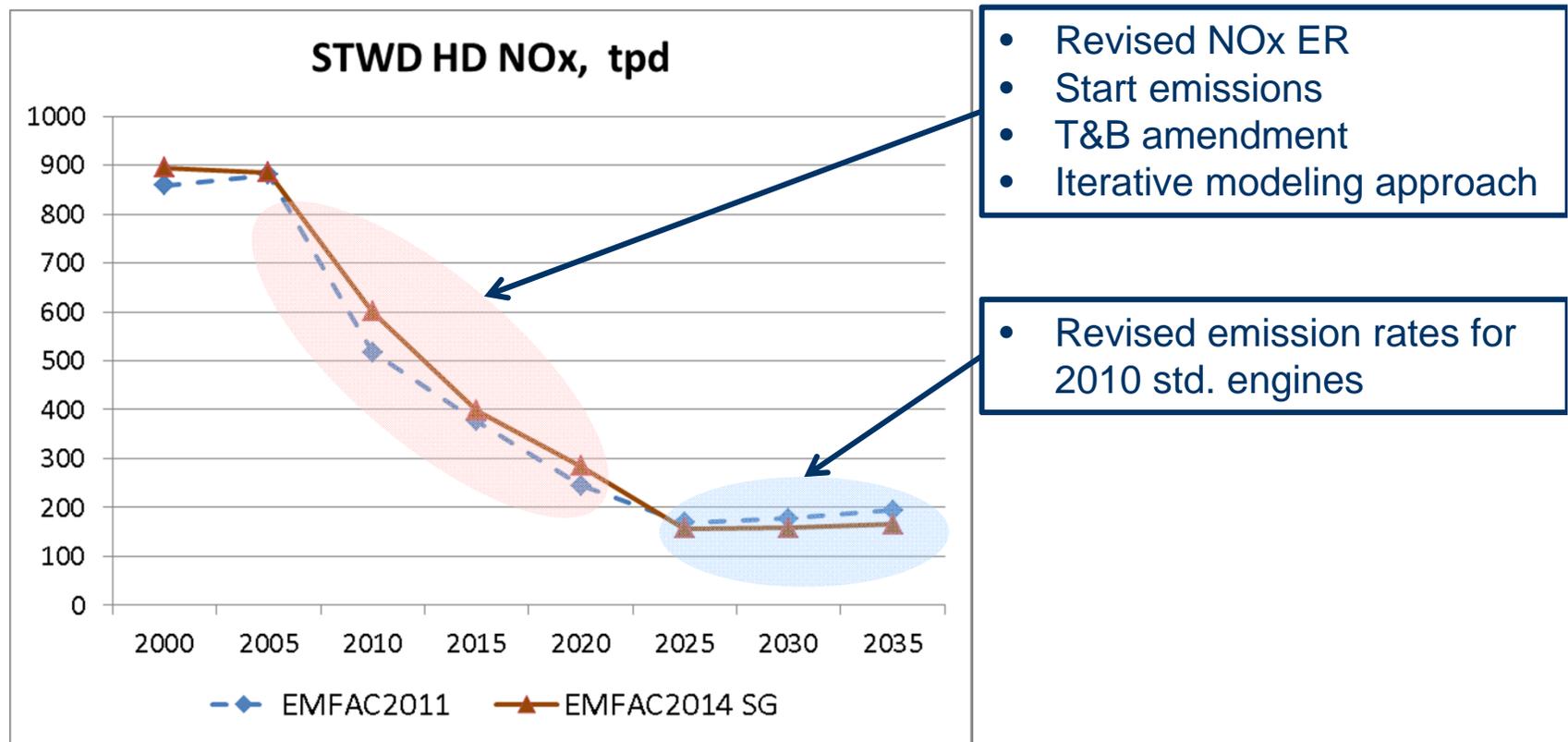
Both models are using EMFAC2011 VMT

EMFAC2014 SG vs. EMFAC2011- Statewide

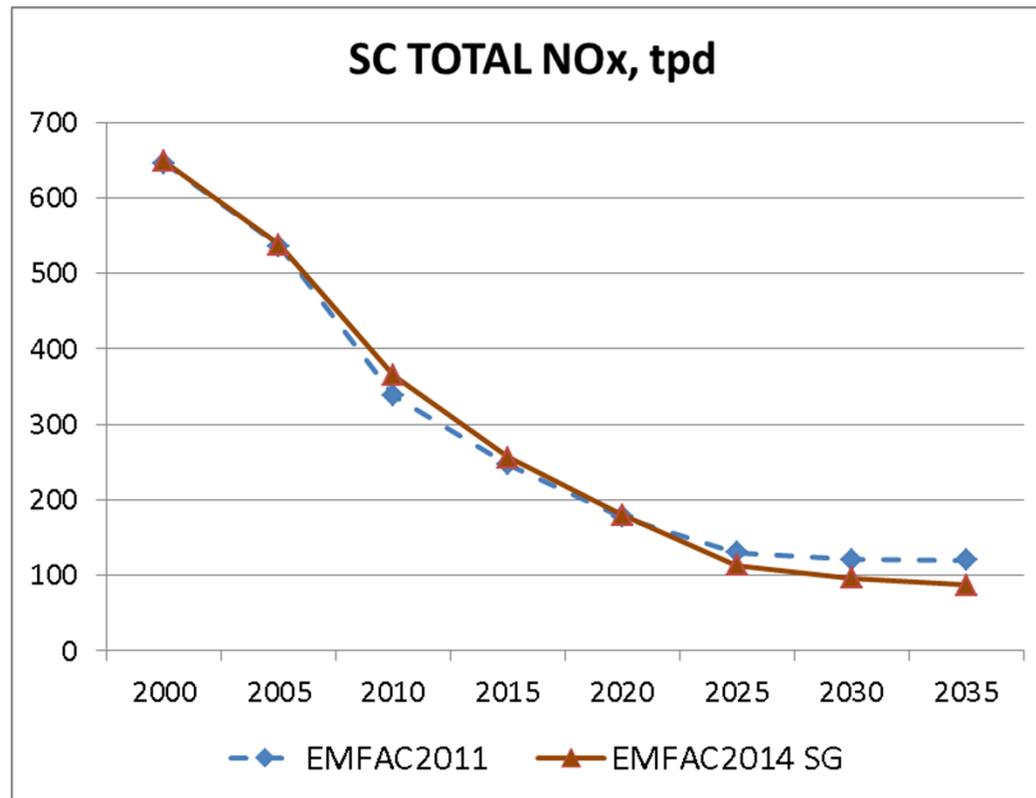


• Advanced Clean Cars

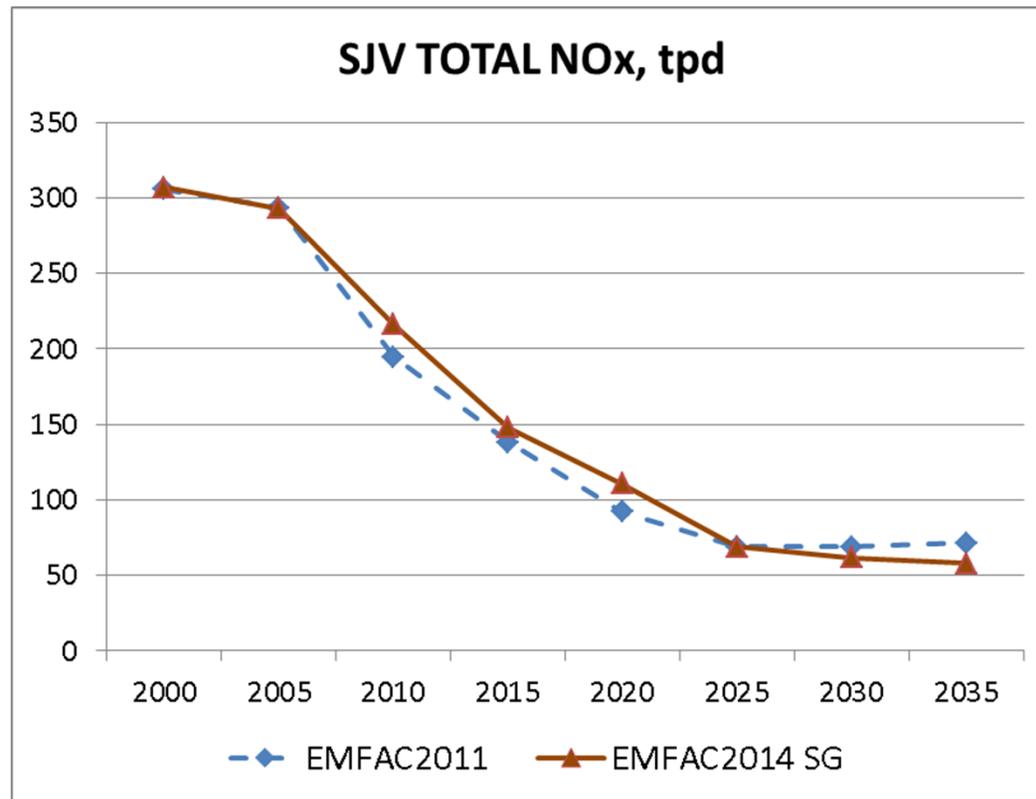
EMFAC2014 SG vs. EMFAC2011- Statewide



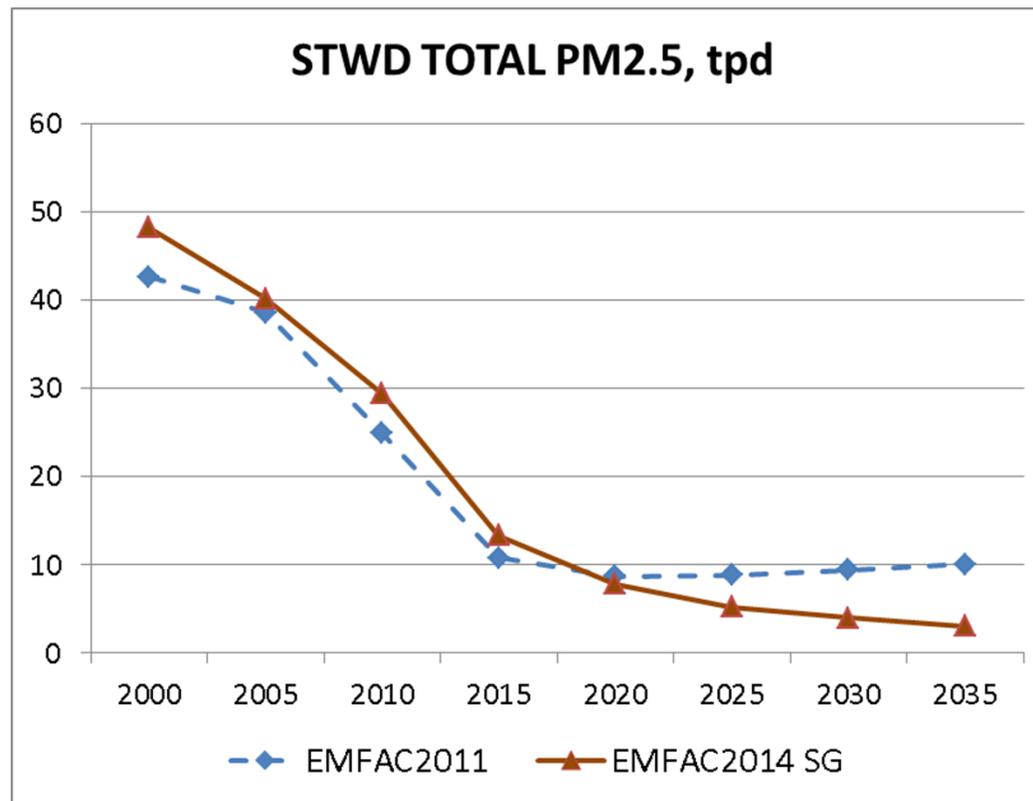
EMFAC2014 SG vs. EMFAC2011 - SC



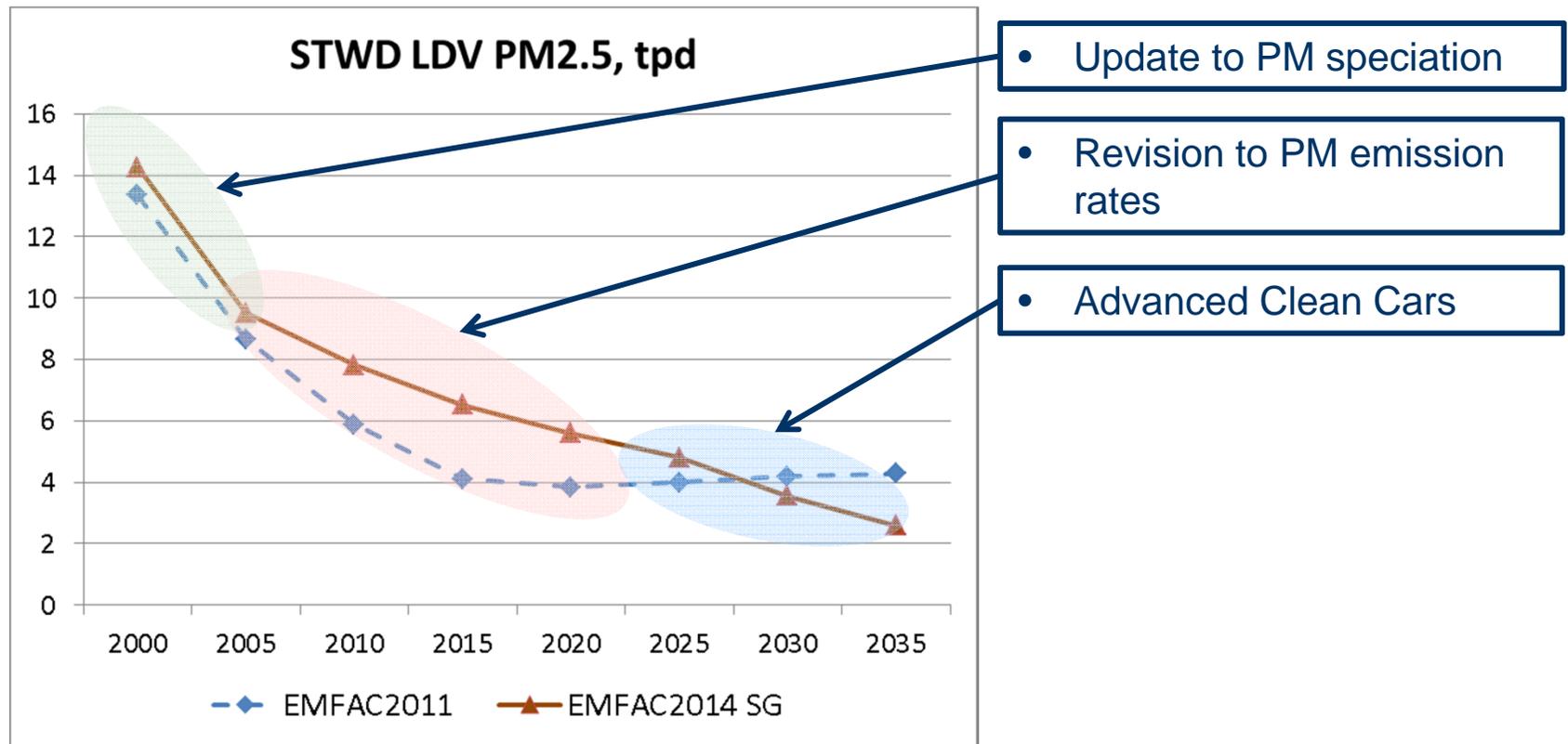
EMFAC2014 SG vs. EMFAC2011 - SJV



EMFAC2014 SG vs. EMFAC2011- Statewide

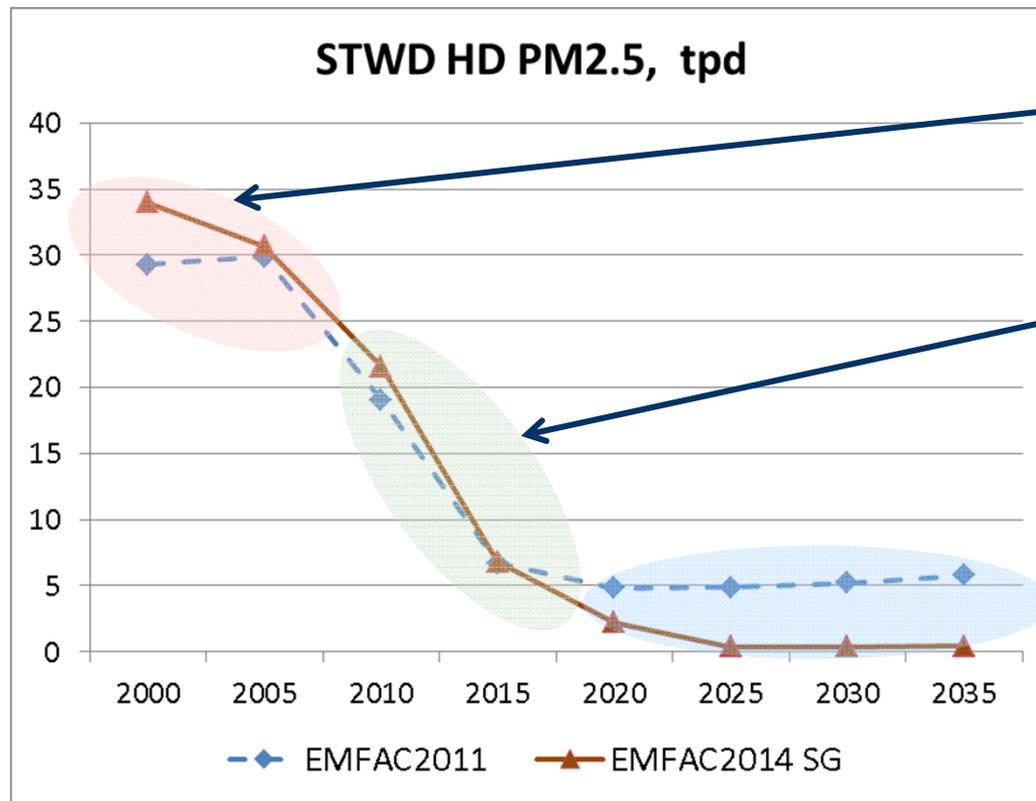


EMFAC2014 SG vs. EMFAC2011- Statewide



Both models are using EMFAC2011 VMT

EMFAC2014 SG vs. EMFAC2011- Statewide

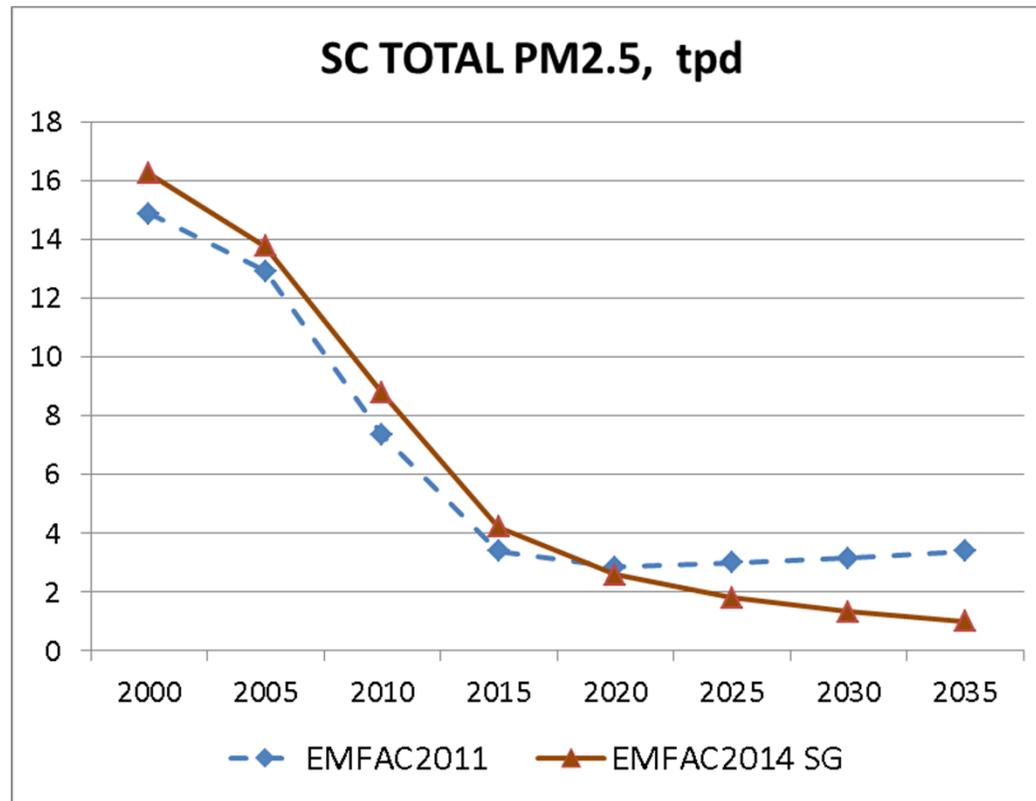


- Inclusion of crankcase emissions

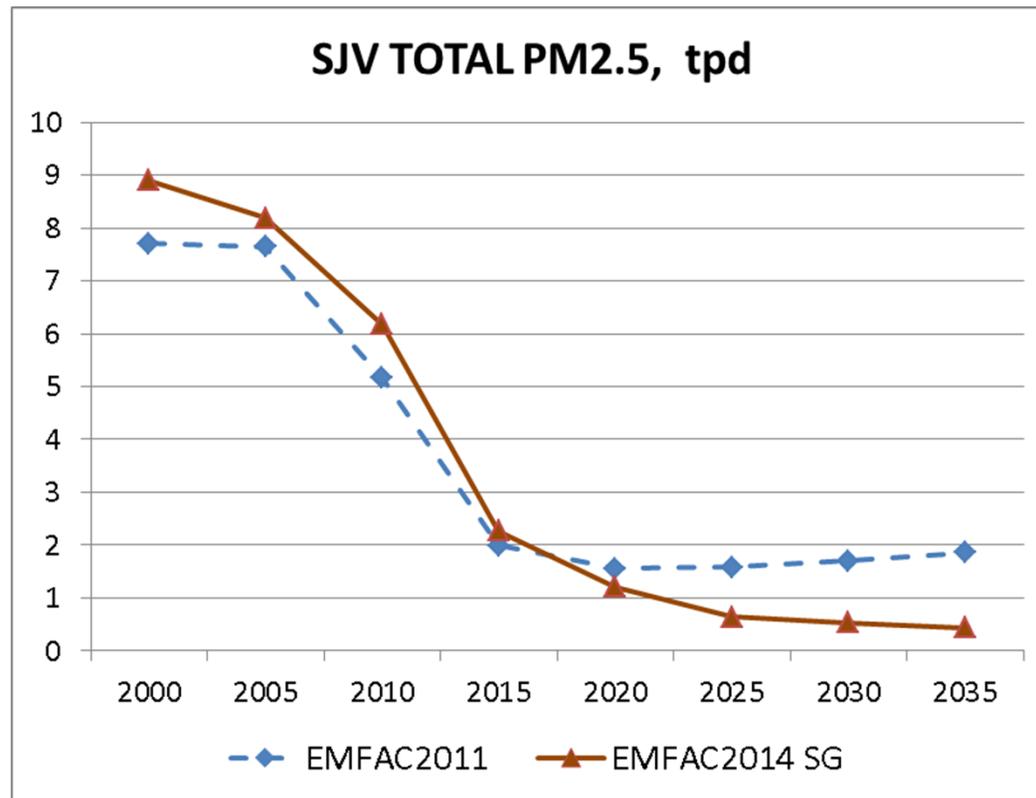
- Emission rates revision
- Engine/chassis model year mismatch
- T&B Amendment

- PM filter more effective than projected

EMFAC2014 SG vs. EMFAC2011 - SC

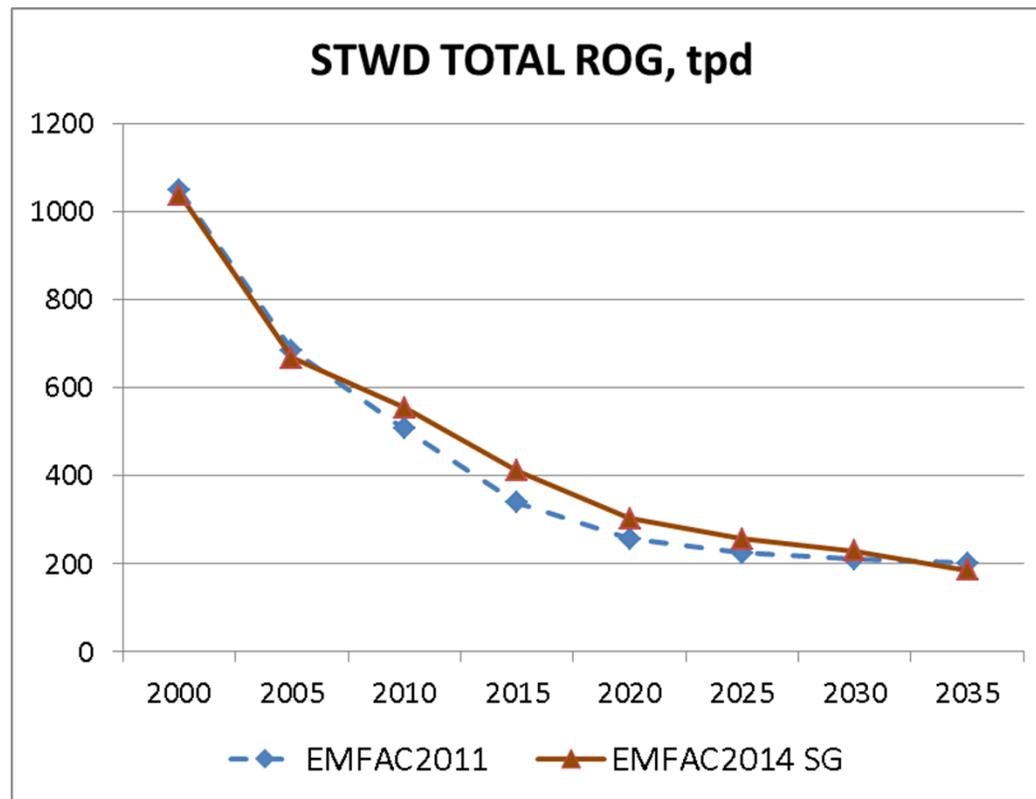


EMFAC2014 SG vs. EMFAC2011 - SJV



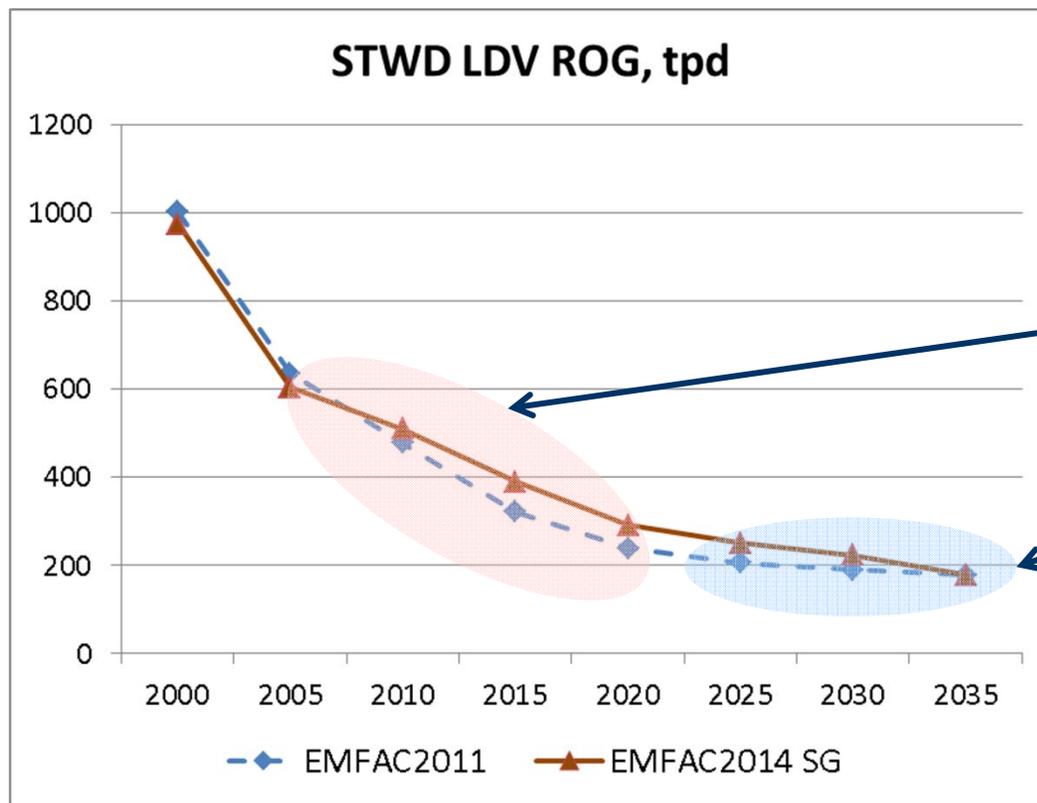
Both models are using EMFAC2011 VMT

EMFAC2014 SG vs. EMFAC2011- Statewide



Both models are using EMFAC2011 VMT

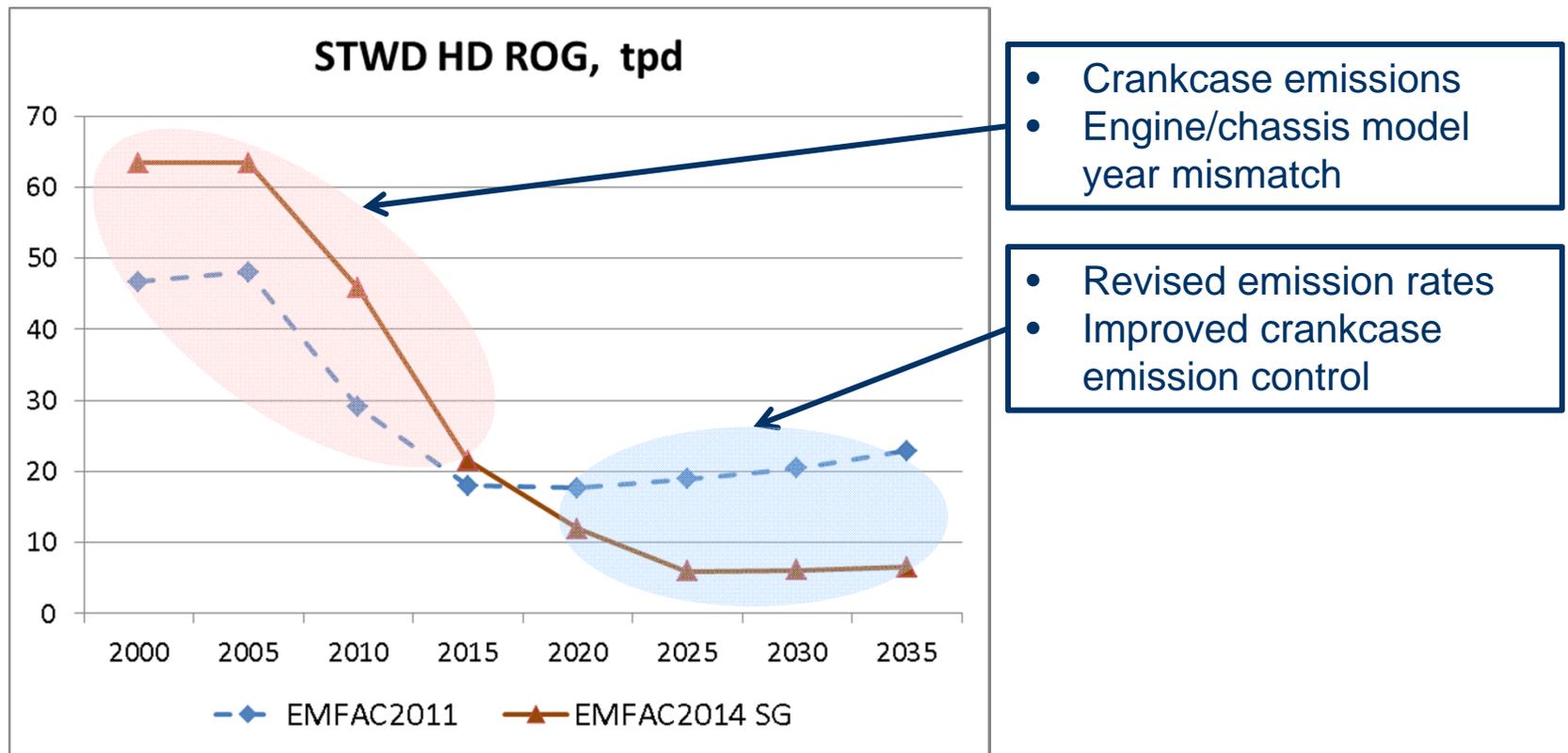
EMFAC2014 SG vs. EMFAC2011- Statewide



• Change in zero-evap technology penetration

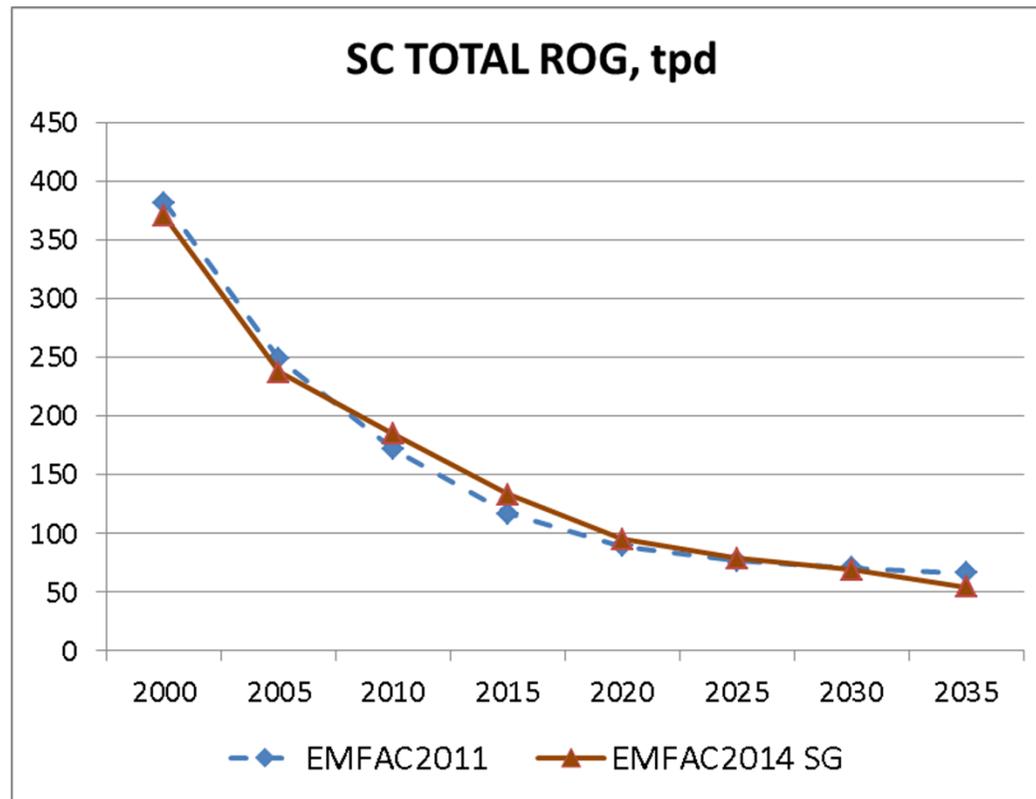
• Advanced Clean Cars
• HC speciation revision

EMFAC2014 SG vs. EMFAC2011- Statewide

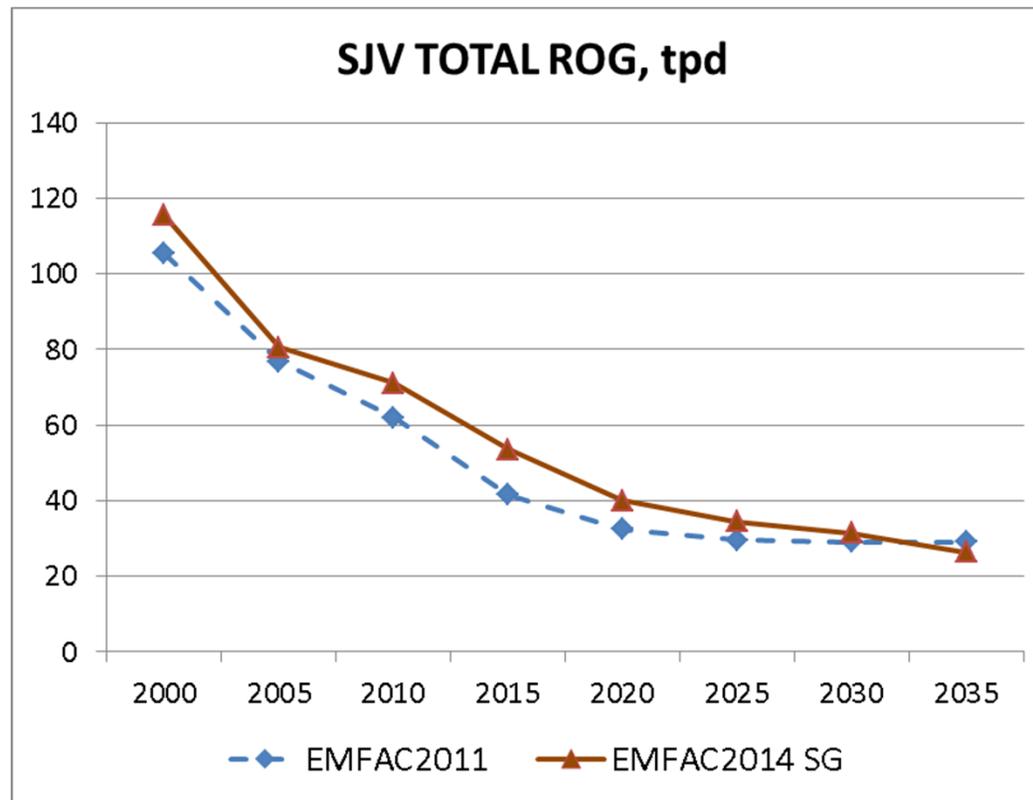


Both models are using EMFAC2011 VMT

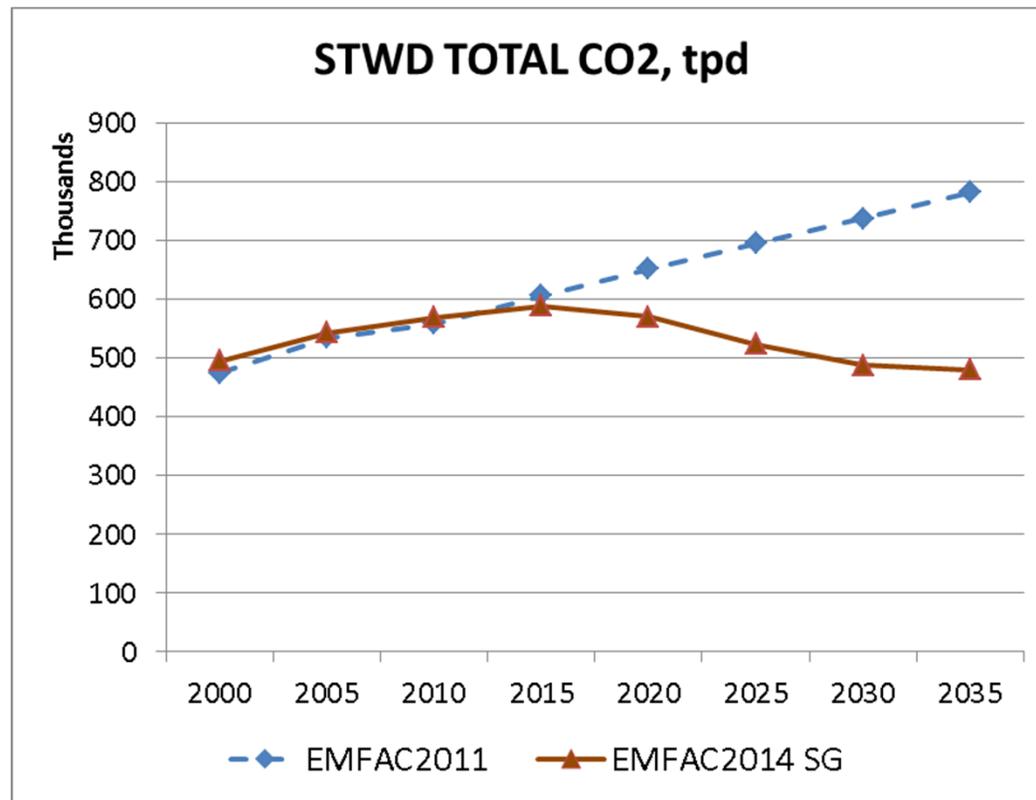
EMFAC2014 SG vs. EMFAC2011 - SC



EMFAC2014 SG vs. EMFAC2011 - SJV

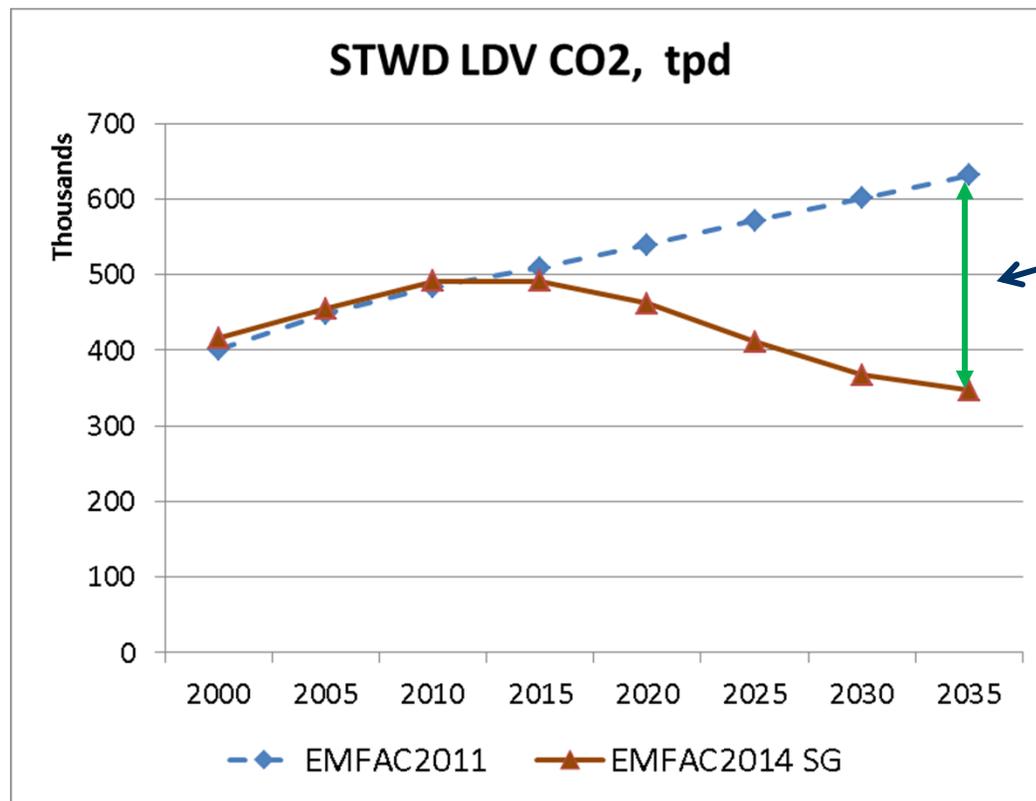


EMFAC2014 SG vs. EMFAC2011- Statewide



Both models are using EMFAC2011 VMT

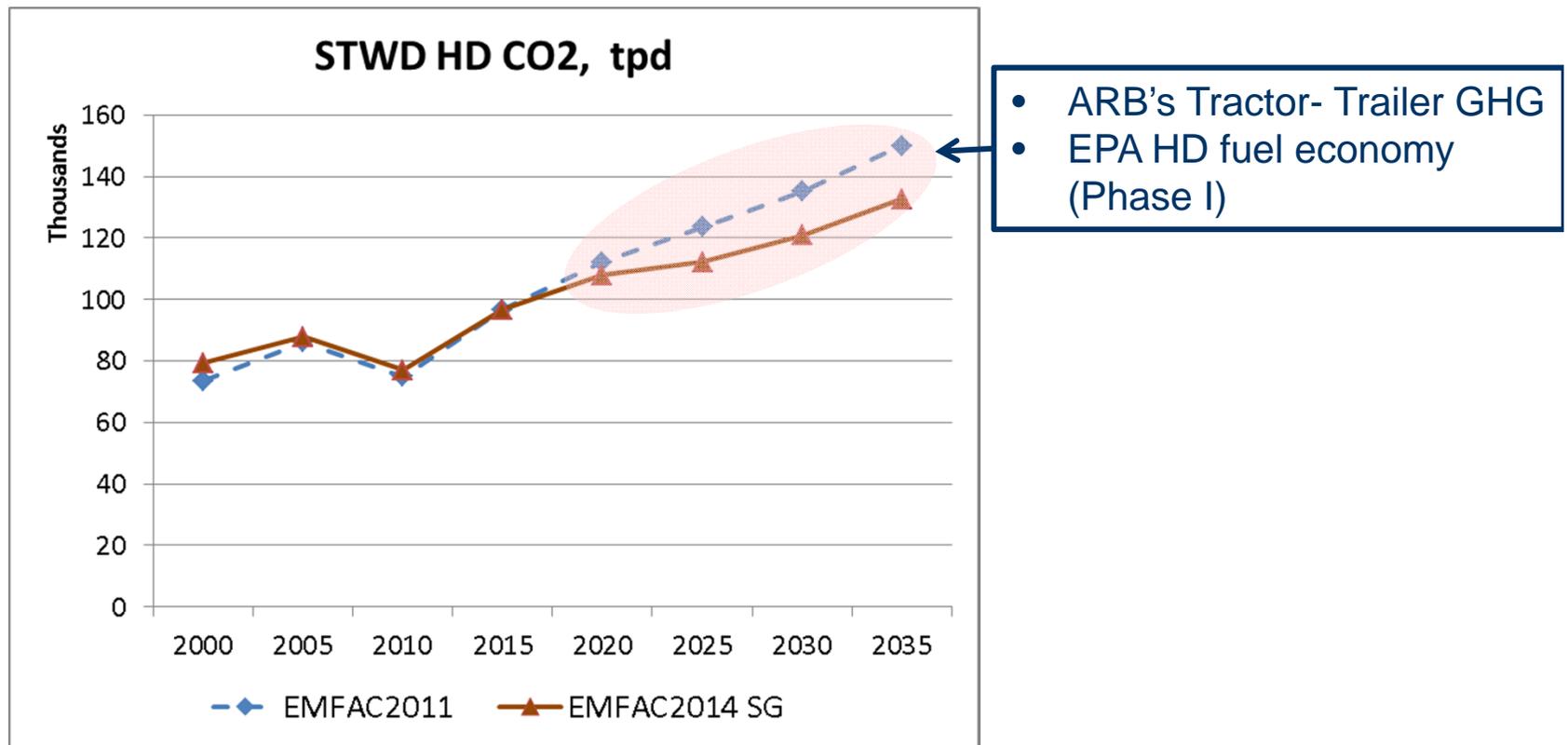
EMFAC2014 SG vs. EMFAC2011- Statewide



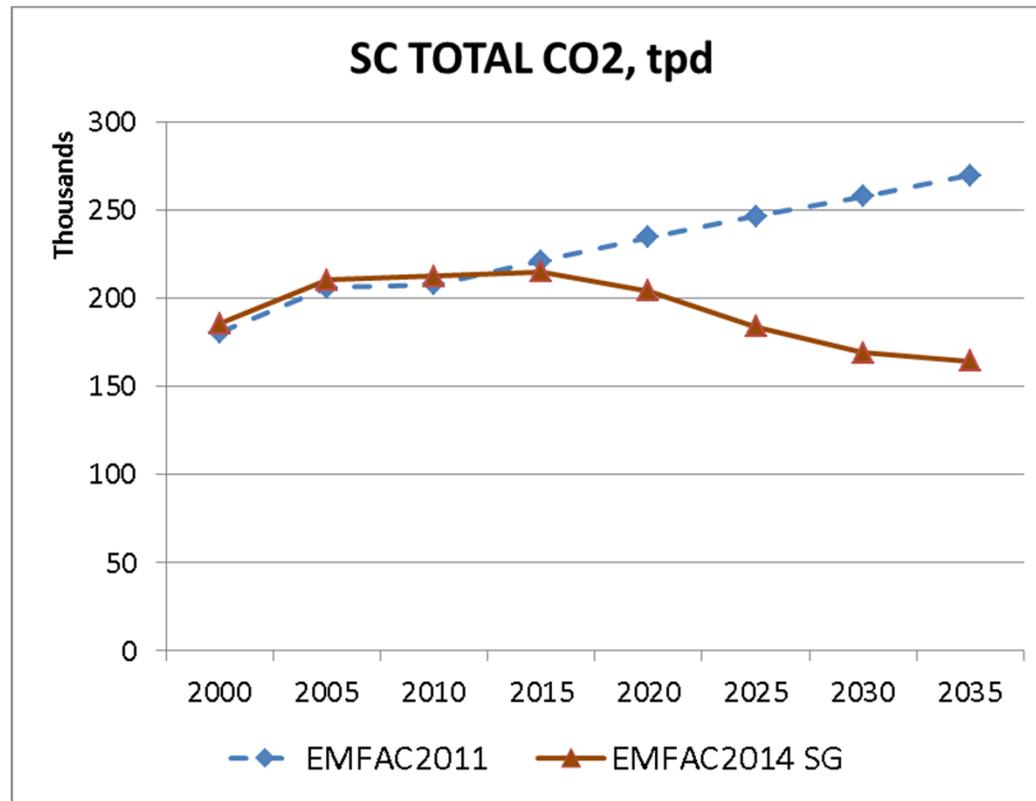
- Pavley I
- Advanced Clean Cars
- ZEV requirements

Both models are using EMFAC2011 VMT

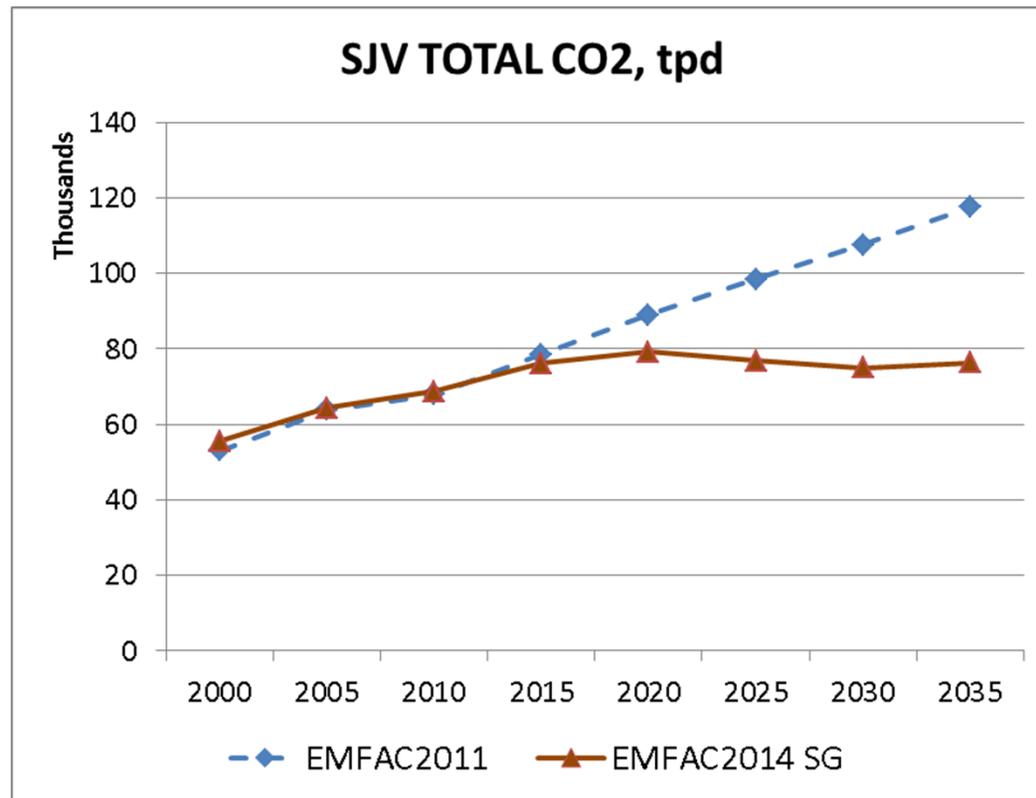
EMFAC2014 SG vs. EMFAC2011- Statewide



EMFAC2014 SG vs. EMFAC2011 - SC



EMFAC2014 SG vs. EMFAC2011 - SJV



EMFAC2014 SG vs. EMFAC2011- Summary

- Statewide, South Coast and San Joaquin Valley share similar trends
 - In general, EMFAC2014 SG has higher emissions in around 2010 and lower beyond 2025
- NOx is impacted by both light and heavy duty vehicles
 - Light duty – Advanced Clean Car
 - Heavy duty – Diesel start emissions, SCR effectiveness at higher speed

EMFAC2014 SG vs. EMFAC2011 Summary

- ROG is dominated by light duty vehicles
 - Lower beyond 2030 with Advanced Clean Car
- PM2.5 is dominated by both light and heavy duty vehicles
 - Heavy duty diesel – PM filter is very effective
 - Light duty gasoline – emission rates revision
- CO2 is lower due to ACC/ZEV for light duty and TTGHG/EPA phase 1 for heavy duty

EMFAC2014 SG – User defined VMT

- Previous example uses EMFAC2011 VMT at vehicle class level
 - Not impacted by fleet mix
- Planning agencies will have new VMT
 - Options to use total VMT or VMT by vehicle class
 - Using total VMT as SG inputs and fleet mix among vehicle classes in the base model will be used
 - Options to input speed at daily vs. 24-hour



Next Steps

Next Steps

- Remaining work
 - Integrate remaining functionality
 - Web data tool
- Finalize EMFAC2014 by end of the year
- Collect latest MPO/RTPA FSTIP data for use in generating SIP on-road emission inventories
- Submit EMFAC2014 to USEPA for action in early 2015

Long Term Plan

- Evaluate user needs for next version of EMFAC
- Current MSAB Contracts
 - Compare to fuel based emission inventory
 - Forecast methodologies
 - Evaporative High Emitters (under development)
- Evaluate findings from ARB Vehicle Emissions Research
<http://www.arb.ca.gov/research/veh-emissions/veh-emissions.htm>
- Mine data from in-house testing programs (VSP, etc)
 - Sacramento, Depot Park, and El Monte Facilities
- Findings and new data via the regulatory process
- Consider results from testing and studies conducted by outside stakeholders and researchers



QUESTIONS?

Contact

EMFAC Team

Mobile Source Analysis Branch

Air Quality Planning and Science Division

Air Resource Board

EMFAC2014@arb.ca.gov

Join our listserv from MSEI website

<http://www.arb.ca.gov/msei/msei.htm>