

Emissions Inventory Revisions

Statewide Truck and Bus Rule
In-Use Off-Road Equipment Rule
Drayage Truck Rule

Briefing Prior to Workshops (Aug-Sept 2010)

8/26 – Fresno

9/7 - Sacramento

8/31 – El Monte

9/8 - Oakland

9/1 – San Diego

Note: These slides are draft versions that we anticipate will appear in the workshop presentation; please consider these slides draft – they will be finalized for the workshops. For questions please contact Todd Sax at (916) 322-5474

Summary

- Recession has significantly reduced emissions across both categories
- In-Use Off-Road and Truck/Bus inventories updated
 - Off-Road inventory now substantially lower
- Combined emissions are lower than anticipated
 - Provides margin for regulatory relief
 - South Coast (2014): 61 tons/day NOx Eq.
 - San Joaquin Valley (2014): 40 tons/day NOx Eq.

Outline

- Truck and Bus Inventory Revisions
- Off-Road Inventory Revisions
- Revised Margin

Statewide Truck and Bus Rule Emissions Inventory



Truck and Bus Emissions Inventory

- Revisions
 - Vehicle/Fleet Size Categories
 - Odometer
 - Out-of-State Vehicle Miles Traveled
 - Regional Allocation

Vehicle / Fleet Size Categories

- Added medium fleet categories
 - 4-20 trucks
 - 21-40 trucks
- Added motorcoach category

Vehicle / Fleet Size Categories - Medium Fleet Assumptions

Percentage of Total Population -2005

| Fleet Size | T6 Instate | T6 Instate construction | T7 CAIRP | T7 CAIRP construction | T7 Single | T7 Single construction |
|------------|------------|-------------------------|----------|-----------------------|-----------|------------------------|
| 1 | 31% | 29% | 26% | 26% | 32% | 33% |
| 2 | 10% | 10% | 9% | 9% | 10% | 10% |
| 3 | 6% | 6% | 6% | 6% | 6% | 6% |
| 4 - 20 | 23% | 24% | 29% | 29% | 24% | 24% |
| 21 - 40 | 6% | 8% | 9% | 9% | 7% | 7% |
| 41+ | 24% | 23% | 21% | 22% | 22% | 22% |

Average Age (Population-Based) - 2005

| Fleet Size | T6 Instate | T7 CAIRP | T7 Single | T7 Single construction | T7 Tractor | T7 Tractor construction |
|------------|------------|----------|-----------|------------------------|------------|-------------------------|
| 1 | 9.2 | 7.0 | 12.9 | 12.5 | 11.8 | 11.9 |
| 2 | 8.9 | 6.8 | 12.6 | 12.3 | 11.5 | 11.6 |
| 3 | 8.9 | 6.9 | 11.7 | 11.5 | 11.3 | 11.4 |
| 4 - 20 | 8.3 | 6.7 | 11.0 | 10.8 | 10.0 | 10.1 |
| 21 - 40 | 7.3 | 5.7 | 9.3 | 9.1 | 7.4 | 7.5 |
| 41+ | 6.0 | 4.5 | 7.7 | 7.5 | 5.9 | 6.0 |

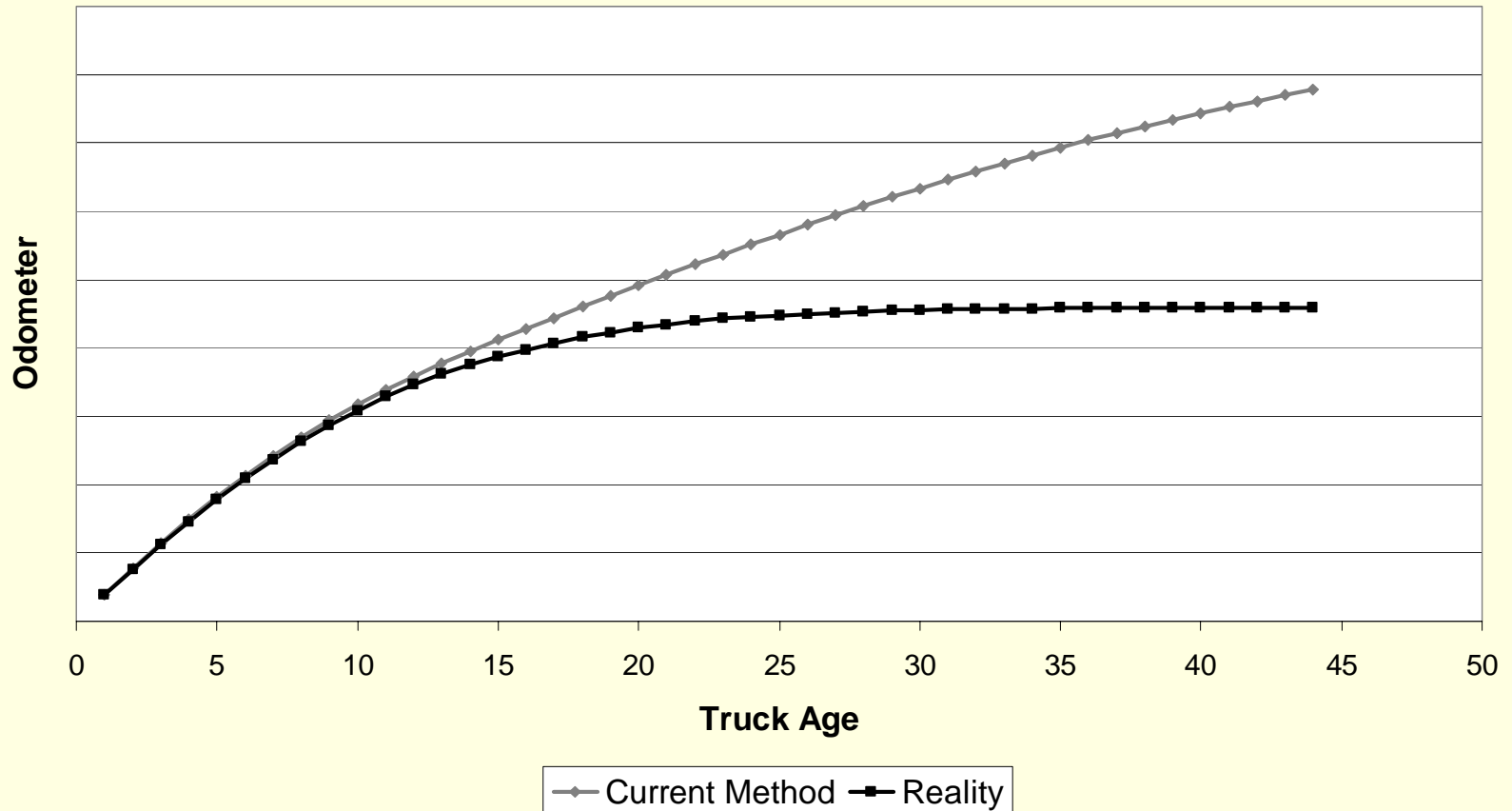
Vehicle / Fleet Size Categories - Motorcoach Assumptions

- Received new data from the California Bus Association (CBA) on motorcoaches
- Agreed upon revised growth rate, population and methodology
- Population based on reporting to Public Utilities Commission
- Mileage accrual based on CBA survey
- Inventory reflects revisions

Odometer Revision

- Current assumption
 - Odometer is sum of accrual
- Reviewed
 - Truck sales data from truckpaper.com
 - Odometer data from bond program
 - VIUS 1992 and VIUS 2002

Odometer \neq Sum of Accrual



Odometer Revision Results

- Cap MHDDT Odometer at 400,000 miles
- Cap HHDDT Odometer at 800,000 miles
- Results in small impact on emissions
 - Varies by calendar year
 - Emissions lower by a few percent
 - Emissions benefits slightly smaller because impacts baseline more than with Rule

Out-of-State VMT Revision

- Previous assumption based on 2005 data
- Received new data: 2007-2009
 - 2006 data incomplete
 - 2007-2009 data are complete
 - Data on CA registered interstate trucks appears plausible
 - Trend in data representing non-CA registered interstate trucks does not appear accurate
- Developed revised out-of-state VMT estimate
- Revised VMT more consistent with BOE Fuel statistics

IFTA Data (Million Miles/Yr)

| | CA Registered IFTA Truck Miles in CA | |
|------|--------------------------------------|---|
| 2005 | 2,189 | <ul style="list-style-type: none">• CA Registered IFTA 2005-2007: 20% increase• Increase larger than BOE fuel report for all trucks (~4%)• Then 20% decrease due to recession |
| 2007 | 2,660 | |
| 2008 | 2,213 | |
| 2009 | 2,134 | |

IFTA Data (Million Miles/Yr)

| | CA Registered IFTA Truck Miles in CA | Reported Out-of-State Truck Miles in CA | <ul style="list-style-type: none"> • Out of state does not follow same trend <ul style="list-style-type: none"> • 2005 much higher than new data • 2008 higher than 2007 • Not consistent with other trends on impact of recession <p>CHOICE: Use data as is OR estimate</p> |
|------|--------------------------------------|---|---|
| 2005 | 2,189 | 4,398 | |
| 2007 | 2,660 | 2,943 | |
| 2008 | 2,213 | 3,761 | |
| 2009 | 2,134 | 3,358 | |

IFTA Data (Million Miles/Yr)

| | CA Registered IFTA Truck Miles in CA | Reported Out-of-State Truck Miles in CA | Modeled Out-of-State Truck Miles in CA no recession | Modeled Out-of-State Truck Miles in CA with recession |
|------|--------------------------------------|---|---|---|
| 2005 | 2,189 | 4,398 | 3,144 | 3,144 |
| 2007 | 2,660 | 2,943 | 3,419 | 3,397 |
| 2008 | 2,213 | 3,761 | 3,601 | 3,115 |
| 2009 | 2,134 | 3,358 | 3,654 | 2,843 |

Regional Emissions

May Workshop

- Based on ARB field study and other data, corroborated with vehicle counts and transportation models
- Used regional allocation that assumed percentage of statewide emissions by air basin
- Age distribution of an inventory category was consistent across air basins

Revisions to Regional Allocation

- Field study data shows
 - Single-unit, medium heavy trucks travel mostly in air basin of registration
 - In-state tractors travel in populated areas and San Joaquin Valley
- Revision accounts for differences in populations/age distribution
 - Based on actual DMV registration
 - Among air basins for single-unit and medium heavy trucks
 - Between regions for in-state tractors

Regional Assessment

VMT Distribution Updates (Percent VMT by Region)

| CY2005 | Medium In-State | | Heavy Single-Unit | |
|------------------------|-----------------|-----|-------------------|-----|
| | New | May | New | May |
| South Coast | 45% | 42% | 41% | 37% |
| San Joaquin Valley | 10% | 12% | 10% | 18% |
| San Francisco Bay Area | 19% | 17% | 18% | 17% |
| Sacramento Valley | 9% | 9% | 9% | 9% |
| San Diego | 7% | 8% | 8% | 8% |
| Mojave Desert | 1% | 2% | 2% | 2% |
| Other | 9% | 10% | 13% | 10% |

Regional Assessment

VMT-Weighted Average Age

| CY2005 | Medium In-State | | Heavy Single Unit | |
|------------------------|-----------------|-----|-------------------|-----|
| | New | May | New | May |
| South Coast | 6.1 | 6.4 | 8.8 | 8.8 |
| San Joaquin Valley | 7.1 | 6.4 | 7.7 | 8.8 |
| San Francisco Bay Area | 6.5 | 6.4 | 9.3 | 8.8 |
| Sacramento Valley | 6.0 | 6.4 | 7.4 | 8.8 |
| San Diego | 6.0 | 6.4 | 8.5 | 8.8 |
| Mojave Desert | 6.4 | 6.4 | 9.1 | 8.8 |
| Other | 7.2 | 6.4 | 10.2 | 8.8 |

Regional Assessment

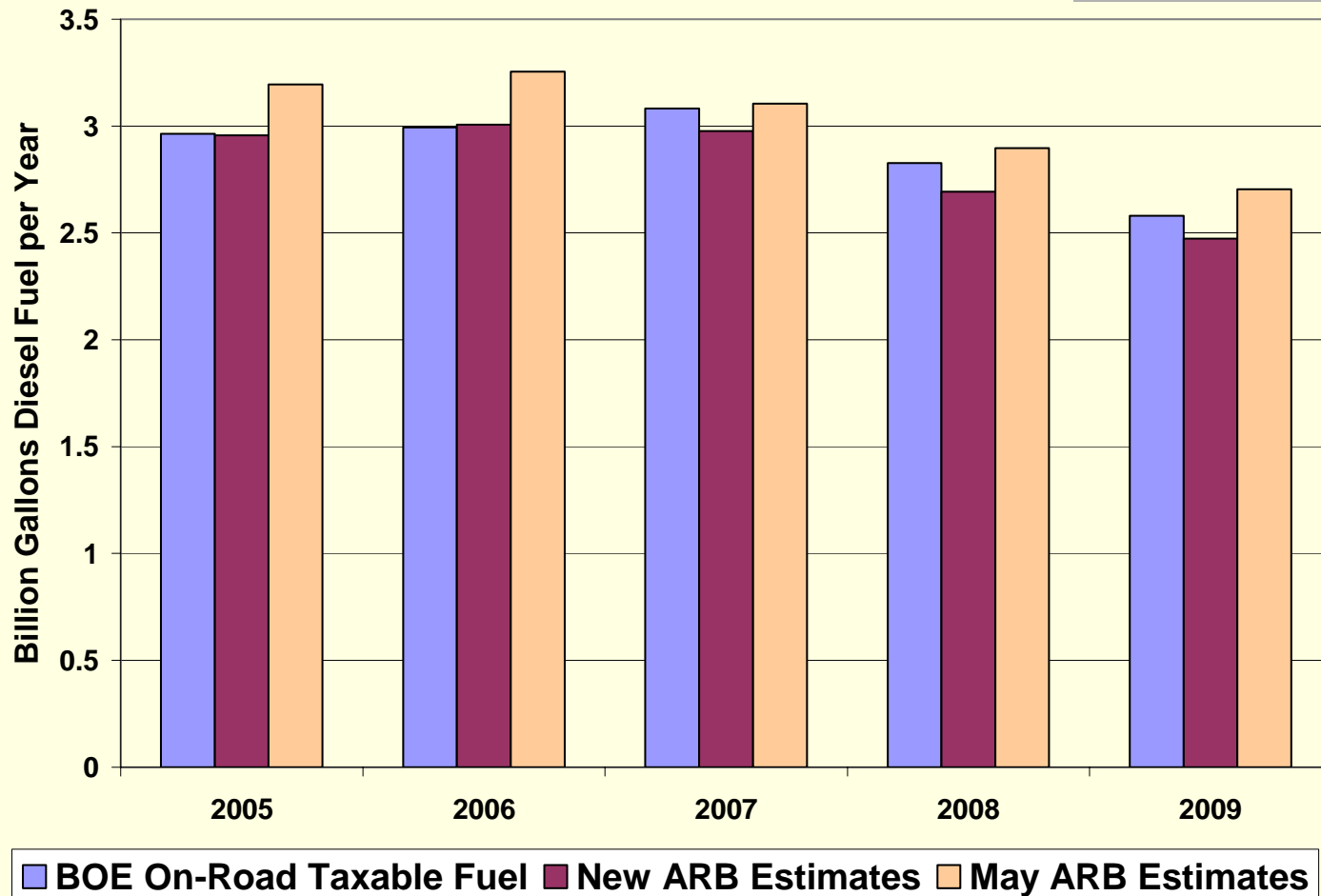
In-State Tractor Update

| CY2005 | Heavy Tractor VMT (Percent by Region) | | Heavy Tractor VMT- Weighted Average Age | |
|------------------------|--|-----|--|-----|
| | New | May | New | May |
| South Coast | 26% | | 7.6 | 7.8 |
| San Joaquin Valley | 38% | | 7.6 | 7.8 |
| San Francisco Bay Area | 13% | | 7.6 | 7.8 |
| Sacramento Valley | 6% | | 7.6 | 7.8 |
| San Diego | 5% | | 7.6 | 7.8 |
| Mojave Desert | 4% | | 7.6 | 7.8 |
| Other | 7% | | 10.1 | 7.8 |

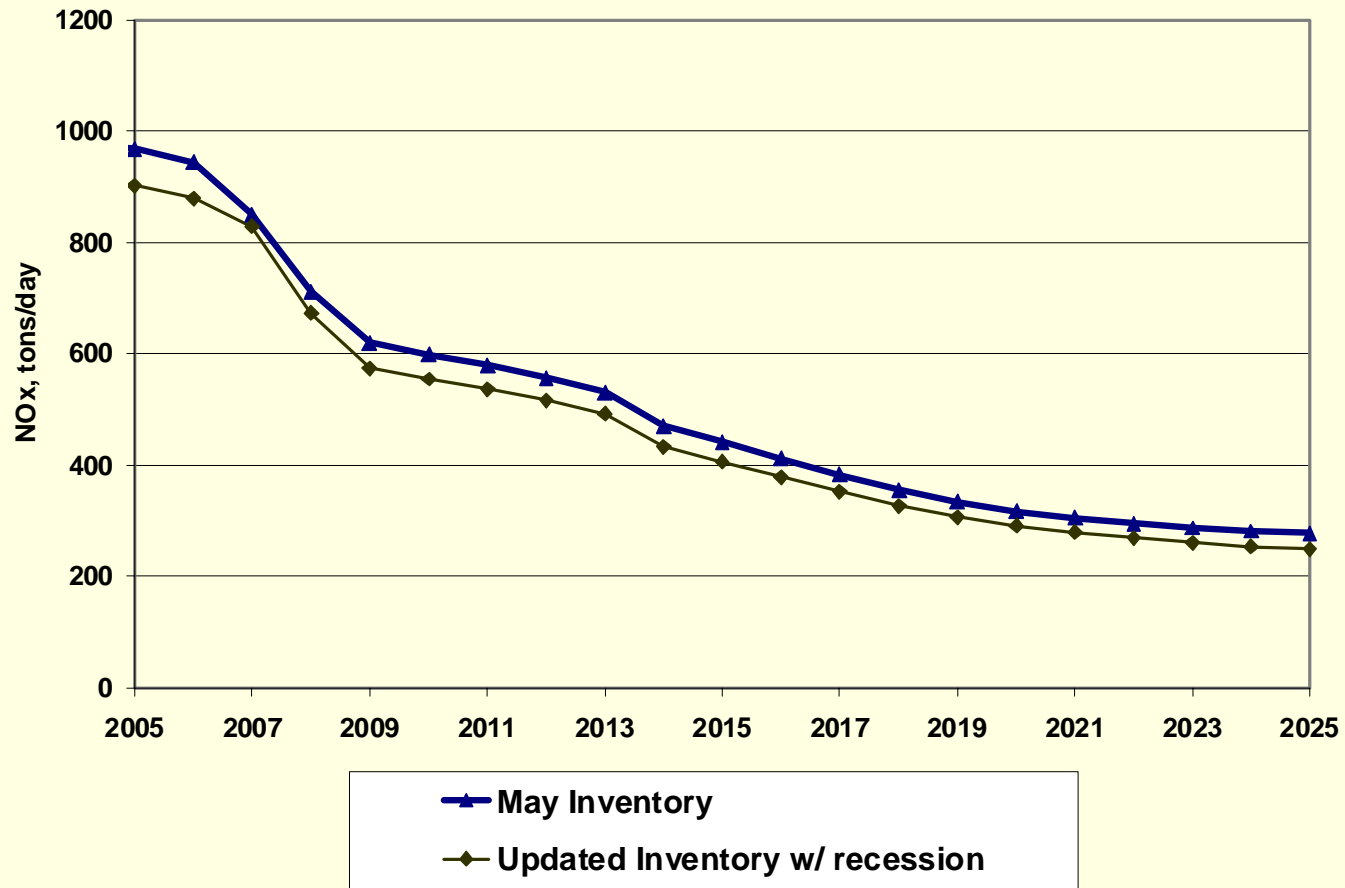
Inventory Update Results

- Lower VMT estimates from out-of-state trucks lowers total VMT for all regions
- Statewide diesel fuel consumption is closer and slightly lower than reported BOE taxable diesel
 - Within 5% of BOE
- Statewide emissions lower than previously estimated
- South Coast emissions lower than previously estimated

Current Draft Statewide Fuel Comparison with Recession

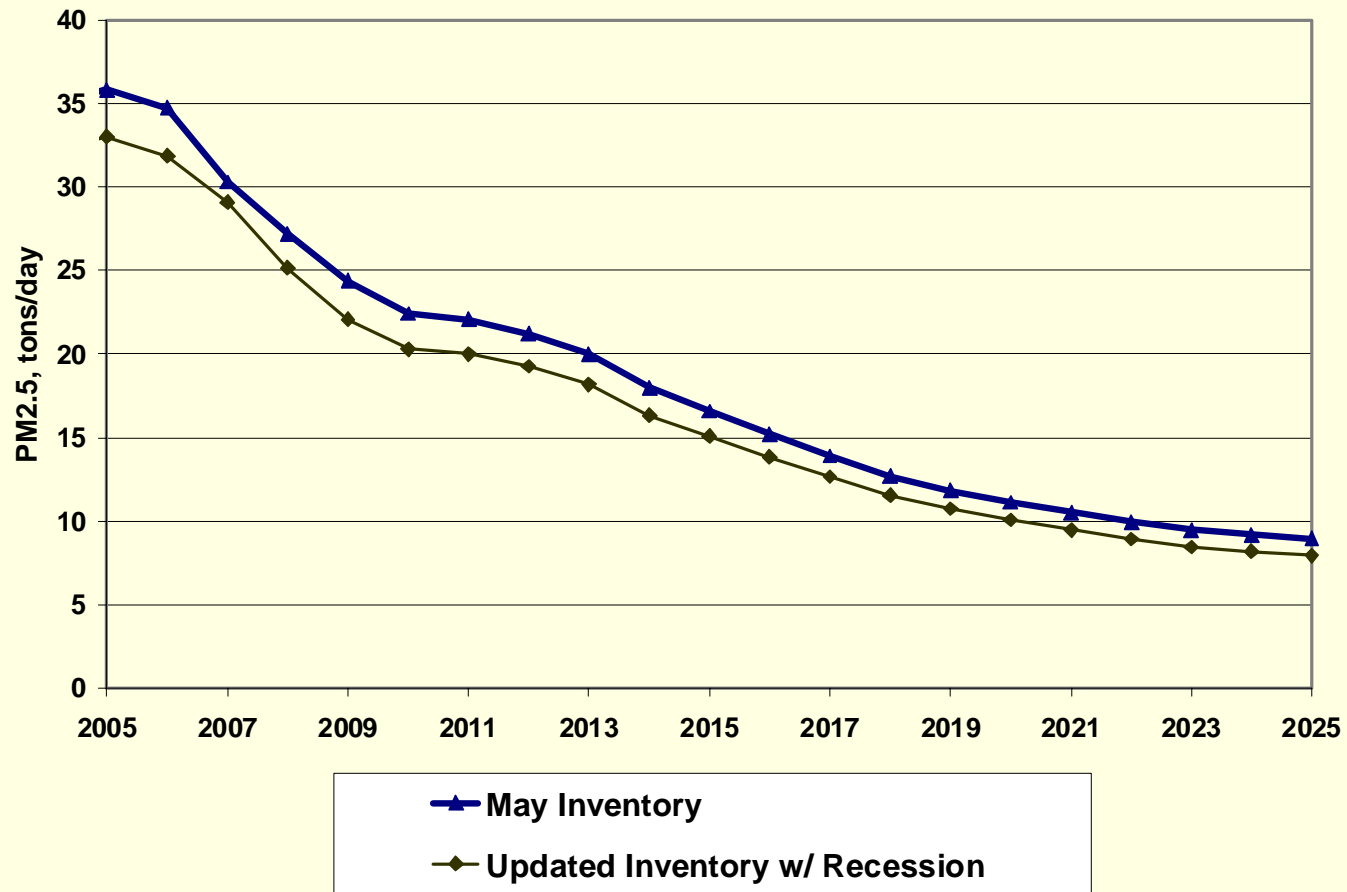


Impact of Revisions on EI Statewide Baseline – NOx



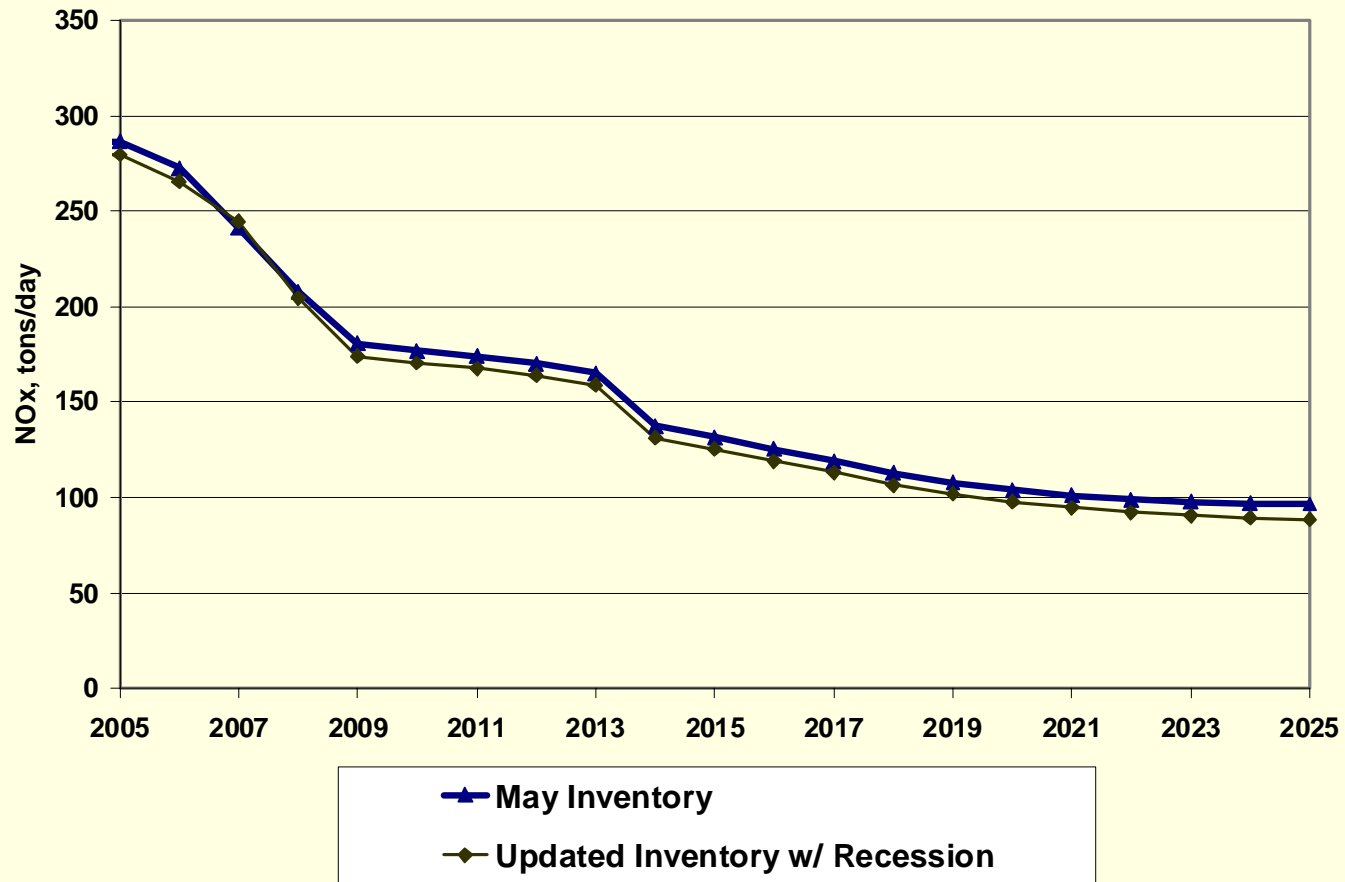
Impact of Revisions on EI

Statewide Baseline – PM2.5

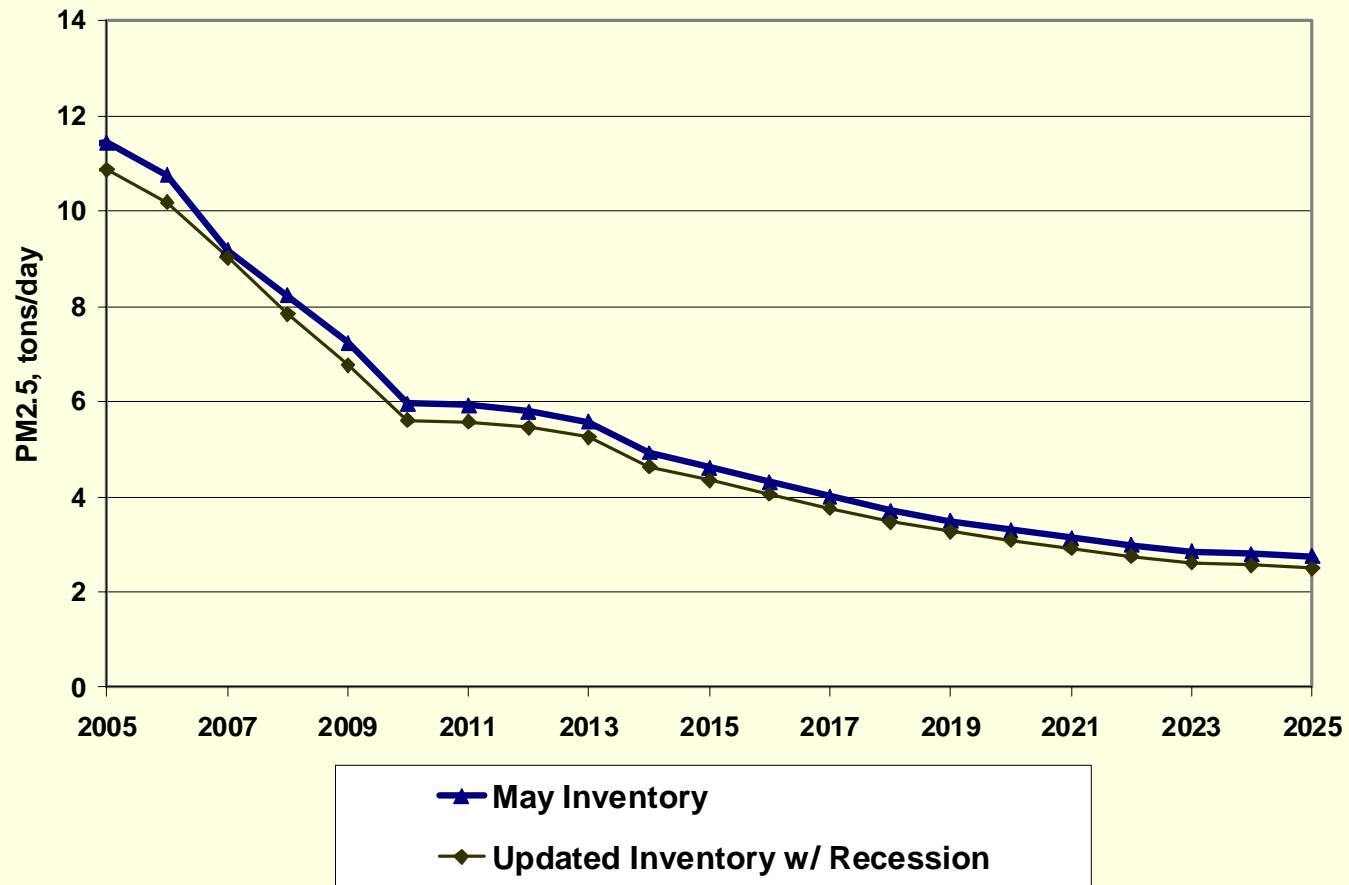


Impact of Revisions on EI

South Coast Baseline – NOx

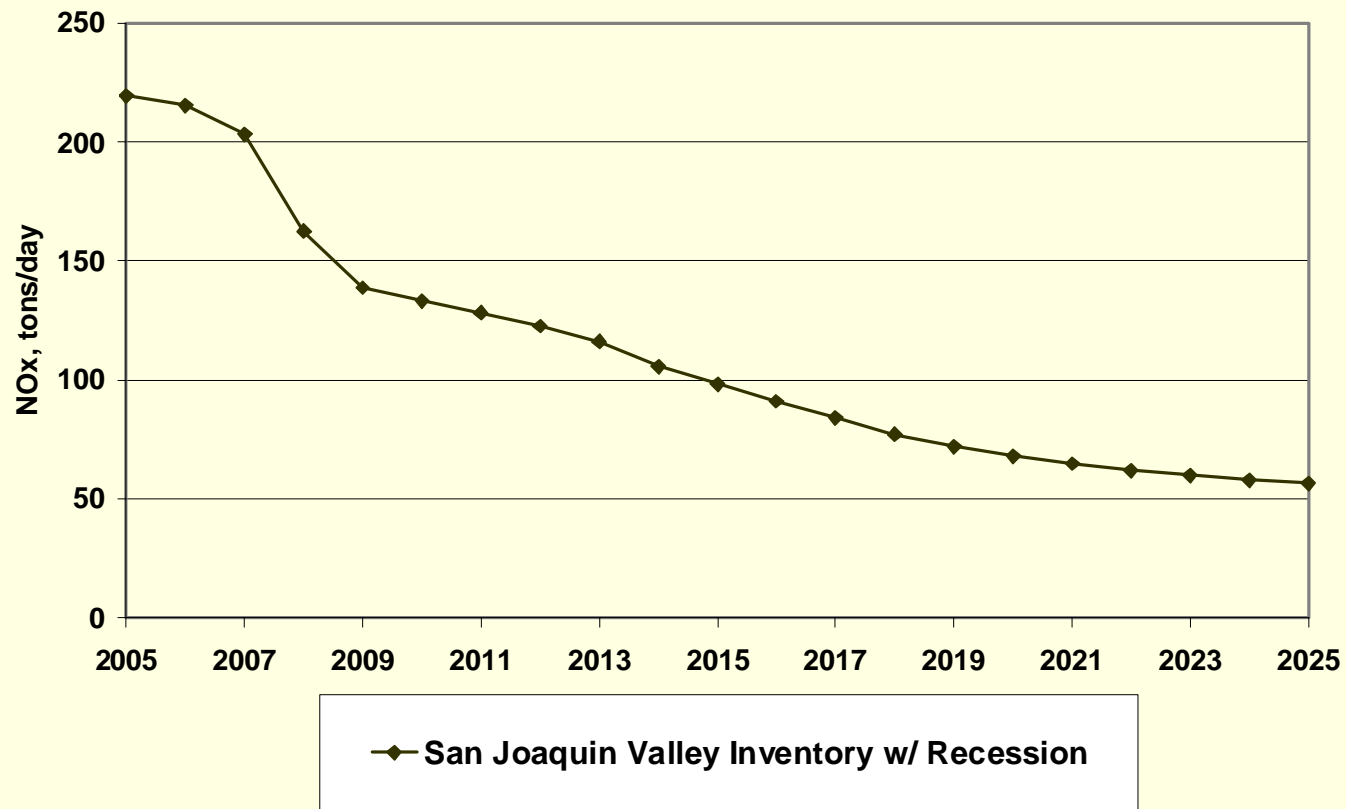


Impact of Revisions on EI South Coast Baseline – PM2.5



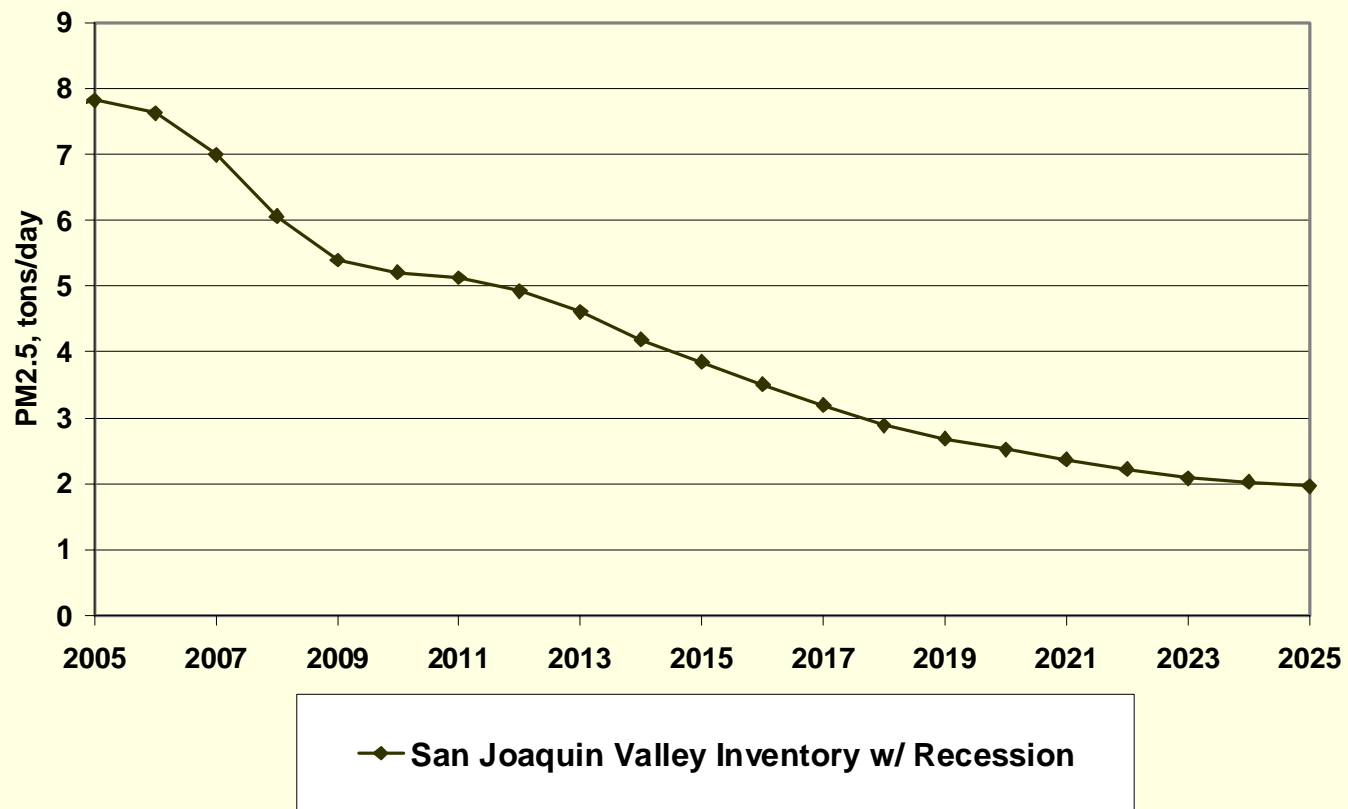
Impact of Revisions on EI

San Joaquin Valley Baseline – NOx



Impact of Revisions on EI

San Joaquin Valley Baseline – PM2.5



Emission Inventory for the In-Use Off-Road Vehicles Rule



Outline

- Update Inventory
- Emission Inventory Inputs
- New Information
 - DOORS Data
 - Engine Load
 - Recession and Forecasting
- Emissions Results
- New Margin

Update Inventory

- Why ARB is updating the inventory
 - Recession
 - Harley paper – fuel consumption too high
 - New data available

In-Use Off-Road Vehicles Emissions Inventory Approach

Estimating Emissions

- Population - (POP)
- Activity - (ACT)
- Load Factor - (LF)
- Emission Factor - (EF)

$$\text{Emissions} = \text{POP} \times \text{ACT} \times \text{LF} \times \text{EF}$$



Population

- SIP inventory population based on California and national survey data.
- Revised inventory population based on DOORS reporting database
 - Fleet owners were required to report all relevant fleet information including total number of vehicles, vehicle types, horsepower and model year.
 - ~132,000 vehicles for 2009
- Additional assessment on DOORS reporting compliance

Reporting Compliance

- Survey of 1000 potential fleet owners was conducted in March 2010 to estimate the remaining off-road vehicles that have not reported to DOORS.
 - Sample derived from a list of 21,800 buyers who had financed construction equipment between 2005-2009
 - 7.3% fleets reported to have equipment but had not registered with DOORS.
 - Estimate about 25 vehicles per fleet for large fleets, 16 for medium and 6 for small.
- Results in about a 10% non-compliance rate for population

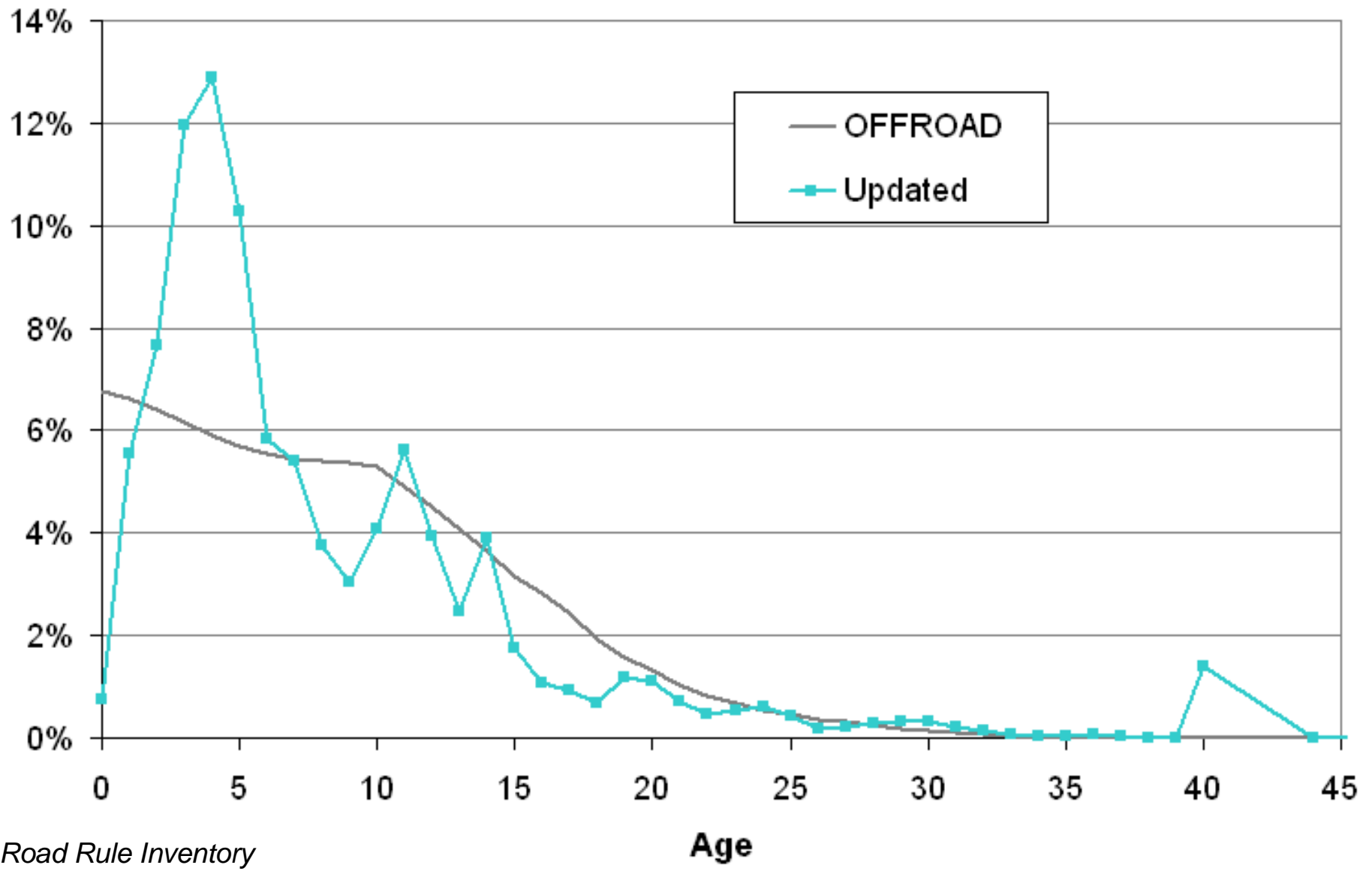
2009 Population

| Sector | OFFROAD | Updated | Percent Change |
|-----------------------|----------------|----------------|-----------------------|
| Construction & Mining | 172,915 | 116,861 | -32% |
| Industrial | 20,107 | 24,226 | +20% |
| Airport GSE | 1,830 | 3,705 | +102% |
| Oil Drilling | 1,021 | 822 | -20% |
| TOTAL | 195,872 | 145,614 | -26% |

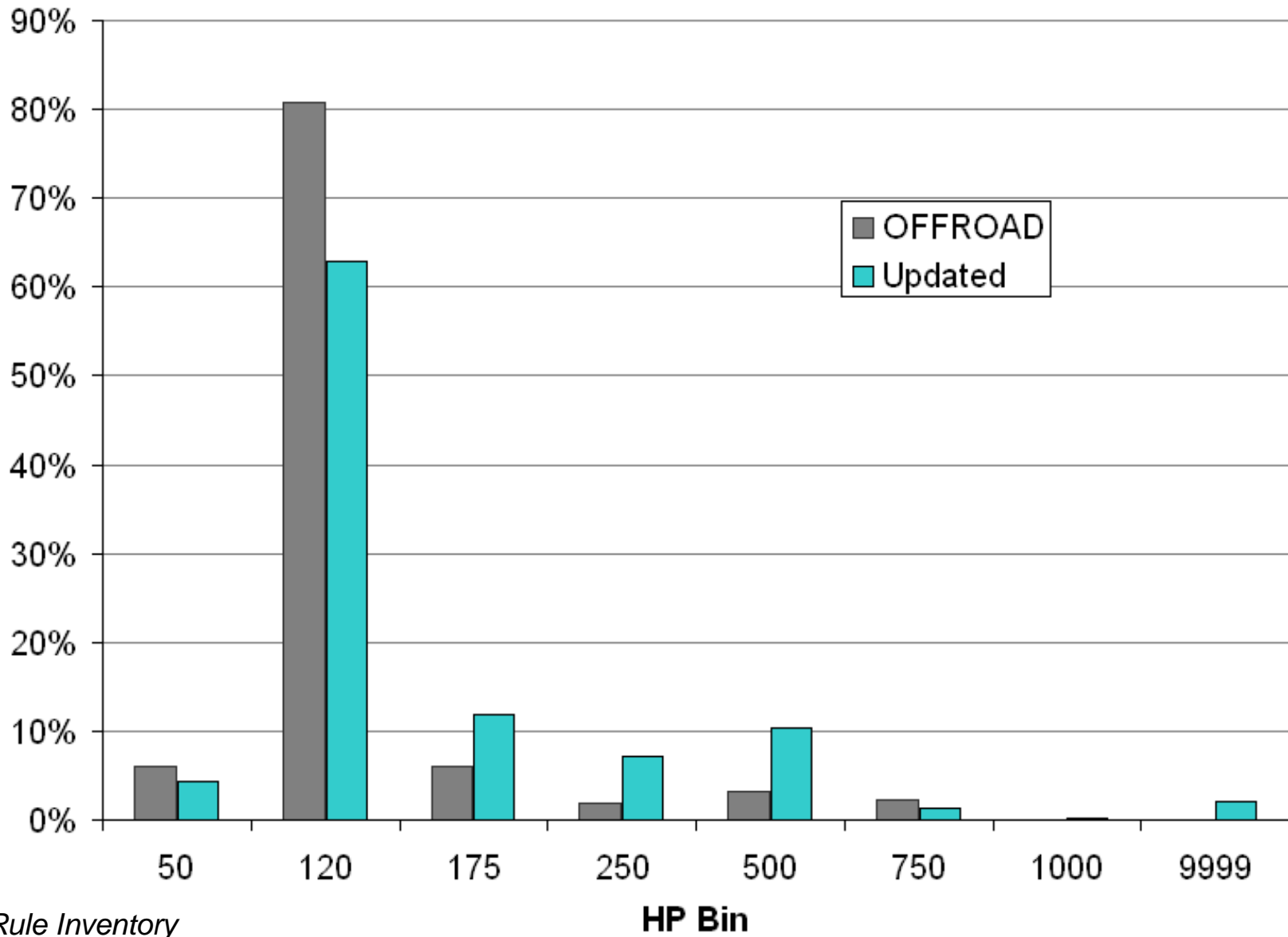
Age and Horsepower Distributions

- The age distribution from DOORS is skewed to younger vehicles than originally assumed.
- The horsepower distributions vary. For some equipment type the DOORS equipment have higher HP for others lower.

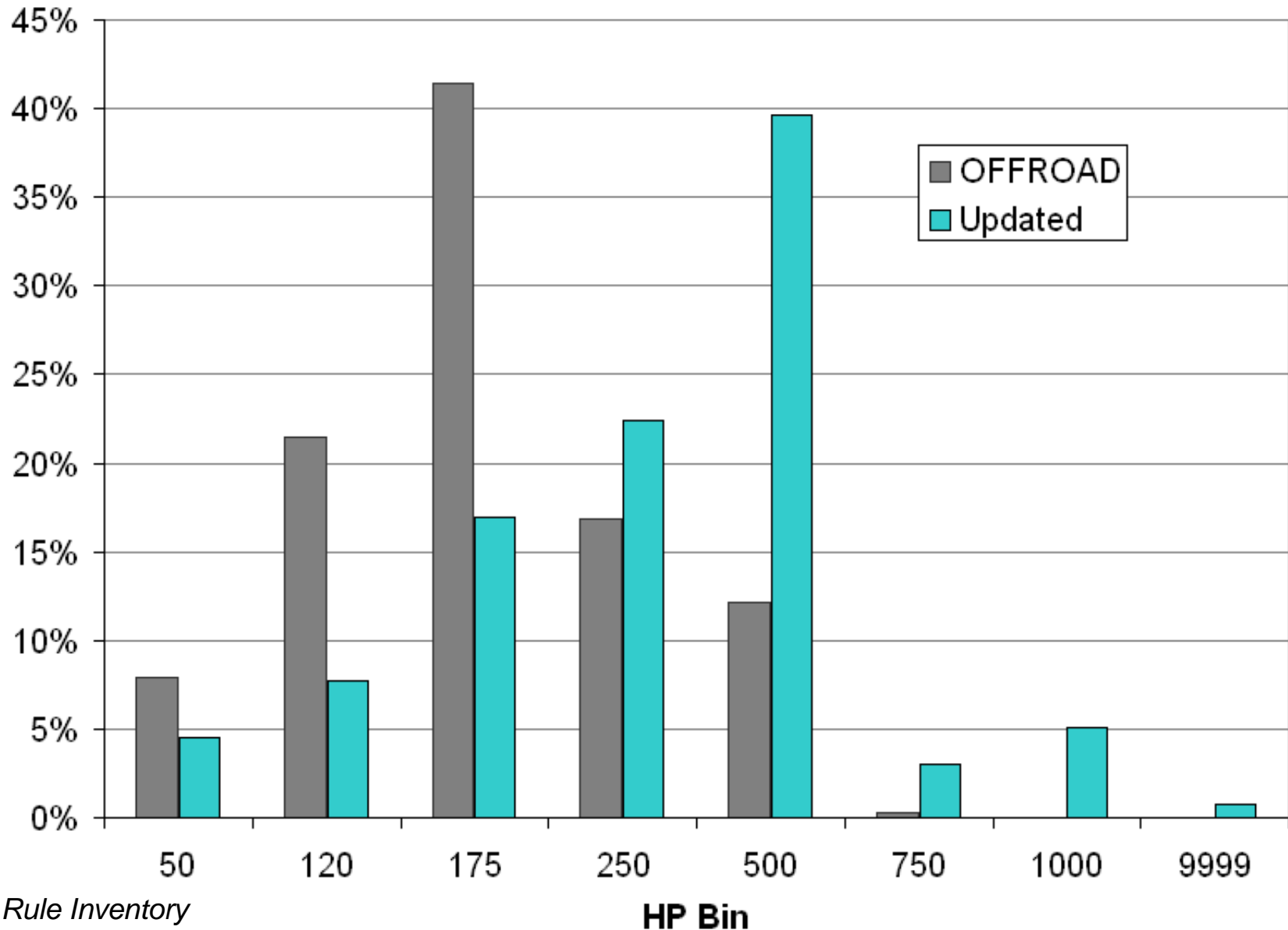
2009 Age Distribution - Excavators



Horsepower Distribution – Tractors/Loaders/Backhoes



Horsepower Distribution – Excavators



Off-Road Rule Inventory

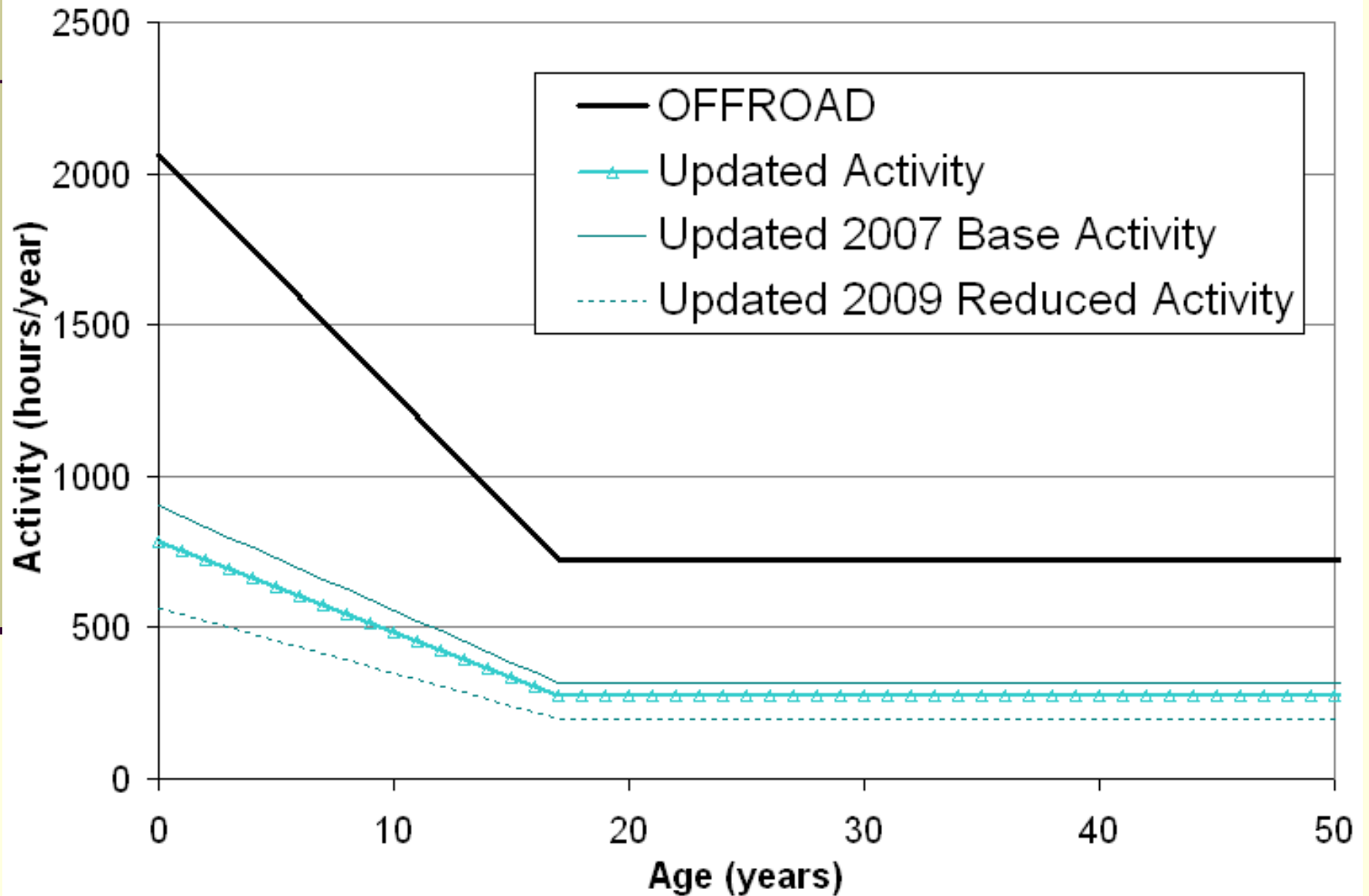
Activity

- SIP inventory activity based on national and some California specific data.
- In 2009, the California legislature approved Assembly Bill 8 2x, which required CARB to amend certain sections of the Off-Road Diesel regulation (AB 8 2x, 2009).
 - For credits fleet owners were required to provide equipment specific activity for the baseline year (2007) and activity for the same equipment in 2009
 - Both 2007 and 2009 activity significantly lower than originally assumed.

Activity

- Developed new activity profiles based on reported activity data
 - 2007 = baseline activity
 - 2009 = reduced activity
- Weighted activity – some fleets reduced population while other reduced activity
 - 34% reduced activity, 66% reduced population
- Compared results to other available data sources
 - TIAX Public Fleet Survey (2003)
 - ERG Survey <175 HP (2007)

Excavators



Average Activity – Top 10 Equipment

| Equipment Type | OFFROAD (hr/year) | Updated (hr/year) | % Change |
|------------------------------|----------------------|----------------------|-------------|
| Tractors/Loaders/Backhoes | 942 | 512 | -46% |
| Excavators | 1,396 | 546 | -61% |
| Scrapers | 1,092 | 453 | -59% |
| Rubber Tired Loaders | 957 | 893 | -7% |
| Crawler Tractors | 1,013 | 409 | -60% |
| Off-Highway Trucks | 1,958 | 1,293 | -34% |
| Forklifts | 1,800 | 690 | -62% |
| Other Construction Equipment | 690 | 429 | -38% |
| Rough Terrain Forklifts | 1,123 | 237 | -79% |
| Cranes | 1,252 | 444 | -65% |

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Load Factor

- Load varies by equipment type and usage
- Collected engine load data from ARB testing programs and manufacturer provided data
 - Analysis indicates that OFFROAD load factors are 25-50% too high
 - Staff concluded load factors should be reduced 33% for the updated inventory
 - Consistent with findings for other off-road equipment.

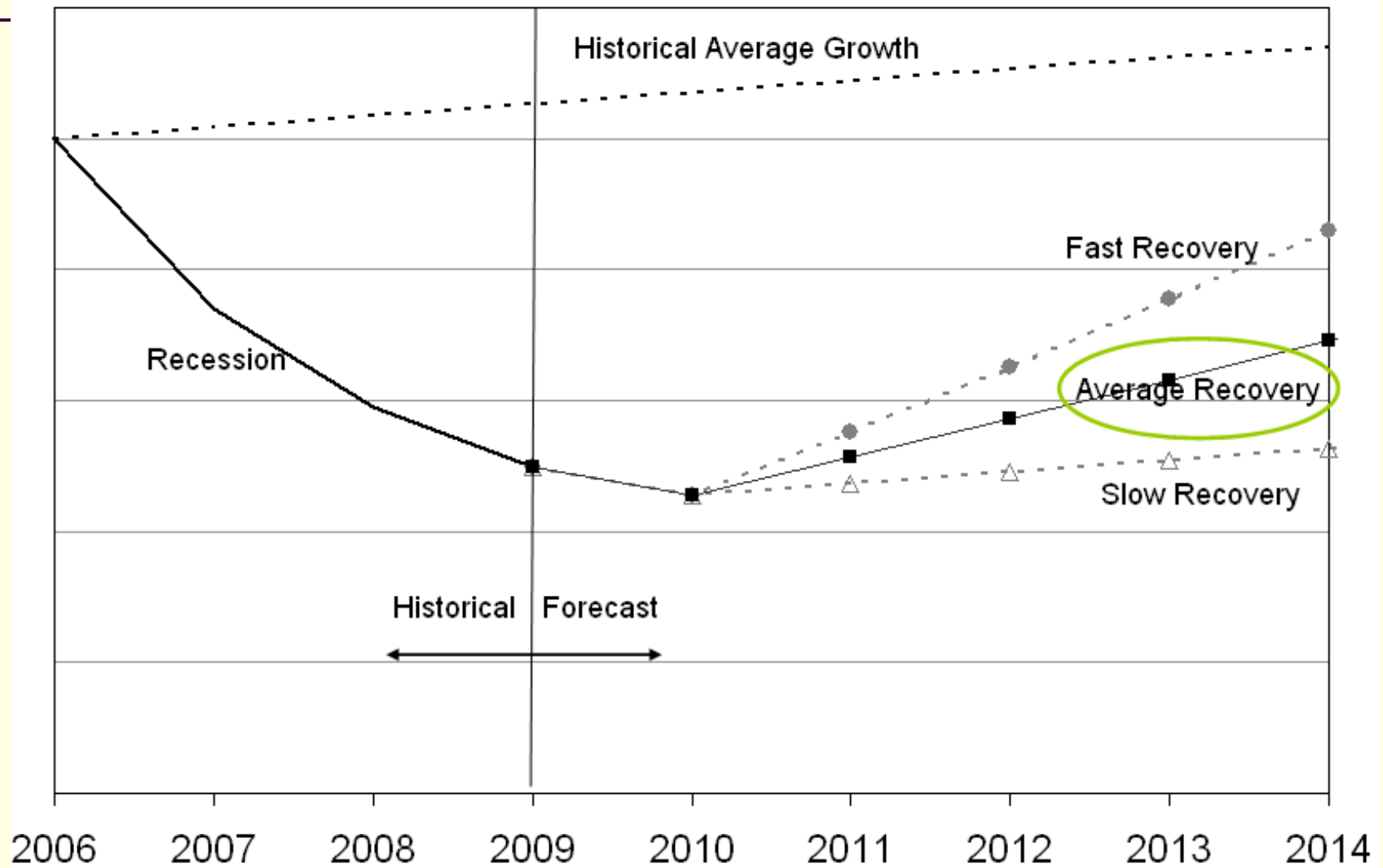
Growth – Annual Historical Rates

- Construction & Mining, and Industrial
 - SIP growth based on national 1970-2000 employment trends
 - Updated growth factor with California-specific growth in construction employment for 1970-2009
- Airport GSE
 - SIP growth based on 1991 Federal Aviation Administration flight operations data
 - Updated growth factor based on 1977-2009 US airline fuel consumption
- Oil Drilling
 - SIP growth based on 2005 ARB survey
 - Growth factor unchanged as most economic surrogates suggest no growth in the industry

Growth – Annual Historical Rates

| Category | OFFROAD | Updated |
|-------------------------|----------------|----------------|
| Airport Ground Support | 2.02% | 1.78% |
| Construction and Mining | 1.96% | 1.84% |
| Industrial | 0.63% | 1.84% |
| Oil Drilling | 0.00% | 0.00% |

Emissions Forecast (2014)



Short Term Forecast (2009-2014)

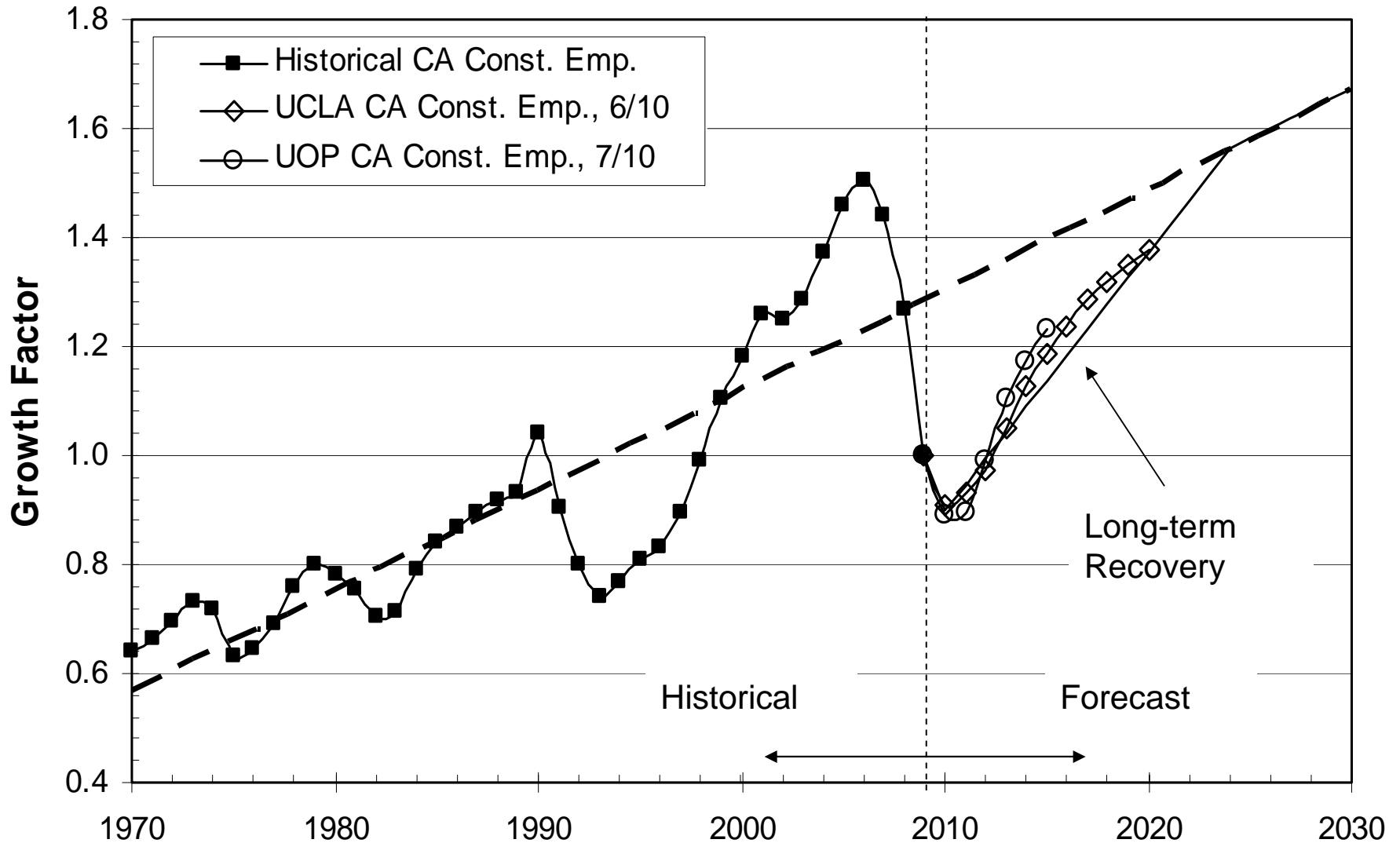
| CY | Construction & Mining, Industrial¹ | Airport Ground Support² |
|-----------|--|---|
| 2009 | 1.00 | 1.00 |
| 2010 | 0.90 | 0.97 |
| 2011 | 0.95 | 1.01 |
| 2012 | 0.99 | 1.05 |
| 2013 | 1.04 | 1.08 |
| 2014 | 1.09 | 1.12 |

1. Based on California construction employment

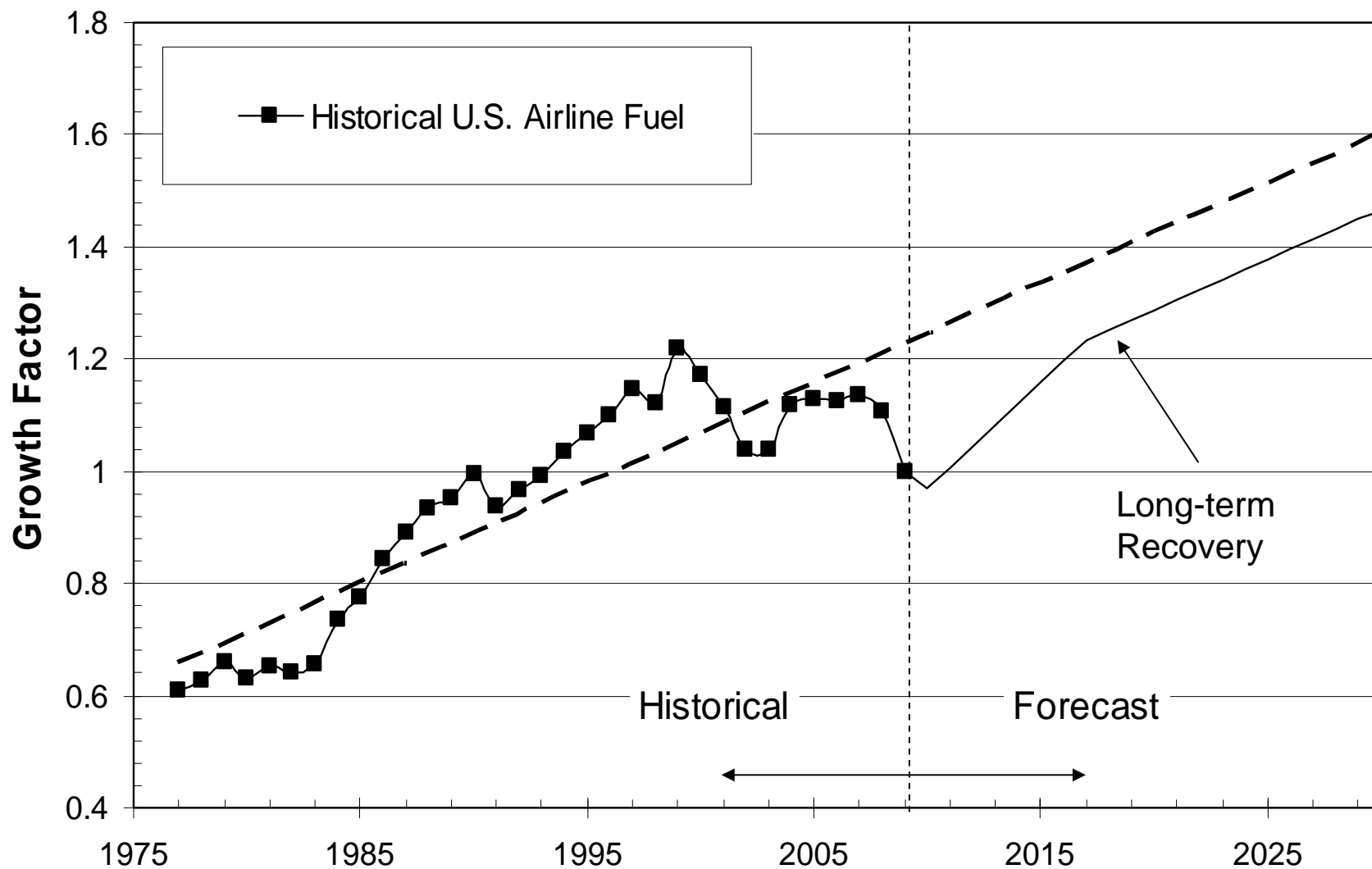
2. Based on U.S. Airline fuel

All fractions relative to 2009

Construction & Mining, Industrial



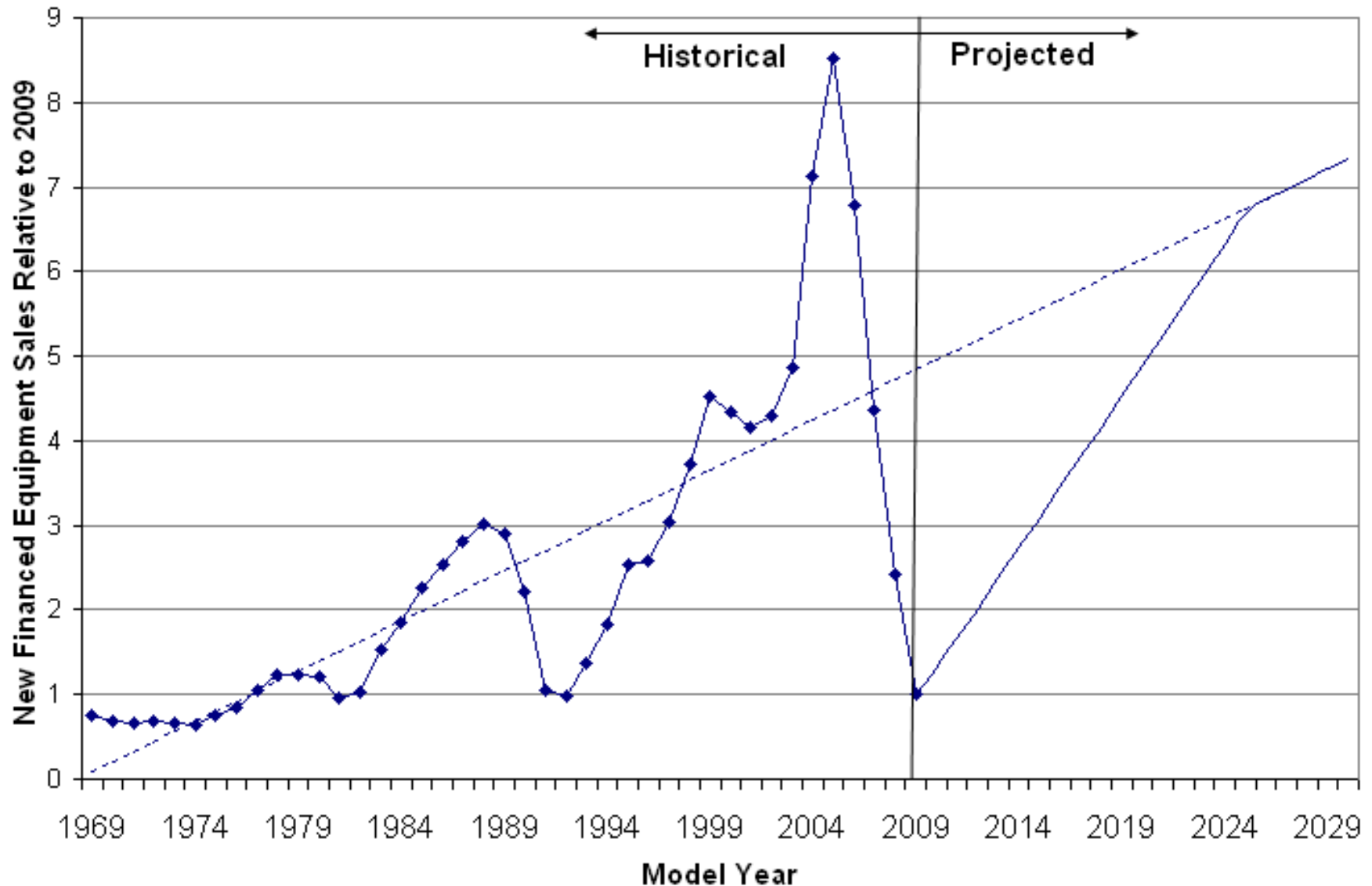
Ground Support Equipment



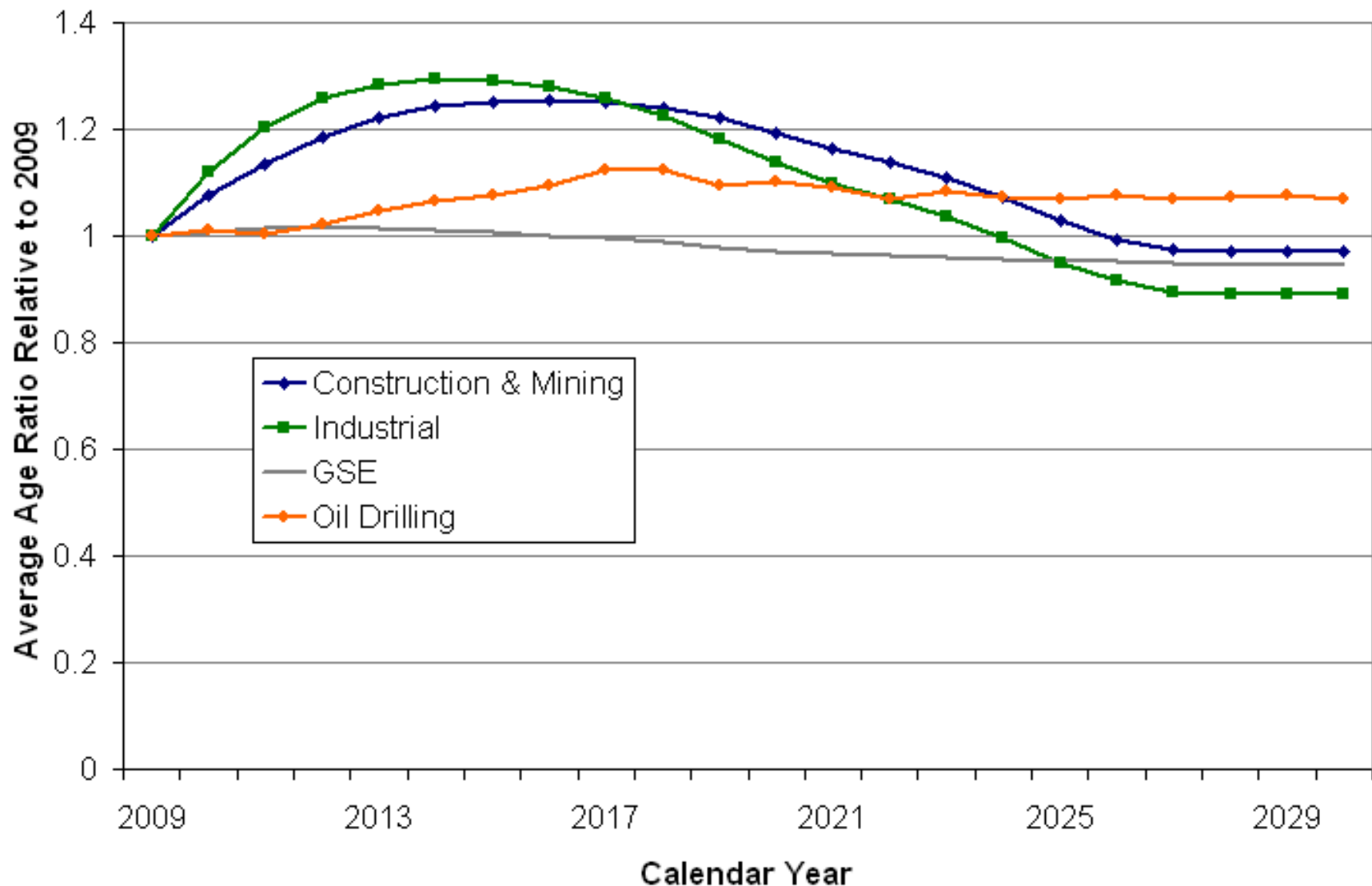
Impact of Recession and Forecasting on Age Distribution

- Staff incorporated the impacts of the economy on sales of new off-road diesel equipment. The strength of new equipment sales will impact the age distribution of the fleet into the future.
 - Depressed sales will lead to the fleet, as a whole, getting older over time
- The recovery scenario has a direct impact on the relative change in the fleet age over time.

Construction Equipment Sales



Impact of Sales on Age – Average Recovery Scenario



Other Inputs

- Brake Specific Fuel Consumption (BSFC)
 - OFFROAD fuel consumption rates are 0.401 lb/hp-hr
 - Staff adopted BSFC values from USEPA's NONROAD model (0.367 lb/hp-hr)
 - USEPA values very similar to engine data and industry comments
- Base Emission Factors – unchanged
- Deterioration Rates – unchanged
 - Capping deterioration at 12,000 hours

Spatial Allocation

- Construction equipment allocation methodology based on human population growth (same allocation used for trucks).
- Updated allocation of industrial equipment with newer employment data.
- GSE and Oil drilling equipment allocation remains unchanged.

Spatial Allocation - Construction

| Air Basin | OFFROAD | 2014 Updated |
|-----------|---------|--------------|
| SC | 36% | 37% |
| SF | 15% | 16% |
| SJV | 10% | 17% |
| MD | 2% | 3% |
| SV | 9% | 9% |
| SD | 9% | 9% |
| Others | 19% | 10% |

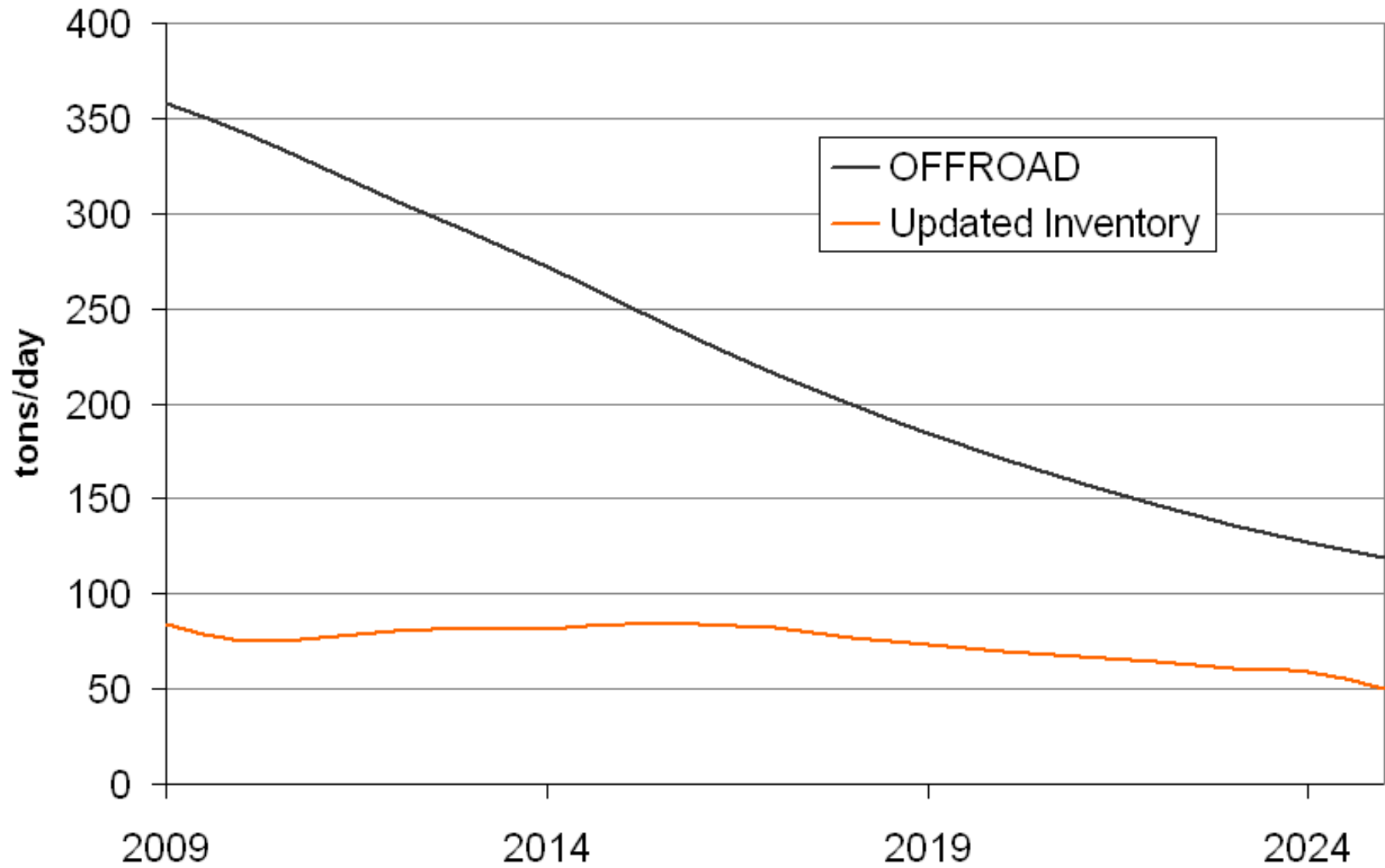
Spatial Allocation - Industrial

| Air Basin | OFFROAD | 2014 Updated |
|-----------|---------|--------------|
| SC | 56% | 47% |
| SF | 24% | 24% |
| SJV | 5% | 9% |
| MD | 1% | 2% |
| SV | 3% | 4% |
| SD | 6% | 7% |
| Others | 6% | 8% |

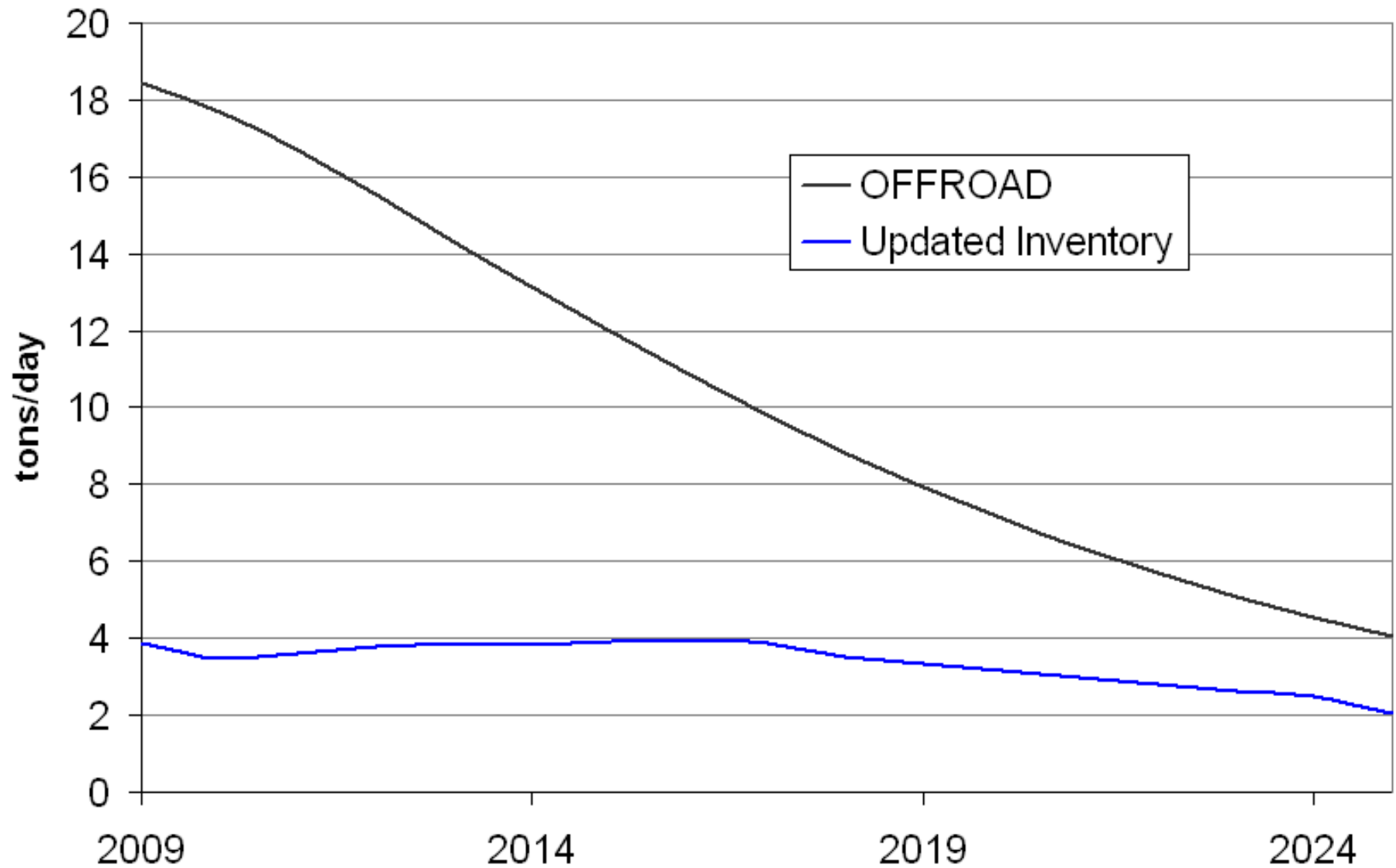
Overall Changes

- Population – lower
- Activity – lower
- Load Factor – lower
- Age – generally younger
- Growth – lower, especially in the early years due to the recession
- **Overall inventory is significantly lower than originally estimated.**

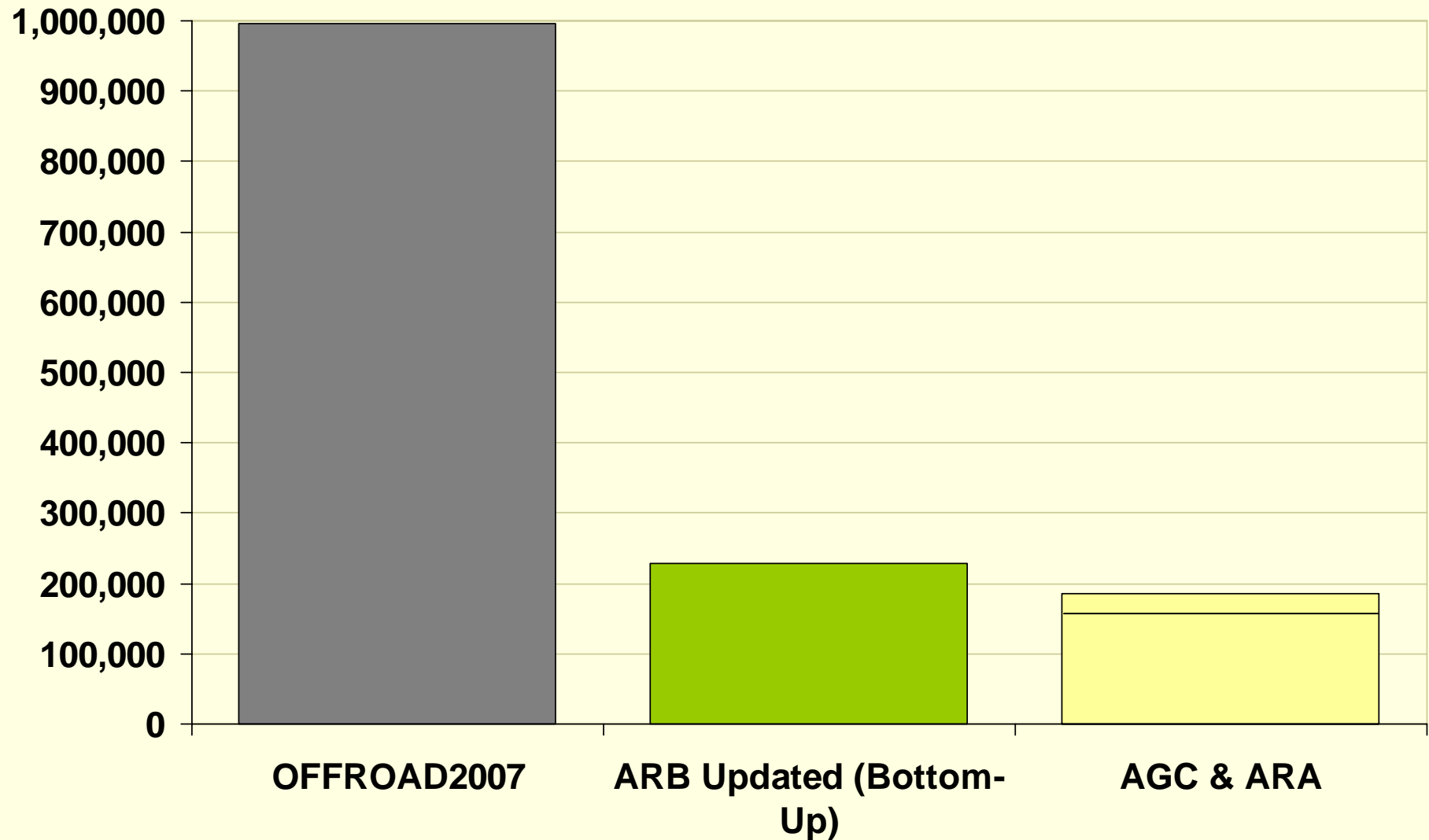
Statewide Baseline Emissions - NOX



Statewide Baseline Emissions – PM2.5



2009 Statewide Fuel Consumption (thousand gallons)



Next Steps

- Incorporate 'low use' vehicles
 - 7% DOORS vehicles designated as low use (<100 hours/year)
 - Assume 10% low use with threshold of <150 hours/year
 - Minimal impact to inventory

Estimated Margin

- Assuming currently adopted rule
- Does not reflect proposed regulatory amendments
- Presented in NOx Equivalent emissions
 - Assuming average economic recovery



Revised Combined Truck and Construction Margin

- South Coast
 - Previous estimate: 21-42 tons/day NOx Eq.
 - Current estimate: 61 tons/day NOx Eq.
 - Reduced truck shortfall due to revised regional allocation and out-of-state VMT
 - Reduced construction emissions due to methodology and impact of recession
- San Joaquin Valley
 - Current estimate: 40 tons/day NOx eq.

South Coast – Average Recovery Scenario (2014)

| South Coast | | 2014 Remaining Emissions (TPD) | |
|-------------------|--------------|--------------------------------|-----------|
| | | SIP | Updated |
| Off-Road | NOx | 85.6 | 26.2 |
| | PM2.5 | 2.3 | 0.9 |
| Trucks | NOx | 55.1 | 81.5 |
| | PM2.5 | 2.3 | 0.9 |
| NOx Eq (pm*10) | | 186.7 | 125.7 |
| New Margin | | | 61 |
| Old Margin | | | 21-42 |

San Joaquin Valley – Average Recovery Scenario (2014)

| SJV | | 2014 Remaining Emissions (TPD) | |
|----------------------|--------------|--------------------------------|-----------|
| | | SIP | Updated |
| Off-Road | NOx | 29.1 | 12.7 |
| | PM2.5 | 0.7 | 0.4 |
| Trucks | NOx | 88.6 | 75.2 |
| | PM2.5 | 1.9 | 1.1 |
| NOx Eq (pm*9) | | 141 | 101 |
| Margin | | | 40 |

Next Steps

- Finalize rule scenario inventories
- Complete documentation and models for release