California's Needs For Further Locomotive and Railyard Emission Reductions

UP Commerce Railyard

Locomotive Technology Symposium

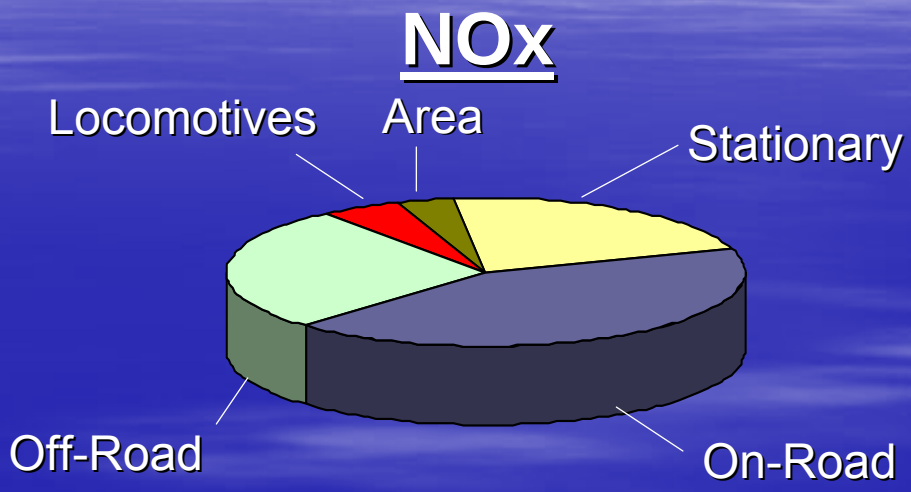
(June 10, 2009)

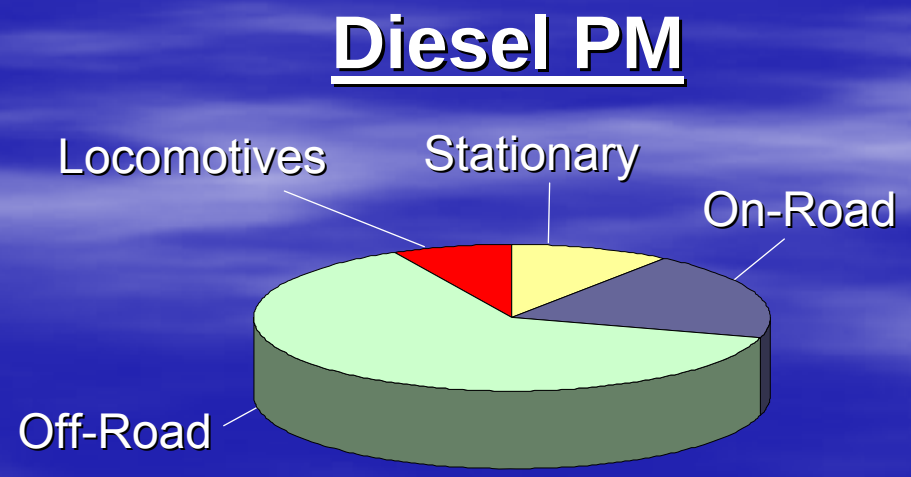
California Environmental Protection Agency

Air Resources Board

California Locomotive Emission Inventory

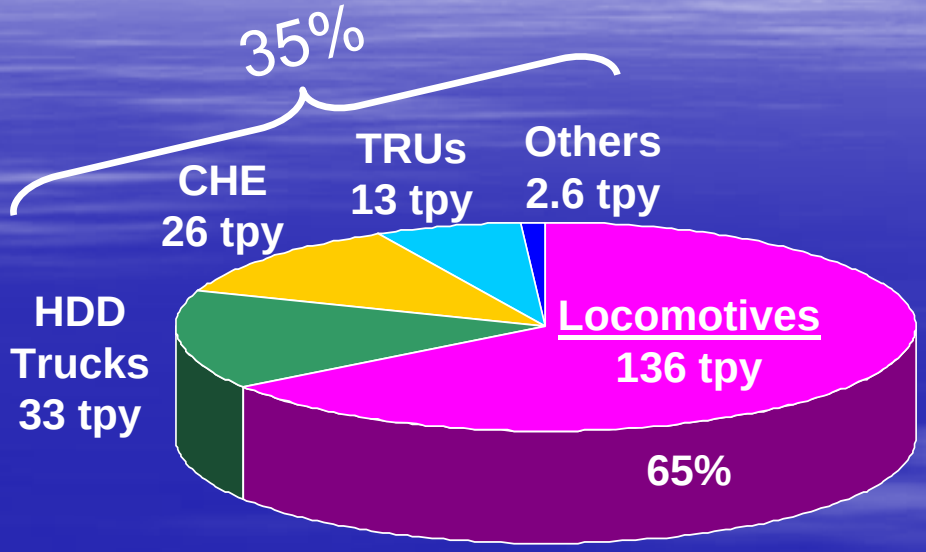
Air Basin	2005 NOx (tpd)	2005 PM (tpd)
Mojave Desert	39	1.3
South Coast	32	0.9
San Joaquin Valley	24	0.7
Sacramento	19	0.6
Bay Area	13	0.3
Salton Sea	9	0.3
Rest of the State	22	0.7
Statewide Total	158	4.8
% of Statewide Mobile Source Emissions	6%	4%





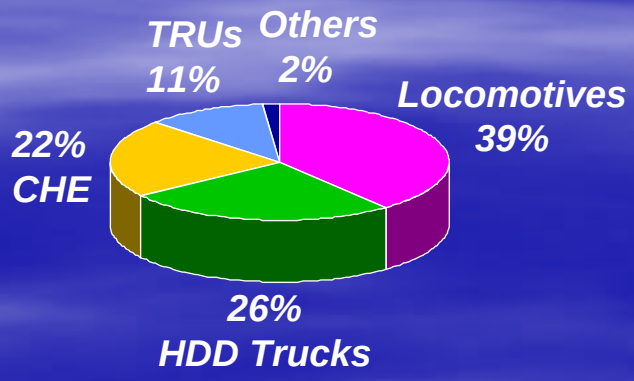
18 Major Railyards:

Diesel PM Emissions in 2005

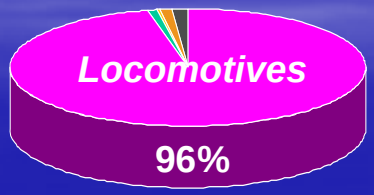


Total: 210 tons per year

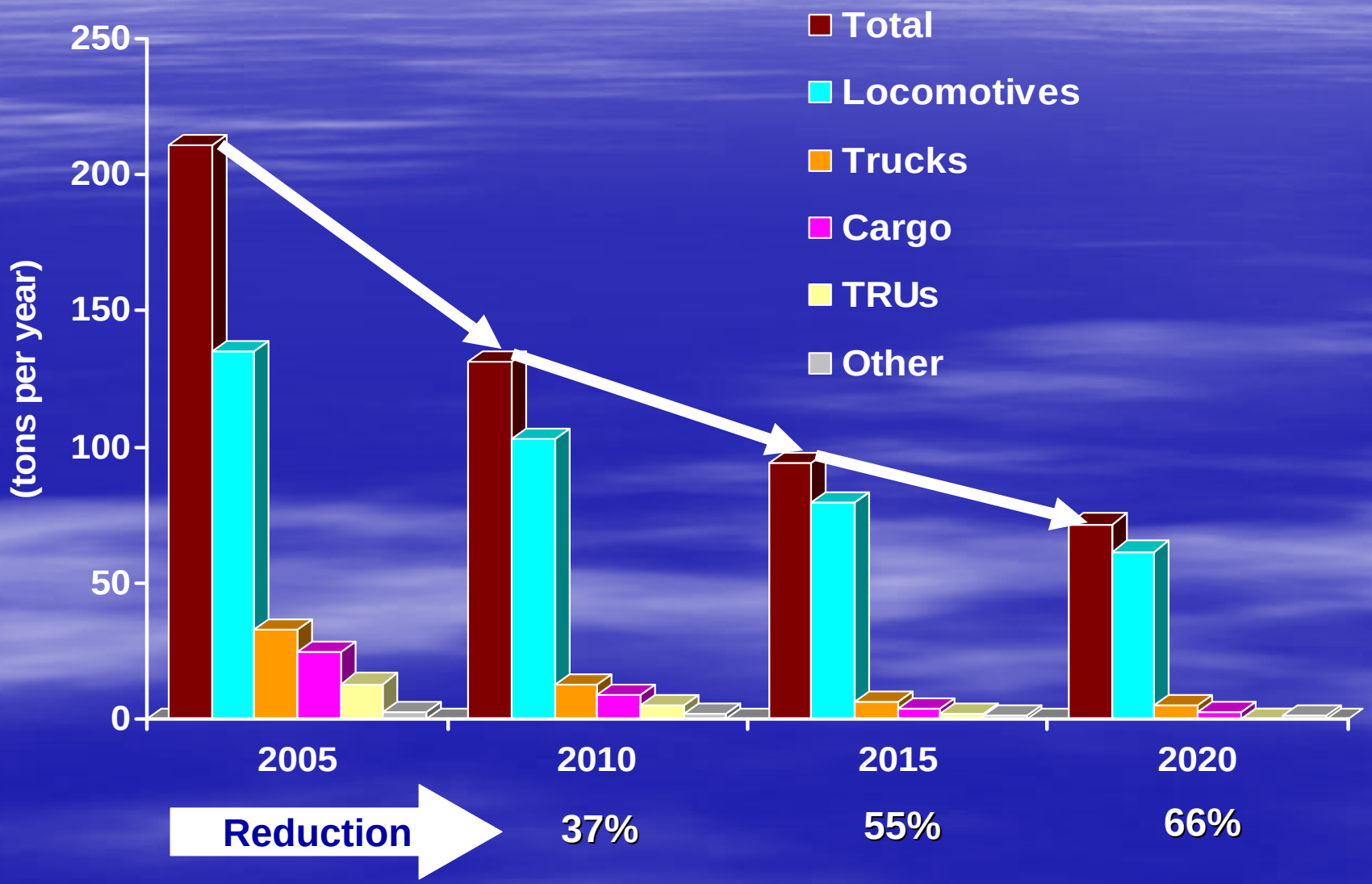
8 Intermodal Railyards DPM



10 Classification Railyards DPM



18 Major Railyards:
Total Diesel PM Emissions



18 Major Railyards:
Maximum Individual Cancer Risks (MICRs*)

Railyard	MICR in 2005 (chances in a million)	MICR in 2015** (chances in a million)
BNSF San Bernardino	2,500	910
UP Dolores (ICTF)	800	220
UP Roseville	645	375
BNSF Hobart	500	160
UP Commerce	500	155
UP Oakland	460	165
UP Industry	450	135
BNSF Barstow	450	320

* 10 railyards have estimated MICRs within a range of 40 to 250 in a million.

** MICR calculations are based on the percent reductions for each railyard for that year.

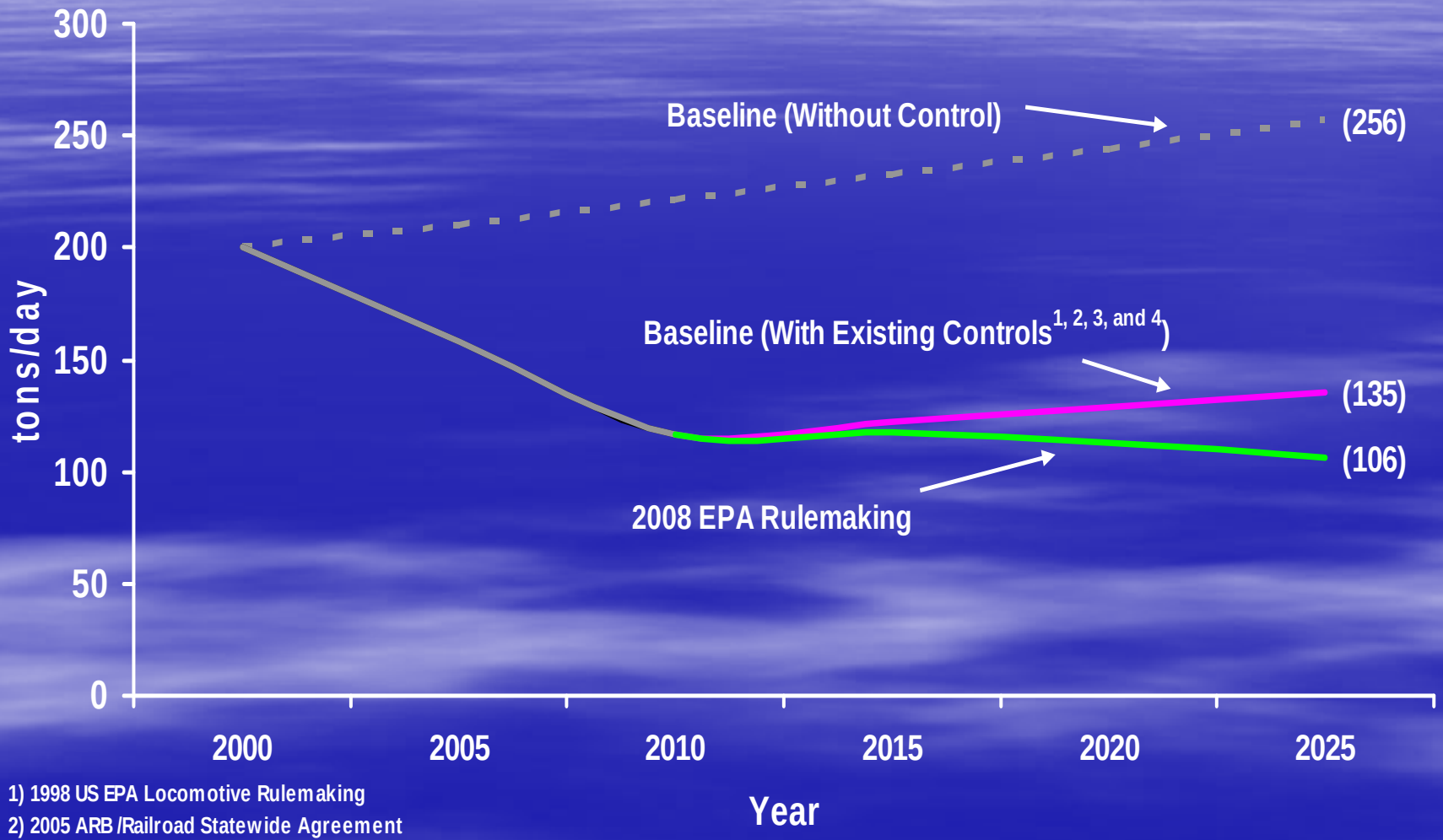
18 Major Railyards: Estimated Diesel PM Emissions and Populations Exposed to Associated Excess Cancer Risks

Year	Diesel PM Emissions (tons/year)	Population Exposure of Excess Cancer Risks (> 10 in a million)	Source of Estimation
2005	210 (locomotives = 136)	3,000,000	18 Railyard HRAs
2015	94 (locomotives = 79)	1,000,000	18 Draft Railyard Mitigation Plans
2020	72 (locomotives = 62)	850,000	18 Draft Railyard Mitigation Plans
2020	30 (locomotives = 25)	375,000	ARB GMERP*
2025	15 (locomotives = 6)	190,000	Staff Recommendations**

* ARB Goods Movement Emission Reduction Plans (GMERP) (April, 2006) specified 85 percent reduction in diesel PM associated cancer risks by 2020.

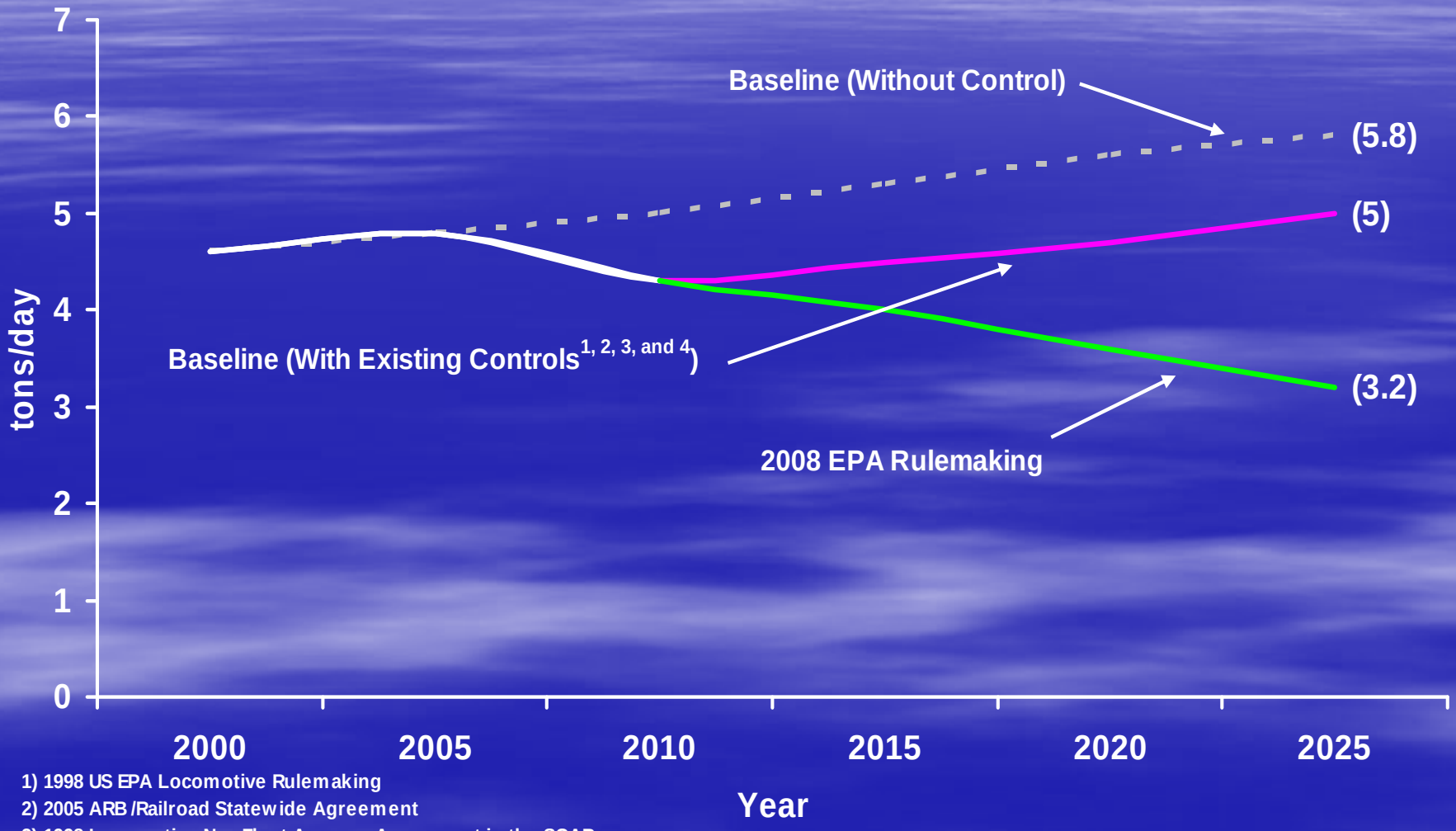
** Assuming only Tier 4 interstate line haul, medium horsepower, and switch (yard) locomotives will be operating in California.

Statewide Locomotive NOx Emissions



1) 1998 US EPA Locomotive Rulemaking
2) 2005 ARB /Railroad Statewide Agreement
3) 1998 Locomotive Nox Fleet Average Agreement in the SCAB
4) 2007 CARB Diesel Fuel Regulation for Intrastate Locomotives

Statewide Locomotive PM Emissions



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Railyard Summary

- 18 railyard mitigation plans provide significant diesel PM emission and risk reductions
- Diesel PM public health risks still high in 2015 and 2020
  - About one million resident exposure (> 10 in a million) in 2015
- Still need further diesel PM emissions and risks reductions
- Locomotives dominate railyard diesel PM emissions at 85 percent in 2015 and later

Technical Options

To Provide Additional Emissions and Risk Reductions from California Locomotives and Railyards

(Draft: December 2008 - Revised Draft: July 2009)

Switch Locomotive Options

- First Phase: Repower 152 to Ultra Low Emitting Switch Locomotive (ULESL) levels
  - NOx = 3.0 g/bhp-hr → 80% reduction
  - PM = 0.1 g/bhp-hr → 85% reduction
  - 2010 to 2012 or later
- Second Phase: Retrofit or repower 244 with DPF and SCR to meet or exceed Tier 4 levels
  - NOx = 1.3 g/bhp-hr → 67% reduction (above ULESL)
  - PM = 0.03 g/bhp-hr → 70% reduction (above ULESL)
  - 2011 to 2015 or later

MHP Locomotive Options

- First Phase: Repower 400 to Low Emitting (LEL) or Ultra Low Emitting Locomotive (ULEL) levels
  - NOx: LEL = 4.0 g/bhp-hr, ULEL = 3.0 g/bhp-hr
    - 70 - 80% reductions
  - PM = 0.1 g/bhp-hr → up to 80% reduction
  - 2012 to 2015 or later
- Second Phase: Retrofit 400 with DPF and SCR to meet or exceed Tier 4 levels
  - NOx =1.3 g/bhp-hr → 65 - 75% reduction (above ULEL or LEL)
  - PM = 0.03 g/bhp-hr → 70% reduction (above ULEL or LEL)
  - 2012 to 2020 or later

Interstate Line Haul Locomotive Options

- UP and BNSF national locomotive fleet
  - 15,000 locomotives, ~10,000 interstate
- Accelerate operation of up to 1,200 UP and BNSF interstate line haul locomotives into California on any given day
  - UP and BNSF may need up to 5,000 in national fleet to ensure 1,200 operating in CA on any given day
- Up to $3M/Tier 4 locomotive with DPF/SCR
- 2015 to 2020 or later

Potential Next Steps

- Revised draft Technical Options Document
  - July 2009
- Release draft recommendations document for public comment and public workshop
  - July/August 2009
- Goal: Release revised draft recommendations document to the public
  - August 24, 2009 (30 days prior to ARB Board meeting)
- ARB Board Meeting:
  - September 24, 2009