

## **Kirk Marckwald**

Association of American Railroads

### **Rail Issues 101**

Faster Freight – Cleaner Air Conference  
February 26, 2007



## **Setting the Context**

---

- What are the some of the challenges of lowering emissions from the Goods Movement System?
- Elements of the Railroads' Environmental Improvement Program (1994-2007)
- What are the emerging locomotive emissions control technologies?
- What reductions have been achieved by this program to date?
- Are the railroads doing their "fair share" to achieve aggressive emissions reductions?

## Southern California Goods Movement

---

- In 2005, POLA and POLB handled 14.2 million TEUs
  - 5<sup>th</sup> largest in world and largest in US
  - 1/3 is international containerized cargo
  - 77% is through traffic
- Up to 40,000 trucks daily on the I-710, I-605, and SR91
- Railroads - BNSF makes 5 million intermodal lifts annually
  - 64% are international containers
  - 70 trains from LA to inland empire; 50 on Alameda Corridor
- 1.6 Billion square feet of warehouse and distribution space
  - Another 32 million square feet under construction (75% in Riverside and San Bernardino)

Source: [http://www.metro.net/projects\\_programs/mcgmap/](http://www.metro.net/projects_programs/mcgmap/)

## Why Does it Matter?

---

- Goods Movement Contribution to Inventory\*
  - Approximately 75% of the statewide diesel PM comes from Goods Movement
  - Approximately 30% of the statewide NOx comes from Goods Movement
- Long-lived engines – a locomotive or ship engine is estimated to last 30-40 years.
- Goods Movement industry provides one out of 12 jobs in Southern California (SCAG)
- Growing fast– container shipments are estimated to double over the next 15-20 years
- Large portion of goods are “transshipped”

\* Source: CARB Proposed Emission Reduction Plan for Ports and Goods Movement in California (3/21/06), Page 14

## Goods Movement: Logistics Building Blocks

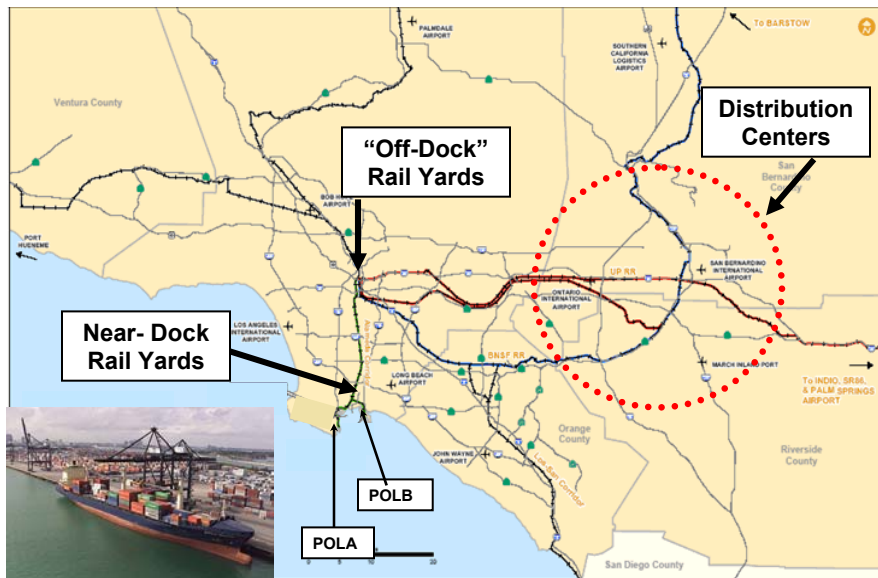


- Most goods arrive in Los Angeles in 40-foot marine containers (up to 8000 on a single ship)
- A standard 53-foot domestic rail container has 60% more useable space than a standard 40-foot marine container
- A standard 53-foot semi-trailer has 70% more useable space
- Rail and truck rates are not directly related to box size
  - Cost per cubic foot is what matters to an importer

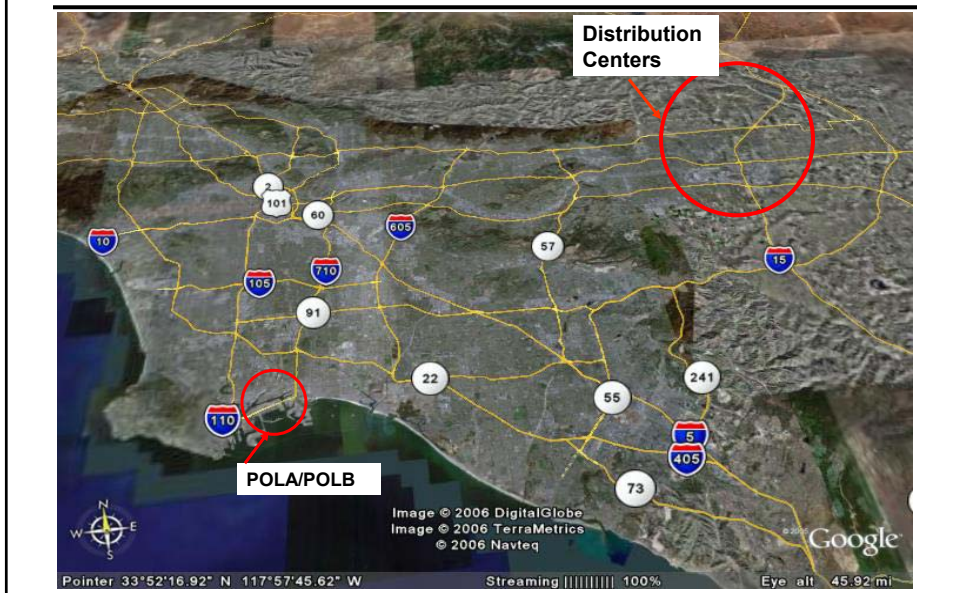
**Result: huge incentive to repack 40-foot marine containers into 53-foot domestic containers for trucks or trains as soon as possible**

<http://www.ieor.berkeley.edu/People/Faculty/leachman-pubs/PortModal.pdf>

## The Challenge: Goods Movement Flow



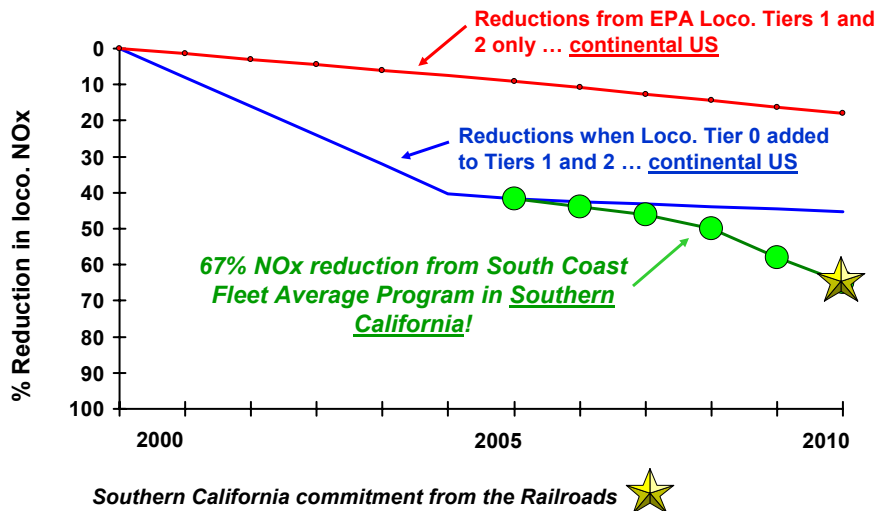
## Another View



## Railroads Environmental Improvement Program (1994 – Present)

- 1994 – Supported the US EPA's standards for new and re-manufactured locomotives
- 1998 – Signed MOU with the ARB to ensure on average the cleanest and best locomotives would operate in Southern California by 2010
- 2000 – Created a \$5 million end-user research & development program for new particulate trap research at Southwest Research Institute
- 2005 – Signed MOU with ARB projected to reduce PM at statewide railyards 20% by 2008
- 2007 – US EPA to propose new standards for both new and existing locomotives

## South Coast Fleet Average (1998 MOU)



## How the ARB Described the 1998 MOU

“ This compliance requirement would be met by the use of only the cleanest engines within the SCAB non-attainment area by an aggressive phase-in of these engines over five years. In essence, this fleet average requirement represents the most aggressive scrappage and replacement program of any transportation source in the SCAB (in effect, 100 percent scrappage/replacement with the latest, low-emitting locomotives over 5 years from 2005-2010). It would lead to an overall emission reduction of 67 percent by 2010.” [Emphasis Added]

The California State Implementation Plan for Ozone, Vol. II: The Air Resources Board's Mobile Source and Consumer Products Elements, Appendix B, at B-20 (Nov. 15, 1994).

## 2005 CARB/Rail MOU – Outcomes: 20% Reduction of Railyard PM by 2008

- Over 400 intrastate locomotives will be equipped with automatic shutdown devices with 15 minute idling limitation
- At least 80% of California fueling is low-sulfur
  - Six years earlier than required by federal regulation
- At least 99% of all locomotives will comply with stringent smoke regulations– a much higher rate than any other mobile source
- Health risk assessments will be carried out at the 16 major rail yards throughout CA

## How California MOUs Have Driven Air Quality Investments & Improvements

Locomotive Technologies	First Year Available	# of Units	% of CA Fleet	NOx Reduction from base line (per unit)	Incremental Air Quality Investment Nationwide to Date	CA Incremental Air Quality Investment Driven by MOUs by 2010	Are Other Mobile Sources Required to Do?
Mandatory Re-Build –Tier 0 (32% Complete Nationally)	2000	4619		30%	\$231 million		NO
Buy New Units – Tier 1	2002	1861		45%	[\$3.3 billion]		YES
Buy New Units – Tier 2	2005	1038		60%	[\$2.1 billion]		YES
Future Additional Line-haul Units to comply with 1998 MOU	2005	80				\$160 million	NO
Ultra Low-Emitting California Switchers in Service	2005	18	12%	80%		\$21.9 million	NO
Total ULEL California Switchers By 12/07	2005	91	60%	80%		\$ 109.6 million	NO
Automatic Shutdown Devices							NO
Line-haul units nationally (44% Complete)	2001	6113			\$18 million		
California units (Completed)		296	68%			\$ 5.8 million	NO
California units (Future by 6/08)		136	32%			\$ 2.8 million	NO
Incremental Air Quality Investment in California						\$ 300.1 million	



1998 MOU



2005 MOU



1998 and 2005 MOU

## Purchasing & Demonstrating New Technologies

- **Switch Locomotive Purchases:** By 12/07, at least 60% of units in Southern CA will emit at the ULEL rate
  - New “Gen-Set” switch engines using nonroad and truck engine technologies
  - Hybrid switch locomotives (“Green Goats”)
  - Niche market for Spark Ignited LNG technologies
- **Line Haul Locomotive Purchases:**
  - 1038 Tier 2 units as of January 1, 2007
- **Research & Development**
  - Hybrid line-haul locomotives with a manufacturer
  - Testing of OxyCats on 3800 hp line-haul units
- **Emission Reductions at Railyards**
  - Hood Development Program
  - Remote Sensing Feasibility Evaluation

## What near-term strategies & technologies are being implemented now?

- Dedicate/concentrate cleanest locomotives to service in CA ('98 MOU)
- Ultra Low-Emission switch locomotives
  - Hybrid Locomotives
  - Gen Set Switchers
- Development of retrofit particulate traps
- Expanded near dock rail
- More “on-dock” rail

*For more information: Go to UP Technology Exhibit today or Wednesday*

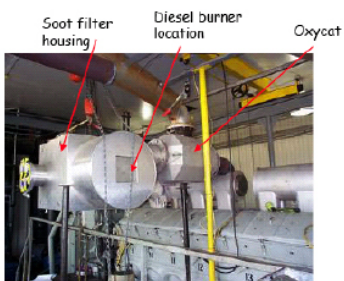


# Liquefied Natural Gas Switch Locomotive

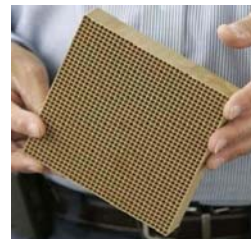
1200 sustainable horsepower, spark ignited



## Diesel Particulate Filter (DPF) R&D



- Railroads have been co-funding a \$5 million R&D project investigating performance durability and applicability of DPF to older switching locomotives
- R&D work being performed by Southwest Research Institute ("SwRI") through the Association of American Railroads
- One UP 1500 HP switcher equipped with DPF operating in Oakland
- One BNSF 1500 HP DPF equipped unit arriving to Southern California shortly



# What are Others Saying?



## Are the Railroads Doing Their "Fair Share"? **Yes**

	Trucks	Off-Road Equip.	Ships	Aircraft	Urban Buses	Locomotives
<b>Inventory**</b>						
<b>NOx</b>	29%	17%	13%	2.4%	2%	2.7%
<b>PM</b>	3.2%	7.5%	6%	0.5%		0.8%
<b>Standards for New Units</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Retrofit Existing Units</b>	No	No	No	No	Yes	Yes
<b>Rebuild to Standards</b>	No	No	No	No	No	Yes
<b>NOx Fleet Avg. in SCAQMD</b>	No	No	No	No	No	Yes
<b>Statewide PM 2005 MOU</b>	No	No	No	No	No	Yes

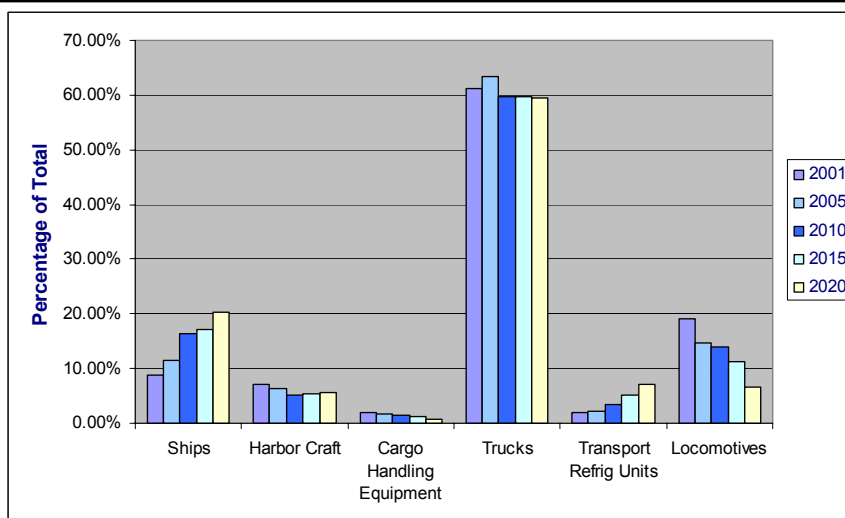
(\*\*South Coast AQMP Inventory 2010)

## Are these Programs Helping to Reduce Diesel PM from Railyards? **Yes**

Sources	Emissions (tpy) & Reductions			
	2005 (Base)	2010	% Reduction	Strategy
Through Trains	10	5	50%	'98 MOU
Switcher Locomotives	7	0.7	90%	'98, '05 MOU, CARB Diesel
Loco Refueling	2	0.5	75%	'98, '05 MOU
Cargo Equipment	34	13.6	60%	ARB Rule
Container Truck	7	0.7	90%	Bond (or Moyer) Funding
<b>Total</b>	<b>60</b>	<b>20</b>	<b>65%</b>	

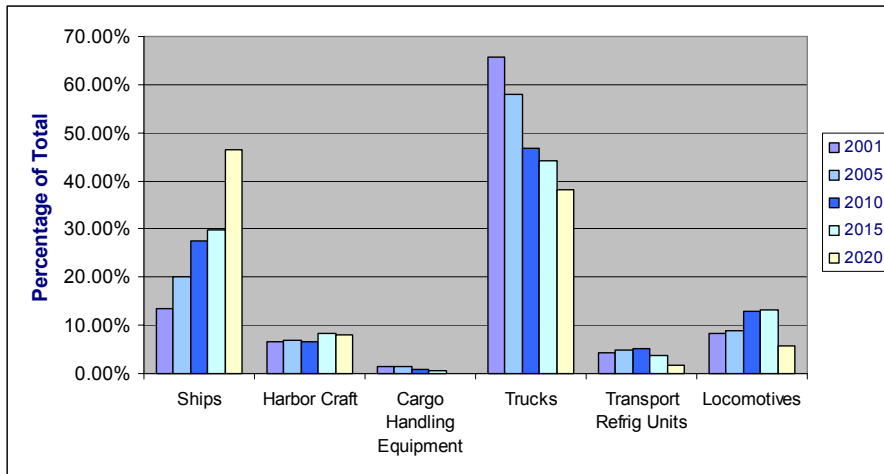
*Based on information the California Air Resources Board staff presented in 1/27/06 ARB Meeting*

## Projected Statewide Goods Movement NOx Emissions w/ Implementation of CARB Strategies



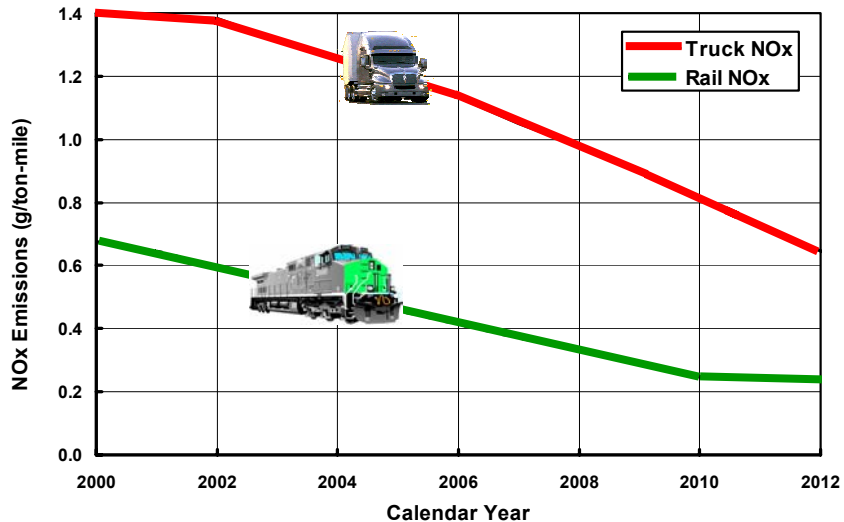
Source: CARB Draft Emission Reduction Plan for Ports and International Goods Movement in CA (3/21/06), Page 118

## Projected Statewide Goods Movement Diesel PM Emissions w/ Implementation of CARB Strategies

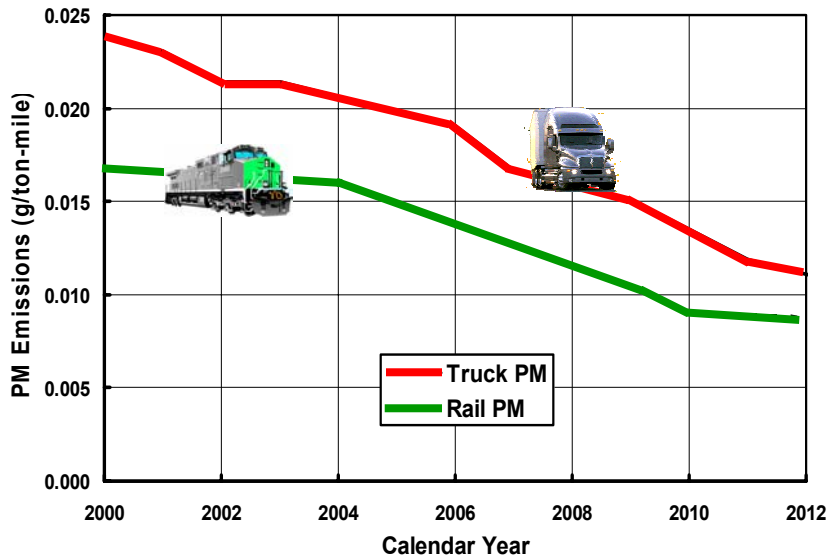


Source: CARB Draft Emission Reduction Plan for Ports and International Goods Movement in CA (3/21/06), Page 117

## NOx Emissions per ton Mile of Freight South Coast Air Basin



## PM Emissions per ton Mile of Freight South Coast Air Basin



### **Most Difficult Challenge: Evaluate Possibilities from a Systems Perspective**

- System design must balance the needs of shippers, transporters, commuters, adjacent communities, regulators, and many other stakeholders
- Altering one part of the system can cause disruption to the entire goods movement system of ship, rail, and truck operations throughout California
  - International port calls, labor opportunities, freeway traffic patterns, and even commuter rail operations
- Unintended economic and environmental consequences of various public policy choices must be squarely addressed
  - Mode Shift, Port Shift, Country Shift
- This issue requires a statewide focus and management team, as the Governor has tried to achieve.

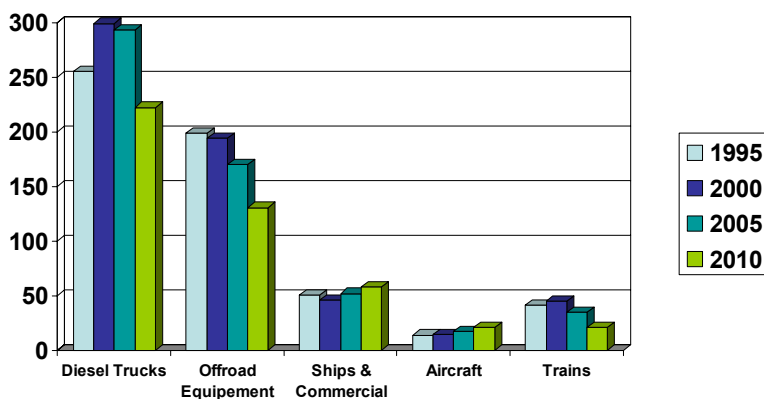
## Please contact me if you would like additional information

---

Kirk Marckwald  
 Principal  
 California Environmental Associates  
 415-421-4213, extension 12  
[kirk@ceaconsulting.com](mailto:kirk@ceaconsulting.com)

## SCAQMD NOx Inventories

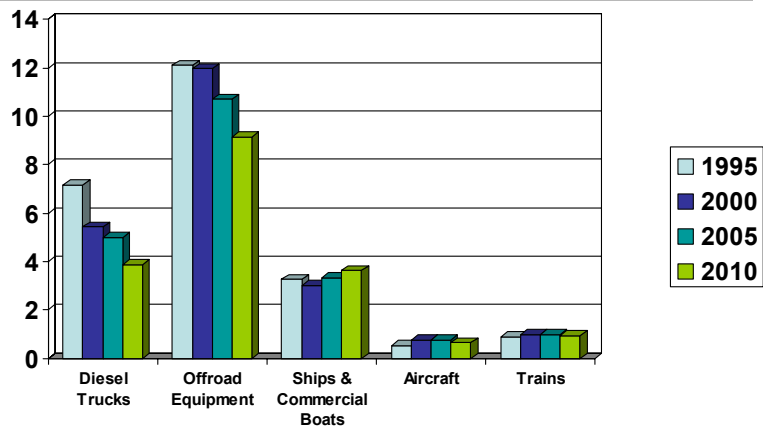
---



2010	Diesel Trucks	Offroad Equip	Ships	Aircraft	Trains
% SCAQMD NOx Inventory	28.5%	16.7%	12.6%	2.4%	2.7%

Data Source: ARB – Almanac Emission Projection Data (Published in 2005).  
 Diesel Trucks – LHDD1, LHDD2, MHDD, HHDD

# SCAQMD PM2.5 Inventories



2005	Diesel Trucks	Offroad Equip	Ships	Aircraft	Trains
% SCAQMD NOx Inventory	3.2%	7.5%	5.6%	0.5%	0.8%

Data Source: ARB – Almanac Emission Projection Data (Published in 2005).

Diesel Trucks – LHDD1, LHDD2, MHDD, HHDD