Executive Summary

International trade through California ports is a key contributor to the State's economic vitality. The logistics industry that manages the flow of goods into, through and out of California is also a growing source of high paying jobs with demonstrable career ladders into the middle class. Unfortunately, this prosperity comes with a price. Air pollution from international trade and goods movement in California is a major public health concern at both the regional and community level. In addition, goods movement is now the dominant contributor to transportation emissions in the State. The staff of the Air Resources Board (ARB or Board) has developed this draft plan to identify and initiate specific actions necessary to reduce these emissions and protect public health.

The draft emission reduction plan is part of the broader Goods Movement Action Plan being jointly carried out by the California Environmental Protection Agency (Cal/EPA) and the Business, Transportation & Housing Agency (BT&H). Cal/EPA and BT&H's Phase 1 Action Plan released in September 2005 highlighted the air pollution impacts of goods movement and the urgent need to mitigate localized health risks in affected communities. The Phase I Action plan established four specific goals for addressing this problem: reduce emissions to 2001 levels by 2010; continue reducing emissions past until attainment of applicable standards is achieved; reduce diesel-related health risks 85% by 2020, and ensure sufficient localized risk reduction in each affected community. These goals are being refined through further discussion in the Goods Movement Public Health & Environmental Mitigation Work Group and the Integrating Committee.

Successful implementation of the ARB emission reduction plan will depend upon actions at all levels of government and partnership with the private sector. No single entity can solve this problem in isolation. The basic strategies to reduce emissions include regulatory actions, incentive programs, lease agreements, careful land use decisions and voluntary actions. The measures address all significant emission sources involved in goods movement including marine vessels, harbor craft, cargo handling equipment, locomotives and trucks.

ARB staff will refine the draft emission reduction plan over the next several months, based on input from the general public, affected industries, the Cal/EPA and BT&H Goods Movement Action Plan work groups, local air districts and other stakeholders. Staff is also seeking scientific peer review of its health risk assessment methodology and conclusions. Public workshops on the plan will be scheduled throughout California early next year. Finally, an ARB public hearing on the emission reduction plan will be held in the Spring of 2006 (exact date to be determined).

Specific actions to reduce goods movement emissions are already underway. Rules for sources under ARB's direct regulatory authority have been adopted and more are on the way. Likewise, the U.S. Environmental Protection Agency (U.S. EPA) is working on national regulations affecting marine vessels, locomotives and harbor craft, scheduled for promulgation next year. Together, ARB staff, U.S. EPA staff and other state representatives are exploring a potential "Sulfur Emission Control Area" (SECA) designation for parts of the U.S. coastline, which would require all visiting vessels to use lower sulfur fuels. A significant amount of existing incentive funds have been applied to goods movement emission sources and ARB has prioritized continued funding on this source of statewide significance. Finally, several local entities are pursuing elements of this emission reduction plan through their own ordinances, regulations, lease agreements, environmental mitigation requirements and voluntary efforts. Staff expects all of those activities to continue.

Public Health Assessment

As part of the emission reduction plan, ARB staff estimated the public health impacts of the goods movement system in California. This was no simple undertaking and has yet to undergo scientific peer review. Accordingly, the results should be considered very preliminary and subject to change. Health impacts of pollutants commonly associated with emissions from goods movement include premature death, cancer risk, respiratory illnesses, and increased risk of heart disease. Particulate matter, primarily from diesel engines, and pollutants that form ozone and particulate matter in the atmosphere are key pollutants associated with these health effects. The large body of scientific research on these pollutants forms the basis for air quality standards and risk assessments used in ARB programs.

ARB staff estimates that emissions from current (2005) goods movement activities result in approximately 750 premature deaths per year. Without additional emissions control, that figure will rise to approximately 920 premature deaths per year by 2020. To put that number in perspective, ARB staff estimates that the total statewide deaths associated with particulate matter and ozone exposure above the levels of the State standards are approximately 9,000 per year. Estimates are also provided in this plan for the annual rate of other health impacts that could be quantified such as air pollution related hospitalizations, asthma attacks and missed work/school days. Non-quantifiable risks are discussed in a qualitative way.

The economic valuation of these health effects is substantial, assuming the standard value of $9.3 million dollars (in 2020) per life ended prematurely. For the 15-year period between 2005 and 2020, staff estimates an aggregate health impact equivalent to approximately $70 billion in present value dollars. Reducing these health impacts as quickly as possible is essential.

Please note: the health impact assessment in this plan is premised on the quantity of emissions assigned to the "goods movement" category (see below). If those assumptions change, then so will the calculation of total health effects associated with "goods movement".

Emission Inventory

The emissions associated with international trade and goods movement are categorized by source and shown in Table 1 for 2001 and 2020 below. This plan evaluates the following pollutants: diesel particulate matter (diesel PM), nitrogen oxides (NOx), reactive organic gases (ROG), and sulfur oxides (SOx). For each category, staff estimated 2001 "baseline" emissions, current (2005) levels and future forecasts for 2010, 2015 and 2020. The future forecasts include the benefits of existing requirements and assumed growth rates. Without further action, ship emissions will increase through 2010 and beyond, making this the single most challenging category to address. Truck, rail, cargo handling and harbor craft emissions are expected to decrease continuously but not at a rate fast enough to meet public health goals.

Table 1
2001 and 2020 Statewide Emissions
from Ports and International Goods Movement
(tons per day)

Source	Diesel PM		NOx		ROG		SOx	
	2001	2020	2001	2020	2001	2020	2001	2020
Ships	8	21	94	223	3	6	59	158
Harbor Craft	4	4	86	83	9	9	1	<1
Cargo Handling Equipment	1	<1	21	6	3	<1	<1	<1
Trucks	3	2	129	50	14	9	2	1
Locomotives	2	1	77	45	5	4	3	<1
Total	**18**	**28**	**407**	**407**	**34**	**28**	**65**	**159**

The ship inventory (baseline and growth forecast) tracks with the June 2005 Port of Los Angeles report, adjusted to include all other ports in California. The emission inventory includes all ship emissions within 24 miles of shore. Dockside emissions are an especially important health risk to nearby communities. Off-shore emissions are most important from the standpoint of regional ozone and fine particulate matter (PM2.5) levels. Growth factors were calculated separately for harbor craft (tug boats, ferries, fishing boats, other vessels) and cargo handling equipment.

To determine goods movement-related locomotive emissions, staff took a subset of the statewide inventory. The fraction of train activity related to movement of internationally imported and exported goods was estimated at about 40% in the Los Angeles region and about 35% in the San Francisco Bay Area and Central Valley. Other trains were assumed to be moving into California from the Midwest or from the North, or hauling non-international goods. Staff also developed emission estimates for locomotive activity within ports and intermodal rail yards. ARB staff is seeking comment on whether dividing locomotive emissions between domestic and international operations is appropriate for defining rail-related goods movement emissions.

For trucks, ARB staff made similar assumptions. Nearly all goods are moved by truck at some point, whether imported through the ports, from other states, Mexico, or Canada, whether generated and consumed within California, or whether generated and exported from California. For this plan, ARB staff estimated goods movement truck emissions for three components: (1) trucks at ports and rail yards, (2) the portion of overall regional truck emissions attributed to direct trips to and from ports, and (3) "secondary" truck trips to distribution centers or truck/rail intermodal transfer facilities. ARB staff is seeking public comment on whether goods movement-related truck emissions should be defined this way.

Emission Reduction Targets

As noted above, the Phase I Goods Movement Action Plan established four goals to reduce goods movement-related emissions over time. This plan defines several additional targets for each emission source category, based on staff's assessment of technological feasibility and probable timing. In every case, the emission reduction targets are inclusive of anticipated growth. When implemented, they will result in a net *decrease* in emissions.

This plan also anticipates what the potential attainment needs of the South Coast air basin will be with respect to the national ozone and PM2.5 standards. Specifically, the plan seeks to reduce NOx emissions by 30% in 2015 beyond current control levels, and an additional 50% beyond current controls in 2020. These NOx targets are based on very preliminary "carrying capacity" estimates that will be refined through modeling as part of the upcoming State Implementation Plan (SIP) process.

For now, the plan assumes across-the-board reductions from goods movement emission sources in each region. During SIP preparation, final regional reduction targets will be developed, all source categories will be more closely assessed, and a complete list of SIP measures will be proposed taking into account technological feasibility and cost. This will occur through a public process involving ARB, U.S. EPA, local air districts, metropolitan planning organizations and all other stakeholders. New SIPs for ozone and PM2.5 are due in 2007 and 2008, respectively.

Emission Reduction Strategies

Ships are the most challenging emission sources in the goods movement system. The vessels that transport goods in and out of California harbors have little or no emissions control and run on high emitting bunker fuel. Unless that changes, ship emissions will continue to increase as trade expands. Ocean going ships are the only category of emission sources that do not meet the 2010 goal for reducing emissions back to 2001 levels. Instead, this plan would achieve that goal by 2015. The plan proposes a mix of strategies for ocean going ships that would reduce projected emissions from this category 50% or more in 2015 and 65% or more in 2020.

Commercial harbor craft were an early focus for ARB and air districts given proximity to coastal communities. More than $17 million in Carl Moyer Program funds have been used to clean up commercial harbor craft to date. In 2004, ARB adopted a regulation requiring harbor craft to use cleaner diesel fuel in the South Coast starting in 2006, going statewide in 2007. Next year, ARB will consider a regulation to clean up existing harbor craft propulsion and auxiliary engines via replacement, rebuild, add-on controls, and/or alternative fuels. Shore power for harbor craft is also under consideration. The plan targets a 40% plus reduction in this category by 2020.

Cargo handling equipment poses a major health risk to near-port communities due to the location of the emissions. On December 8, 2005, ARB's governing board will consider a proposed regulation to reduce these emissions. The regulation would accelerate the introduction of cleaner technologies beginning in 2007 with increasing benefits in 2010 through 2015. The overall strategy relies on implementation new engine standards that phase in from 2007-2015. Overall, emissions from cargo handling will continue to decline through 2020 and beyond. The last element of the strategy would be to step up diesel PM control to the 85% level in the future as additional verified retrofit technologies become available. By 2020 emissions will be reduced by over 80% for the key pollutants.

Trucks are the largest contributor to port-related NOx and the largest on-shore source of diesel PM. Existing regulations are reducing these emissions each year but very significant impacts remain. Cleaning up the truck fleets serving ports, reducing traffic congestion and idling, routing trucks away from neighborhoods, and providing the cleanest diesel fuel are components of the overall truck strategy. Recent ARB actions include anti-idling rules, controls for transport refrigeration units, community-based truck inspections, low sulfur fuel requirements, and reducing excess NOx from 1993-1998 trucks. The primary new strategy in this plan is to modernize truck fleets serving ports. Staff set a goal of replacing pre-2003 trucks with trucks that are 80% or more controlled for both PM and NOx by 2010. In addition, all pre-2007 trucks would be retrofitted with diesel particulate filters to achieve 85% PM control. Lastly, the strategy would require PM and NOx retrofits for 2003-2006 trucks expected to serve the port beyond 2010 (if verified technologies are available). The plan targets an over 55% reduction in diesel PM and NOx and a 38% reduction for ROG by 2020.

Locomotives are subject to existing federal standards and the two memoranda of understanding negotiated with the ARB in 1998 and 2005. The plan proposes new strategies to upgrade engines in switcher locomotives and to retrofit diesel PM controls on existing engines. There are at least two technologies that could provide 80-90% reductions from switchers by 2010: diesel-electric hybrids and multiple off-road diesel engine configurations. Particulate retrofits have not been used in California rail yards yet but they have been introduced in Europe and both major railroads are testing locomotives equipped with diesel particulate filters right now. A third element of the strategy relies on U.S. EPA adoption of cleaner new engine standards (Tier 3), more stringent rebuild requirements, and national idling limit devices. ARB staff is recommending federal standards that would achieve 90% control of diesel PM and NOx

for new engines. A comprehensive program to bring these cleaner locomotives to California could make the fleet 90% cleaner by 2020. The plan targets a 68% reduction in PM by 2020 and nearly 90% reduction for the other pollutants.

The plan includes two additional strategies that are conceptual in nature and would be implemented by other agencies and segments of the goods movement industry. These are improved land use decision-making and site specific mitigation at the project or community level.

In 2005, ARB recognized the importance of land use decision-making with the approval of our guidance document "Air Quality and Land Use Handbook: A Community Health Perspective." This document recommends that local government consider the health impacts of air pollution in land use permitting and planning processes. A key recommendation is to provide appropriate separation between air pollution sources, like ports and rail yards, and sensitive land uses, like homes and schools.

The other overarching strategy is mitigation tailored to address existing community problems or the impacts of new projects. Environmental review provisions of State and federal law provide the legal framework for development of environmental mitigation where government approvals are required for a new project. For major expansions related to goods movement, development of a community benefits agreement may be a mechanism to address environmental and other community impacts. The concepts outlined in the plan for statewide application -- especially use of cleaner engines and fuels – may be feasible earlier in targeted situations. This provides opportunities for site specific mitigation prior to full implementation of the strategies on a statewide basis. This would help mitigate community impacts as quickly as possible with a priority on the most impacted areas. Mitigation of existing impacts near rail yards is an example of the need to address health risk issues in specific communities as well as on a statewide basis.

The complete list of plan strategies along with implementation timeframes is shown in Table 3.

Table 3
List of Strategies to Reduce Emissions from Ports and International Goods Movement

Strategy	Status (Adopted or New Strategy)	Implementation Could Begin By		
		2010	2015	2020
SHIPS				
Vessel Speed Reduction Agreement for Southern California	2001	✓		
U.S. EPA Main Engine Emission Standards	2003	✓		
U.S. EPA Non-Road Diesel Fuel Rule	2004	✓		
ARB Rule for Ship Auxiliary Engine Fuel	New	✓		
Cleaner Marine Fuels	New	✓	✓	✓
Emulsified Fuels	New	✓	✓	✓
Expanded Vessel Speed Reduction Programs	New	✓	✓	✓
Install Engines with Emissions Lower than IMO Standards in New Vessels	New	✓	✓	✓
Dedicate the Cleanest Vessels to California Service	New	✓		
Shore Based Electrical Power	New	✓		
Extensive Retrofit of Existing Engines	New		✓	✓
Highly Effective Controls on Main Engines and Existing Engines	New		✓	✓
Sulfur Emission Control Area (SECA)	New		✓	
Expanded Use of Cleanest Vessels in California Service	New		✓	
Expanded Shore Power and Alternative Controls	New		✓	
Full Use of Cleanest Vessels in California Service	New			✓
Maximum Use of Shore Power or Alternative Controls	New			✓
COMMERCIAL HARBOR CRAFT				
Incentives for Cleaner Engines	2001-2005	✓		
ARB Low Sulfur Diesel Fuel Rule	2004	✓		
ARB Rule to Clean Up Existing Engines	New	✓		
Shore Based Electrical Power	New	✓		
New Engine Emission Standards	New		✓	

Strategy	Status (Adopted or New Strategy)	Implementation Could Begin By		
		2010	2015	2020
CARGO HANDLING EQUIPMENT				
Incentives for Cleaner Fuels	2001-2005	✓		
ARB Low Sulfur Diesel Fuel Rule	2003	✓		
ARB/U.S. EPA Tier 4 Emission Standards	2004	✓		
ARB Stationary Diesel Engine Rule	2004	✓		
ARB Portable Diesel Equipment Rule	2004	✓		
ARB Rule for Diesel Cargo Handling Equipment	New	✓		
ARB Rule for Gas Industrial Equipment	New	✓		
Upgrade to 85 Percent Diesel PM Control or Better	New		✓	
Zero or Near Zero Emission Equipment	New			✓
TRUCKS				
ARB/U.S. EPA 2007 New Truck Emission Standards	2001	✓		
Vehicle Replacement Incentives	2001-2005	✓		
ARB Truck Idling Limits	2002-2005	✓		
ARB Low Sulfur Diesel Fuel Rule	2003	✓		
ARB Smoke Inspections for Trucks in Communities	2003	✓		
ARB Transport Refrigeration Units Rule	2004	✓		
ARB Low NOx Software Upgrade Rule	2005	✓		
Port Truck Modernization	New	✓	✓	
Enhanced Enforcement of Truck Idling Limits	New	✓		
Ensure International Trucks Meet U.S. Emission Standards	New	✓		
LOCOMOTIVES				
ARB Low Sulfur Diesel Fuel Rule	2004	✓		
ARB 2005 Agreement with Railroads to Cut PM Statewide	2005	✓		
Upgrade Engines in Switcher Locomotives	New	✓		
Retrofit Diesel PM Control Devices on Existing Engines	New	✓		
Use of Alternative Fuels	New	✓		
More Stringent National Requirements	New		✓	
Concentrate Tier 3 Locomotives in California	New		✓	
OPERATIONAL EFFICIENCY				
Efficiency Improvements	New	✓	✓	✓
Transport Mode Shifts	New	✓	✓	✓
LAND USE DECISIONS	New	✓	✓	✓
PROJECT AND COMMUNITY SPECIFIC MITIGATION	New	✓	✓	✓

Health and Economic Impacts

The strategies outlined in this plan will provide significant statewide health benefits and in the communities adjacent to ports, rail yards, intermodal facilities and highways. These strategies are projected to reduce health impacts by over 50% in 2020, as compared to a no further action baseline. Table 4 shows the health outcomes in 2020, with and without the proposed strategies.

Table 4
Health Benefits of New Plan Strategies in 2020

Impact	Number Without Plan in 2020	Number Avoided With Plan in 2020
Premature Deaths	920	500
Hospital Admissions (Respiratory Causes)	320	170
Asthma Attacks	18,000	9,900
Work Loss Days	160,000	86,000
Minor Restricted Activity Days	1,100,000	570,000
School Absence Days	350,000	180,000

The projected health benefits from these strategies also have an economic benefit. Table 5 shows the dollar value of the health benefits of the plan in 2020.

Table 5
Value of Health Benefits from Reducing Statewide Emissions from Ports and International Goods Movement
(Year 2005 dollars)

Impact	Value in 2020 (in millions)	Range (in millions)
Premature Deaths	$1,700 to $3,000	($600-$5,800)
Hospital Admissions (for Respiratory Causes)	$2 to $4	($1-$5)
Asthma Attacks	$0.2 to $0.3	($0.04-$1.0)
Work Lost Days	$6 to $10	($5-$11)
Minor Restricted Activity Days	$13 to $22	($6-$50)
School Absence Days	$6 to $10	($2-$19)
Total	**$1,700 to $3,000**	**($600-$5,800)**

By 2020, the total cumulative cost to implement the new plan strategies is $3-6 billion in net present value. Table 6 shows the range of cumulative costs.

Table 6
Cumulative Costs to Implement Plan Strategies
(Year 2005 dollars)

Year	Range of Cumulative Cost (in billions)	
	Low End	High End
2010	$1.3	$1.4
2015	$2.3	$3.8
2020	$4.1	$8.5

To derive a cost-benefit ratio, we looked at the cumulative health benefits from premature deaths avoided and the economic value of those benefits over the 2005-2020 timeframe of the plan, in present value dollars.

Table 7
Benefit*-Cost Ratio for Plan Strategies from 2005 Through 2020
(in present value dollars)

	Cumulative Costs and Benefits (2005-2020)
Premature Deaths Avoided by New Plan Strategies	4,500
Economic Value of the Premature Deaths Avoided	$23 billion
Cumulative Costs to Implement New Plan Strategies	$3 - $6 billion
Benefit-Cost Ratio	**4-8 to 1**

* Benefits reflect only premature deaths avoided.

Thus, for every $1 invested to implement these strategies, there are $4 to $8 dollars in economic benefits realized by avoided premature deaths. The level of benefits would rise if you considered other health impacts as well.

Plan Performance

ARB staff has evaluated whether the emission reduction plan is sufficient to meet the numerical goals set forth in the introduction above.

The first objective is to stop emissions growth. In Southern California, the Board of Harbor Commissioners set a goal of "no net increase" in emissions from the Port of Los Angeles using a 2001 baseline. This plan applies the same goal statewide. Staff calculated the reductions needed to meet the 2010 target on a statewide basis and for local air districts with the greatest port and goods movement activity -- South Coast, San Diego, San Francisco and the San Joaquin Valley. In every case, the 2010 target will be achieved and some geographical areas it will be exceeded.

With respect to reducing goods movement-related diesel PM 85% by 2020, that target turned out to be extremely ambitious. Staff drew that goal from ARB's statewide diesel risk reduction plan adopted in 1991 which set the same goal for the 1.2 million on and off-road diesel engines in the State. However, marine vessels and harbor craft were not part of ARB's original thinking and are less amenable to particulate trap retrofits (the basis of the 85% target) by 2020. Accordingly, staff estimates that the plan will achieve only a 44% mass reduction in goods movement-related diesel PM by that date and a corresponding 64% exposure-weighted risk reduction. ARB staff are seeking public comment on how best to close this gap.

For the South Coast NOx reduction targets, the picture is good. Compared to the 30% reduction target by 2015, the plan provides for 50% control. Similarly, for the 50% reduction target in 2020, the plan provides 60% control.

Vision for the Future

Meeting the public health challenge posed by goods movement requires a combination of innovative and readily available strategies. Government will do its part but cleaner technology and operational efficiencies must become the industry standard. The draft plan envisions that emissions reductions will be reduced at each step in the goods movement pathway – from ship to shore to truck or locomotive to the final destination. New emission standards for engines, cleaner fuels, performance standards and incentives, fleet upgrades and retrofits are all part of the picture.

Timing is crucial. There is already a public health threat that needs to be abated as quickly as possible while we prepare for even greater growth in international trade. ARB's strategy provides several near-term reductions, with longer term measures to provide a cleaner goods movement system by 2020. Steady progress is also needed. The draft plan provides for annual reductions in statewide port-related emissions after accounting for projected growth.

Staff's long term vision is an economically vibrant, environmentally sustainable, non-polluting goods movement industry that enhances the quality of life for all Californians.