



Reducing Ship Hotelling Emissions (Phase II)

Workgroup Meeting
March 19, 2008

California Environmental Protection Agency



Air Resources Board

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Topics

- ◆ Background
- ◆ Phase II timelines and affected ships
- ◆ Current ARB activities
 - Inventory improvements
 - Ship category / affected ports discussion
 - Control techniques
- ◆ Next steps

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Background

- ◆ Goods Movement Emission Reduction Plan
- ◆ Shore Power (Cold-Ironing) Feasibility report
- ◆ Shore power regulation

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Goods Movement Emission Reduction Plan

- ◆ Approved by Board April 2006
- ◆ Emission reduction strategies Identified for:
 - Ships
 - Commercial harbor craft
 - Cargo handling equipment
 - Trucks
 - Locomotives

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Goods Movement Emission Reduction Plan (Continued)

- ◆ Strategies for ships
 - Ship auxiliary engine fuel (Adopted)
 - Cleaner fuels for main engines
 - Expanded vessel speed reduction program
 - Clean engines
 - Clean ships dedicated to California service
 - Shore power

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Goods Movement Emission Reduction Plan (Continued)

- ◆ 2020 goals for reducing hotelling emissions from Ocean-Going Vessels
 - Shore power for 80% of visits
 - 50% reduction in emissions for remaining visits

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Feasibility Report—Overview

- ◆ Analyzed cost-effectiveness, by ship category and port
- ◆ Draft released March 2006
- ◆ 30-day comment period

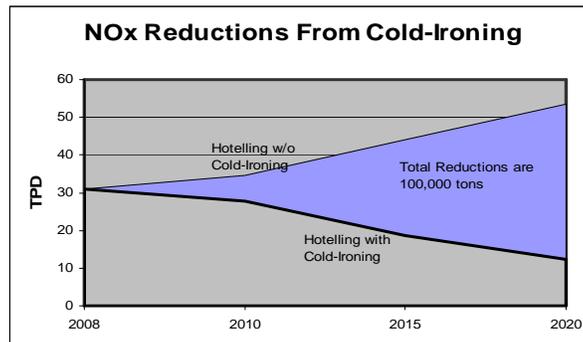
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Feasibility Report—Conclusions

- ◆ Most cost-effective for container, passenger, and refrigerated cargo ships
- ◆ Not cost-effective for ships with irregular or infrequent visits to California
- ◆ Will require significant infrastructure investments

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NOx Emission Benefits from Shore Power



* Based on 20%, 60%, and 80% shore power targets

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Shore Power Regulation

- ◆ Approved by Board December 2007
- ◆ Applies to container, passenger, and reefer ships
- ◆ Applies to fleets making visits to California ports
- ◆ Affects following ports: Hueneme, Long Beach, Los Angeles, Oakland, San Diego, and San Francisco

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Shore Power Regulation (Continued)

- ◆ Two tracks for compliance
 - Reduced onboard power generation option
 - Equivalent emission reduction option
- ◆ 80 percent emission reduction by 2020

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Regulatory Timetable—Phase II

- ◆ Regulation scheduled for Board consideration December 2008
 - Workshop late summer 2008
 - Proposed regulation and staff report released October 2008

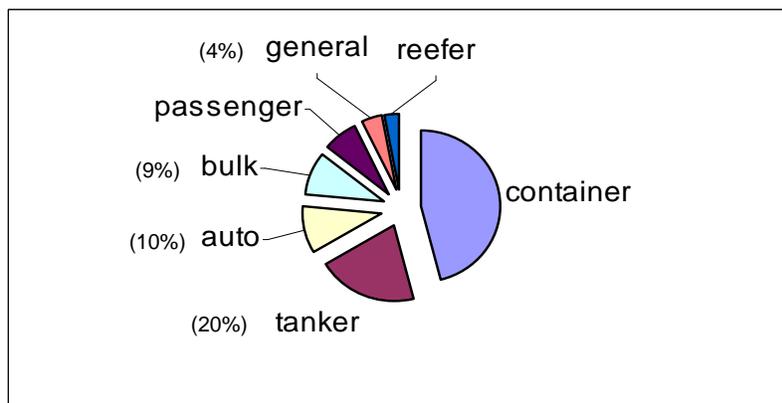
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Remaining Ocean-Going Vessels Subject to Phase II

- ◆ Automobile carriers / RO-RO vessels
- ◆ Dry bulk vessels
- ◆ General cargo vessels
- ◆ Tankers

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Visits by Ship Category (2006)



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Current ARB Activities— Inventory Improvements

- ◆ Sources
- ◆ Description
- ◆ Emissions

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Sources of Emissions on Ships

- ◆ Propulsion engines
 - Very large
 - Used at sea
 - Avg. power 33,000 kilowatts
- ◆ Auxiliary generators
 - Medium size
 - Used in port & sea
 - Avg. total power 7,500 kilowatts
 - Multiple engines
- ◆ Auxiliary boilers
 - Steam generator
 - Used at or near port

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Emissions at Dock

- ◆ “Hotelling”, a.k.a. berthing or docking
- ◆ Auxiliary generator
 - Power for ship, refrig. cargo
 - Subject of this regulation
- ◆ Auxiliary boiler
 - Hot water for crew/passengers
 - Steam for cargo unloading (tankers)
 - Possible regulation in 2008

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Sources of Ship Activity Data

- ◆ Ship visits to a port
 - State Lands Commission
 - Wharfinger
- ◆ Power usage by ships
 - ARB Survey
- ◆ Berthing times
 - Wharfinger
 - ARB Survey

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Statewide Average Hotelling Time

Type	Hours
Auto	18
Bulk	75
General	49
Misc	43
Roro	30
Tanker	35

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Ship Auxiliary Hotelling Emissions by Type (tons/year)

Type	NO _x	PM ₁₀
Auto	229	19
Bulk	257	21
General	103	8
Misc	7	1
Ro-ro	35	3
Tanker	809	66
Total Proposed Reg.	1439	117
C1000	146	12
C2000	367	30
C3000	430	35
C4000	1253	102
C5000	1406	114
C6000	584	47
C7000	437	35
C8000	454	37
Cruise	1014	98
Reefer	288	23
Total Prev. Reg.	6380	533

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Next Steps

- ◆ Schedule
 - Main Engine Reg., April 2008
 - Shore Power 2, December 2008
 - Vessel Speed Reduction, 2008
- ◆ Inventory is being fine-tuned
- ◆ Public Outreach
- ◆ Comments/Questions

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Current ARB Activities—Ship Category Overview

- ◆ Tankers
- ◆ Vehicle/RO-RO
- ◆ Bulk and general cargo
- ◆ Tug boats

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Tankers



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2006 Tanker Visits

California Port	Number of Ships	Total Visits
Statewide	459	2,196
LA-LB	354	878
Richmond¹	132	464
El Segundo	62	284
Martinez²	98	262
Benicia	69	134
Selby	37	51
Rodeo	37	47
Stockton	31	41
San Diego	8	10
Hueneme	7	10
Pittsburg	7	8
Sacramento	7	7

¹ in 2006 Richmond included 5 privately-owned tanker terminals and 1 port-owned tanker terminal
² in 2006 Martinez included 4 privately-owned tanker terminals

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Number of Tankers that Made Multiple Visits to a Single California Port in 2006

- ◆ 2 ships visited between 41 and 50 times (<1%)
- ◆ 3 ships visited between 31 to 40 times (<1%)
- ◆ 6 ships visited between 21 to 30 times (1%)
- ◆ 21 ships visited between 11 to 20 times (5%)
- ◆ 712 ships* visited less than three times (93%)

* Many of these ships visited multiple ports

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Port of Richmond Tanker Activity for 2006

Number of Ships	Number of Visits
3	31-48
2	21-30
2	11-20
19	4-10
7	3
17	2
82	1

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Benicia Tanker Activity for 2006

Number of Ships	Number of Visits
1	18
2	6-7
5	5
0	4
2	3
6	2
46	1

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Tanker Berthing Times

Location	Type	Average Berthing time (Hr/Visit)
POLA	Product	39
POLB	Crude	32
POLB	Product	35
Bay Area	Crude	17
Bay Area	Product	53

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Tanker Power Requirements

Type	Hotelling Load (kW)
Crude	570
Product	470

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Vehicle Carriers and RO-RO Ships



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Vehicle Carrier Visits

California Port	Number of Ships	Total Visits
Statewide	509	1143
Hueneme	143	232
Long Beach	113	325
San Diego	106	202
Benicia	77	214
Los Angeles	36	71
Richmond	33	74
Oakland	1	25

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Vehicle Carrier Berth Times

California Port	Total Visits	Average Berth Time (Hr/Visit)
Long Beach	325	24
Hueneme	232	16
Benicia	214	14
San Diego	202	16
Richmond	74	NA
Los Angeles	72	19
Oakland	25	53

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Number of Ships that Made Multiple Visits to a Single California Port in 2006

- ◆ 11 ships visited 10 or more times in 2006 (2% of total ships)
- ◆ 340 ships visited 5 or less times in 2006 (67% of total ships)

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Ships Visiting More Than One Port in California 2006

- ◆ 278 ships visited 2 ports (556 visits; 49% of total)
- ◆ 33 ships visited 3 ports (99 visits; 9% of total)

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Port of Hueneme Shipping Activity for 2006

Number of Ships	Number of Visits
4	5
4	4
13	3
35	2
86	1

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Vehicle Carrier Power Usage at Berth

- ◆ Power Usage load of 600 kW
- ◆ Range of 90-1,650 kW

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Bulk and General Cargo Ships



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Bulk & General Cargo Ship Visits

Port	Ships	Visits
Statewide	629	1,400
LA/LB	498	765
Stockton	119	137
San Francisco	62	100
Carquinez	59	99
Redwood City	42	55
San Diego	41	62
Richmond	41	70
Oakland	36	62
Sacramento	23	31
Hueneme	9	11
Humboldt	7	8

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Number of Ships that Made Multiple Visits to a Single California Port in 2006

- ◆ 8 ships visited more than 10 times in 2006 (1% of total ships)
- ◆ 853 ships* visited less than 3 times in 2006 (86% of total ships)

* Many of these ships visited multiple ports

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Port of Redwood City Shipping Activity for 2006

Number of Ships	Number of Visits
2	4
0	3
6	2
34	1

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Port of Los Angeles Shipping Activity for 2006

Number of Ships	Number of Visits
2	6
3	5
13	4
17	3
42	2
125	1

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Bulk & General Cargo Ship Hotelling Loads and Berthing Times

- ◆ Electrical load range 50 – 1200 kW.
- ◆ Average load is 340 kW.
- ◆ Average berthing time is 69 hours.

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Challenges

- ◆ Few frequent visitors
- ◆ Low power requirements

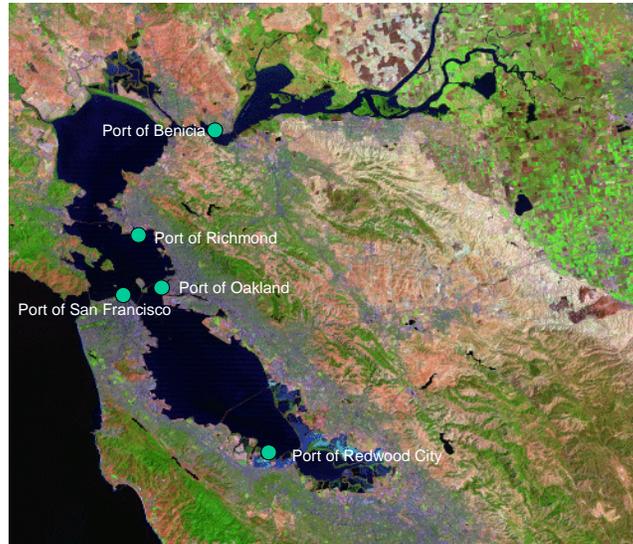
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Affected Ports



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Affected Ports Cont.



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Tug Boats



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Tugs and Location of Operation

Port	Number of Tugs
Statewide	130
San Francisco	57
LA/LB	33
San Diego	29
Stockton/ Sacramento	4
Humboldt	2
Hueneme	2
Newport Beach	1

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Tugs

- ◆ Types of tugs: tractor tugs, tow boats, articulated tug barge (ATB), and integrated tug barge (ITB).
- ◆ At-dock operation of tugs: shut down at-dock, plug in at-dock, and running auxiliary engines at-dock.
- ◆ About 11 tugs run auxiliary engines at dock statewide.
- ◆ Berthing time: 876 hours/year.
- ◆ Power requirements: 86 kW

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Tug Visits

- ◆ Tugs have a home berth but may tie up at other locations.
- ◆ Hours at berth vary with workload.
- ◆ “Live aboard” tugs do not shut down or plug in.

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Question for ITB

- ◆ Integrated tug barge (ITB) treated as a tanker or a tug?

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Current ARB Activities—Potential Control Options

- ◆ Shore power
- ◆ Ship side controls
 - SCR (NO_x)
 - Filters (PM)
- ◆ Shore side controls
 - Bonnet (ACTI)

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Next Steps

- ◆ Next meeting scheduled for May 13 in Sacramento
- ◆ Visit ports
- ◆ Meet with stakeholders

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Contacts: Rule Development

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- ◆ **Webpages:**
Shore Power:
www.arb.ca.gov/ports/shorepower/shorepower.htm
Goods Movement Emission Reduction Plan:
www.arb.ca.gov/planning/gmerp/gmerp.htm



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Contacts: Emissions Inventory

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