Public Workshop
Vessel Speed Reduction for Ocean-Going Vessels
Sacramento
July 29, 2009

Air Resources Board
California Environmental Protection Agency

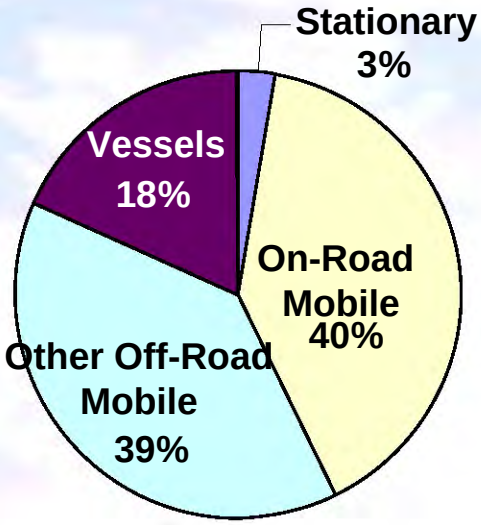
Overview

- Background
- Emissions and Emissions Reductions
- Modeling and Health Impacts
- Cost
- Vessel Speed Reduction Survey
- Issues/Considerations
- Next Steps

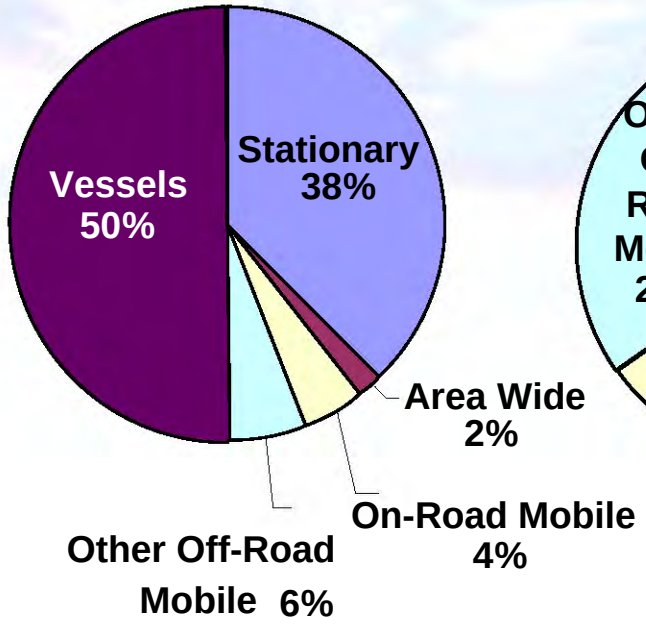
Background

Ocean-Going Vessels are a Large Source of Emissions

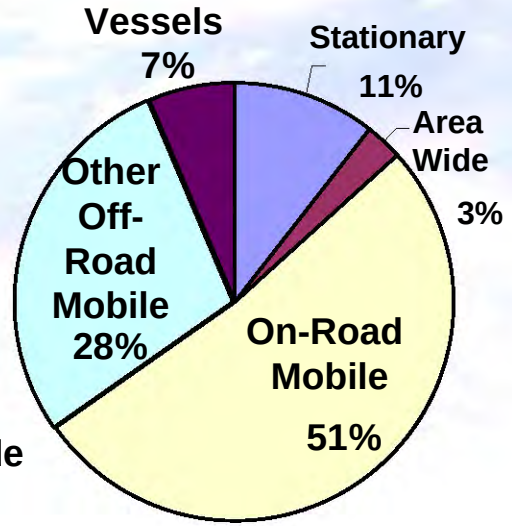
Diesel PM
116 TPD total



SOX
305 TPD total



NOx
3,559 TPD total



Total CO_2 emissions from OGVs are 16,950 TPD

*** Source: 2006 ARB Emissions Inventory**

Why Consider a VSR Measure?

- Potential reductions in criteria/toxic pollutants and greenhouse gases
- Reduces regional and local exposure to diesel PM
- Identified as possible measure to be investigated under:
  - Diesel Risk Reduction Plan
  - Goods Movement Emission Reduction Plan
  - AB 32 – Global Warming Solutions Act
  - State Implementation Plan

Background

- Develop a technical assessment report
  - Evaluate exposure, health, environmental, and economic impacts of a VSR measure
  - Use results of assessment to determine the scope, extent, and form of ARB VSR program

Background

- Scope of VSR
  - All vessels transiting in VSR zone
  - Only vessels coming in and out of port
- Extent of VSR
  - Bubbles around key ports
  - Santa Barbara Channel
  - 24 nm or 40 nm
- Form of VSR
  - Regulatory
  - Voluntary
  - Combination

Emissions and Emissions Reductions

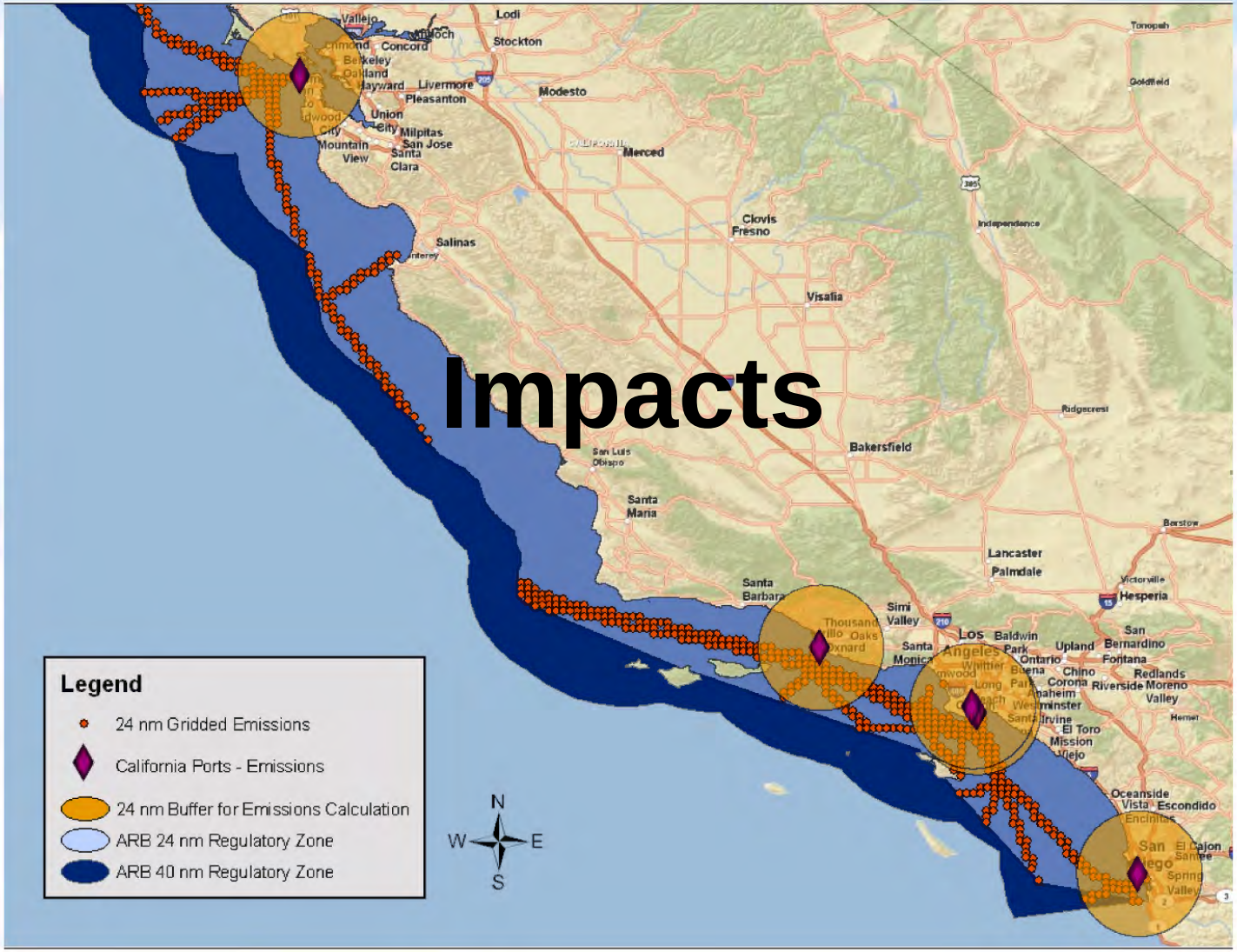
Key Considerations

- All Vessels
  - Includes vessels coming in and out of port and all vessels transiting through the VSR zone
- Port-only vessels
  - Includes vessels coming in an out of port only and excludes transiting vessels
- 24 and 40 nautical miles
- Impacts of OGV fuel regulation (2008 versus 2012)

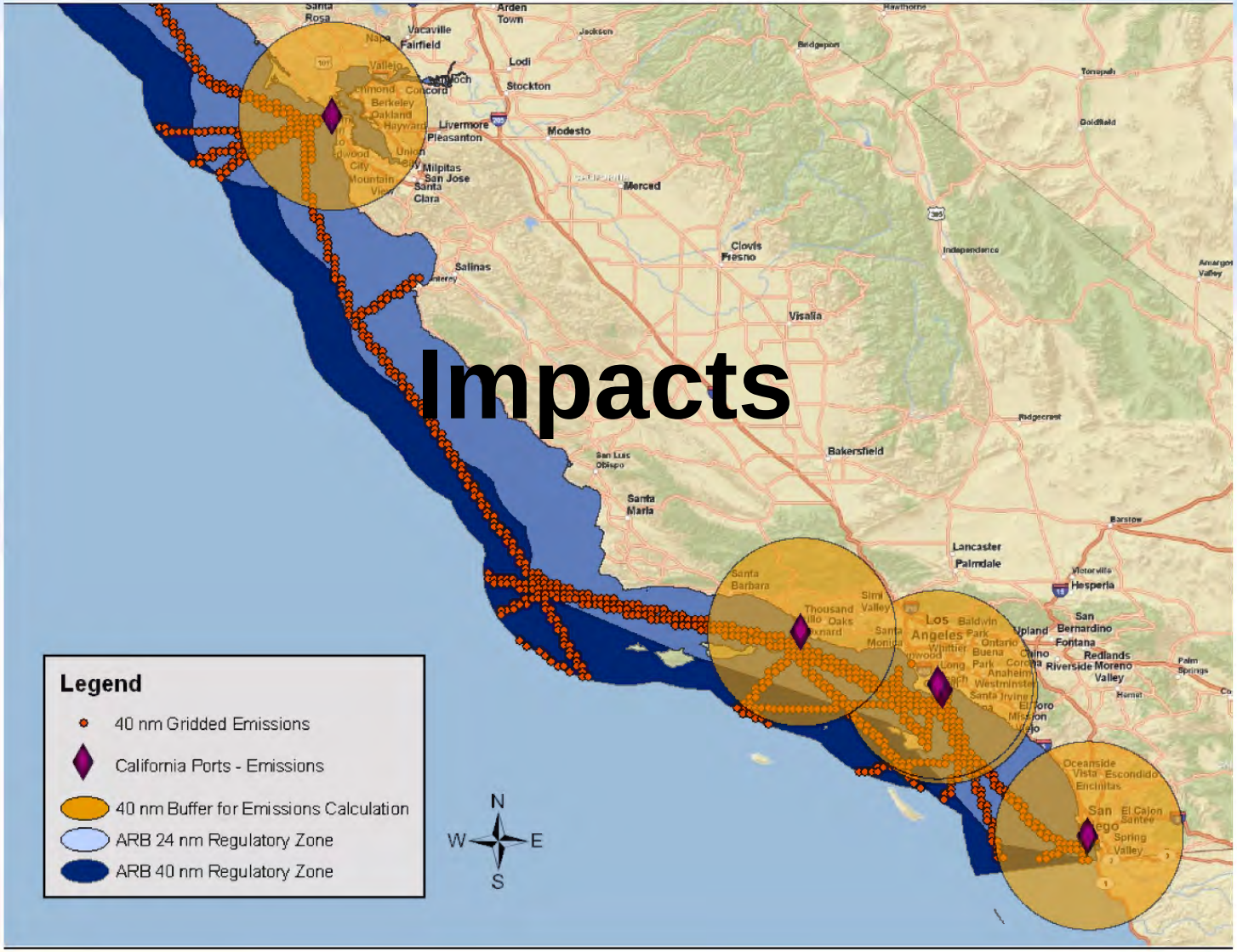
Key Assumptions

- Assumes all vessels slow to 12 knots in the VSR zone (24 or 40 nm)
- Accounts for POLA/POLB VSR program
- Accounts for OGV fuel regulation
- Uses composite statewide growth factors from ARB Marine Model 2.0

Emissions within the 24 nm Zones



Emissions within the 40 nm Buffer Zones



Emissions and Emissions Reductions[1,2]

Emissions with and without VSR for 2008
All traffic and port-only traffic for 24 and 40 nm
tons/day

Pollutant	Without VSR (24 nm)	With VSR: all traffic (24 nm)	With VSR: port only traffic (24 nm)	Without VSR (40 nm)	With VSR: all traffic (40 nm)	With VSR: port only traffic (40 nm)
Diesel PM	5.1	4.2	4.6	8.9	6.1	7.8
NOx	53	42	48	98	63	83
SOx	45	39	42	73	52	64
CO_2	3130	2720	2930	4810	3430	4250

1. Numbers are rounded
2. Estimates do not include OGV fuel regulation.

Emissions and Emissions Reductions[1,2]

Emissions with and without VSR for 2012
All traffic and port-only traffic for 24 and 40 nm
tons/day

Pollutant	Without VSR (24 nm)	With VSR: all traffic (24 nm)	With VSR: port only traffic (24 nm)	Without VSR (40 nm)	With VSR: all traffic (40 nm)	With VSR: port only traffic (40 nm)
Diesel PM	1.0	0.9	0.9	16.8	11.6	15.3
NOx	60	47	54	116	76	104
SOx	2.0	1.7	1.9	153	110	139
CO_2	3540	3080	3330	5790	4290	5320

1. Numbers are rounded
2. Estimates include OGV fuel regulation within 24 nm and includes statewide growth factors.

Emission Reduction Benefits for VSR at 24 nm

ALL TRAFFIC - 12 knot VSR Measure at 24 nm (tons per day)

Ports	Diesel PM	NOx	SOx	CO_2
2008				
Los Angeles/Long Beach	0.07	1	0.6	41
San Diego	0.04	0.5	0.3	21
Bay Area	0.4	4.6	2.7	167
Hueneme	0.4	4.8	2.8	180
Total	0.9	11.2	6.4	409
2012				
Los Angeles/Long Beach	0.01	1.1	0.03	46
San Diego	0.008	0.6	0.01	23
Bay Area	0.07	5.4	0.1	187
Hueneme	0.09	6.0	0.1	201
Total	0.18	13.1	0.24	457

Numbers are rounded

Emission Reduction Benefits for VSR at 40 nm

ALL TRAFFIC - 12 knot VSR Measure at 40 nm (tons per day)

Ports	Diesel PM	NOx	SOx	CO_2
2008				
Los Angeles/Long Beach	0.6	7.3	4.5	283
San Diego	0.1	1.3	0.8	56
Bay Area	0.8	9.2	5.6	342
Hueneme	1.4	16.6	9.9	699
Total	2.9	34.4	20.8	1380
2012				
Los Angeles/Long Beach	1.2	9.1	9.8	354
San Diego	0.2	1.6	1.8	70
Bay Area	1.5	11.5	12.1	427
Hueneme	2.7	20.7	21.5	874
Total	5.6	42.9	45.2	1725

Numbers are rounded

Emission Reduction Benefits of VSR at 24 nm

PORT ONLY TRAFFIC - 12 knot VSR Measure at 24 nm (tons per day)

Ports	Diesel PM	NOx	SOx	CO_2
2008				
Los Angeles/Long Beach	0.03	0.5	0.3	24
San Diego	0.04	0.5	0.3	21
Bay Area	0.29	3.7	2.2	136
Hueneme	0.03	0.3	0.1	11
Total	0.39	5.1	2.9	192
2012				
Los Angeles/Long Beach	0.006	0.6	0.01	27
San Diego	0.008	0.6	0.01	23
Bay Area	0.06	4.2	0.09	154
Hueneme	0.006	0.4	0.005	12
Total	0.080	5.8	0.13	216

Numbers are rounded

Emission Reduction Benefits of VSR at 40 nm

PORT ONLY TRAFFIC - 12 knot VSR Measure at 40 nm (tons per day)

Ports	Diesel PM	NOx	SOx	CO_2
2008				
Los Angeles/Long Beach	0.4	5.9	3.7	234
San Diego	0.09	0.7	0.5	31
Bay Area	0.6	7.5	4.5	273
Hueneme	<0.001	0.2	<0.001	19
Total	1.1	14.3	8.7	557
2012				
Los Angeles/Long Beach	1.0	7.3	8.1	292
San Diego	0.2	0.9	1.0	38
Bay Area	1.2	9.3	9.7	341
Hueneme	0.2	0.3	<0.001	23
Total	2.6	18.0	18.8	695

Numbers are rounded

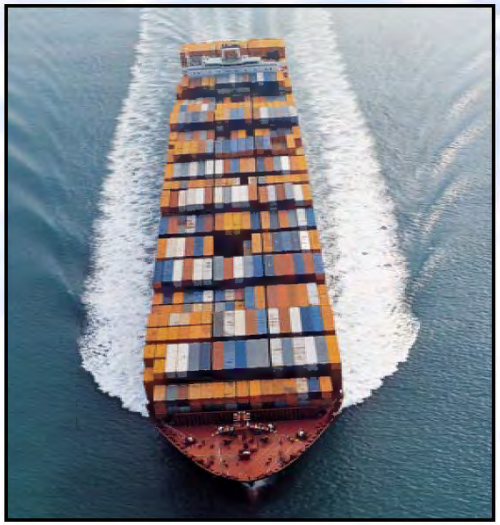
Emission Observations

- The all traffic and port-only traffic scenarios show similar benefits, except Port Hueneme
- Port Hueneme
  - Little emissions benefit from the port-only traffic emissions scenario. Most emissions come from transiting through VSR zones.
- In 2012 the use of clean fuels can significantly reduce diesel PM and SOx within 24 nm
  - Approximately 80% in diesel PM
  - Approximately 90% in SOx

AB-32
Greenhouse Gases

- ARB required to develop and implement measures to reduce greenhouse gas (GHG) emissions
- VSR recognized as a GHG measure
  - Slowing vessel speeds reduces CO_2 emissions
- Most vessels speed up to maintain schedules, negating the benefits of CO_2

Modeling and Health Impacts

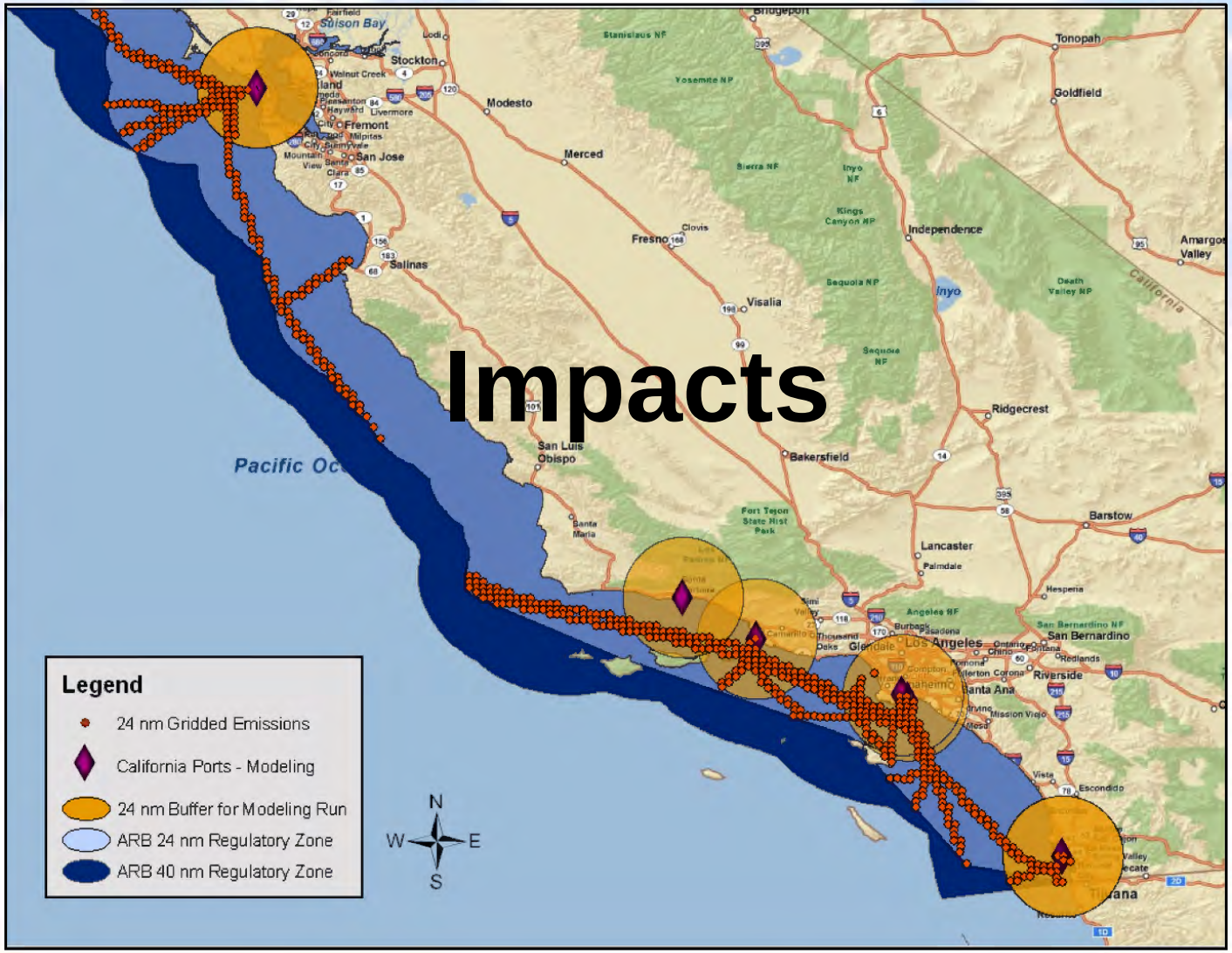


VSR Modeling Overview

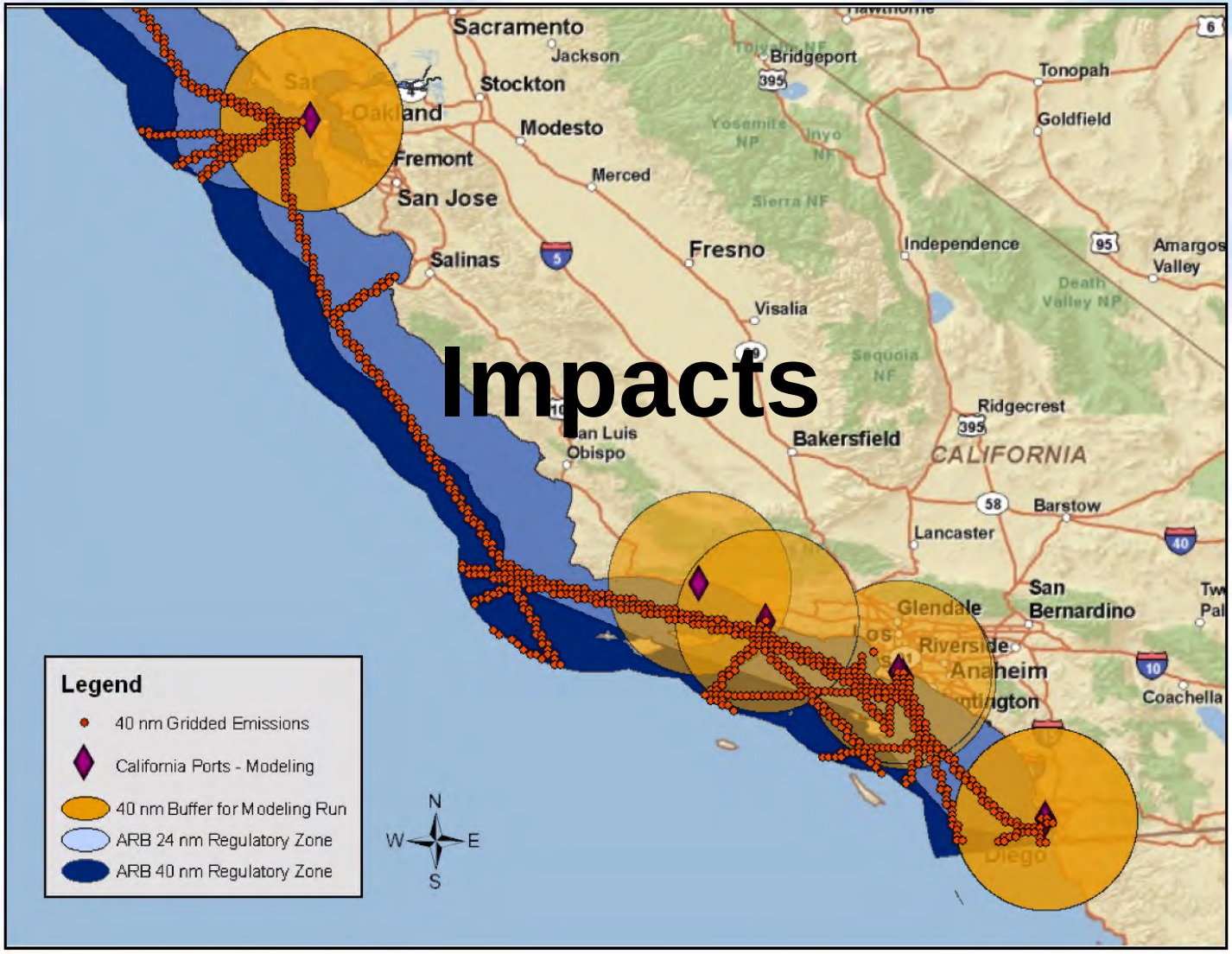
- Air dispersion models are used to estimate emissions impacts from OGVs on regional and local (near-source) coastal communities

- CALPUFF Air Dispersion Model
  - Focus on directly emitted Diesel PM
  - Port Specific (BA, LA/LB, Port Hueneme, SD) and a coastal location near Santa Barbara
  - Used emissions for all vessel traffic
  - Used as a decision making tool
  - 2005 emissions within 24nm and 40 nm

Air Dispersion Modeling (24 nm)



Air Dispersion Modeling (40 nm)



VSR Health Risk Assessment

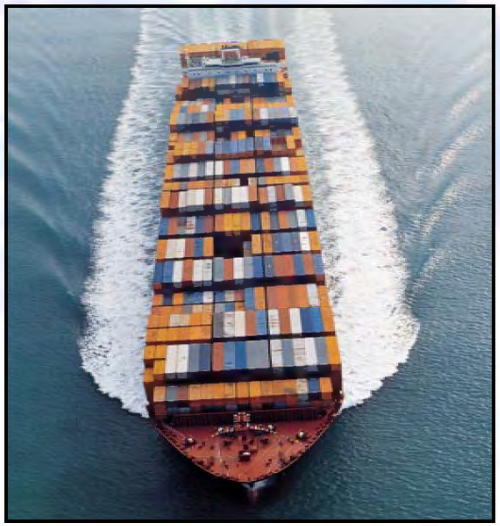
- Present the health impacts of pollutants from OGVs with and without VSR measures **Impacts**
- Potential cancer and non-cancer health impacts from Diesel PM
- Populations exposed to cancer risk levels

VSR Health Risk Assessment Status

- VSR baseline modeling with dirty fuels
  - Currently undergoing review/QC data
- Working on VSR health risk assessment with clean fuels
- Results presented at next workshop
  - Cancer risk
  - Non-cancer risk
    - PM mortality
    - Other non-cancer endpoints

Impacts

Cost



Cost Methodology

- Port Costs (i.e., administrative, vessel monitoring, dockage fees, enforcement)
- Vessel owner/operator costs (i.e., onshore labor, crew supplies, maintenance, onboard labor, general overhead)
- Fuel costs & benefits

Summary of Cost Data

- Vessel owner/operators daily cost due to a one hour delay (time it takes to slow vessel to 12 knots out from 24 nm) range from $250 to $600
- Port costs could range from $50,000 to $100,000 per year (POLA/POLB administrative costs)
- Fuel cost benefits within VSR zones
- Potential fuel cost increases outside VSR zone due to increased speeds to make up for lost time

Additional Cost Needs

- Refined shipping operational costs including onshore and onboard labor
- Cost of VSR impacts due to schedule changes and shipping cost of delivering goods
- Costs ports charge to ship operators/owners to run VSR program

Impacts

Vessel Speed Reduction Survey

VSR Survey - Overview

- Survey conducted in December 2008
- Focused on vessel costs, practices, and potential VSR impacts
- Staff conducted follow-up with companies
- 89 respondents
  - Represented 588 total vessels
    - PMSA submitted summarized cost information on behalf of 13 companies (approximately 200 vessels)

VSR Survey - Overview

Vessel Information Summary from 89 Survey Respondents Representing 58 Companies

Vessel Type	Number of Vessels	% of Total Vessels
Container	252	43
Tanker	127	22
Auto	84	14
Bulk	56	9
General	28	5
Cruise	23	4
RoRo	15	3
Other	3	<1
Total	**588**	**100**

Survey Conclusions

- Most vessel operators indicated that they would have increased operating costs when complying with VSR

- Shipping owner/operators daily cost due to a one hour delay (VSR at 24 nm) range from $250 to $600

Survey Conclusions (cont.)

- Most vessels will speed up outside the VSR zone to maintain schedule
  - Typically speed up by ½ knot or more
  - Potential increase in greenhouse gas emissions
- About half of the vessels indicated that they might change route or consider rerouting if VSR was implemented in the SB channel
- About 75% of vessels indicated they would comply with a voluntary VSR program entering or exiting major ports at 24nm

Survey Conclusions (cont.)

- About half of the vessel owners/operators have concerns about slow speed vessel operations on the maintenance and wear of the engine

- Vessel owners believe that reducing port fees is the most important incentive in a VSR program

Issues/Considerations

VSR Issues/Considerations

- VSR in Major Ports only
  - Ships could speed up through SB channel to make up time spent in a VSR port zone.
- VSR in Santa Barbara Channel
  - Ships may alter route to avoid channel
    - Potential to reroute into naval sea range
    - Disrupt range activities
  - May benefit marine mammals
    - Slower vessel speed could result in fewer whale strikes

Impacts

Next Steps

Next Steps/Key Issues

- Modeling and health risk analysis
  - Clean fuels
  - Risk characterization graphics/mapping
  - Non-cancer health impacts
- Impact on marine mammals and Point Mugu Sea Range
- Cost and Survey Results

Next Steps/Key Issues (cont.)

- Evaluate current and historical speed data
- Evaluate the impacts of VSR to goods movement
- Release Draft Technical Assessment Report for comment (Late 2009)
- Next workshop (Fall 2009)

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http://www.arb.ca.gov/ports/marinevess/vsr/vsr.htm