Air Pollution in the Santa Barbara Channel

Presentation for the Channel Islands Naturalist Corps

Tom Murphy, Manager
Santa Barbara County
Air Pollution Control District
July 18, 2006

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Air Pollution in the SB Channel

- Air Quality (AQ) regulatory framework
- Pollutants of concern/ Health effects
- Ozone AQ trends/ Meteorology
- Shipping in the Santa Barbara Channel
  - Our case study
  - Planning process/ Emissions
  - Regulatory efforts
  - Demonstration project
  - Port Hueneme/ Cabrillo port project
  - Ship types

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3-Tiered Regulatory Framework

- **Federal** – U.S. Environmental Protection Agency
- **State** – California Air Resources Board
- **Local** – Air Pollution Control & Air Quality Management Districts

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Regulatory Framework: Federal

Federal Clean Air Act

- National Ambient Air Quality Standards
- Attainment deadlines and progress requirements
- Planning requirements
- Permitting and enforcement standards
- Performance standards for:
  - new sources
  - sources of hazardous air pollutants
  - fuels and engines
- Federal pre-emption of certain actions

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Regulatory Framework: State

- California Clean Air Act
- California Health & Safety Code
  - More restrictive ambient standards (must protect children and sensitive groups)
  - No set deadlines; “as expeditiously as practicable”
  - Planning, rulemaking, enforcement, public outreach, and transport mitigation requirements
  - Additional programs including: ag sources, portable equipment, toxics, emission banking, & incentives
  - Separate programs for stationary sources (air districts), & mobile sources and fuels (state board), but some cross-over

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Regulatory Framework: Local

APCD Plans, Rules, Policies, Programs

- Air monitors determine whether ambient standards have been achieved
- Plans guide local efforts to achieve state & federal standards
- Rules are adopted consistent with plans, and also to implement policies of the Board of Directors
- Authority to Construct permits are required for new air pollution sources and for modifications to existing sources; large emission sources must use best available control technology and must offset emissions increases with emission reductions
- Operating permits are required for existing sources, and require monitoring and records that ensure compliance; some permits are federally enforceable

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Regulatory Framework: Local (cont'd)

APCD Plans, Rules, Policies, Programs

- Toxic Risk Management programs reduce or mitigate exposure to toxic air pollution, and notify members of the public about potential exposures
- Field inspections verify compliance, and investigate complaints
- Incentive programs reduce emissions from other sources: motor vehicles, heavy duty diesel engines, agricultural equipment, commercial fishing vessels
- Public outreach provides information to, and gathers information from, the communities, businesses, local governments, and others within the district

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California Air Districts & Counties

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Air Pollution in Santa Barbara County

- Ozone, a.k.a. smog
  - Oxides of Nitrogen (NOx)
  - Reactive Organic Gases (ROG, or VOCs)
- Particle Pollution
  - Inhalable Particulate Matter (PM10)
  - Fine Particulate Matter (PM2.5)
    - Primary and secondary formation
- Toxic Air Contaminants
  - Identified by state or federal government
  - Classified for cancer or non-cancer effects
  - Effects can be from short term (acute) exposure, or long term (chronic exposure)

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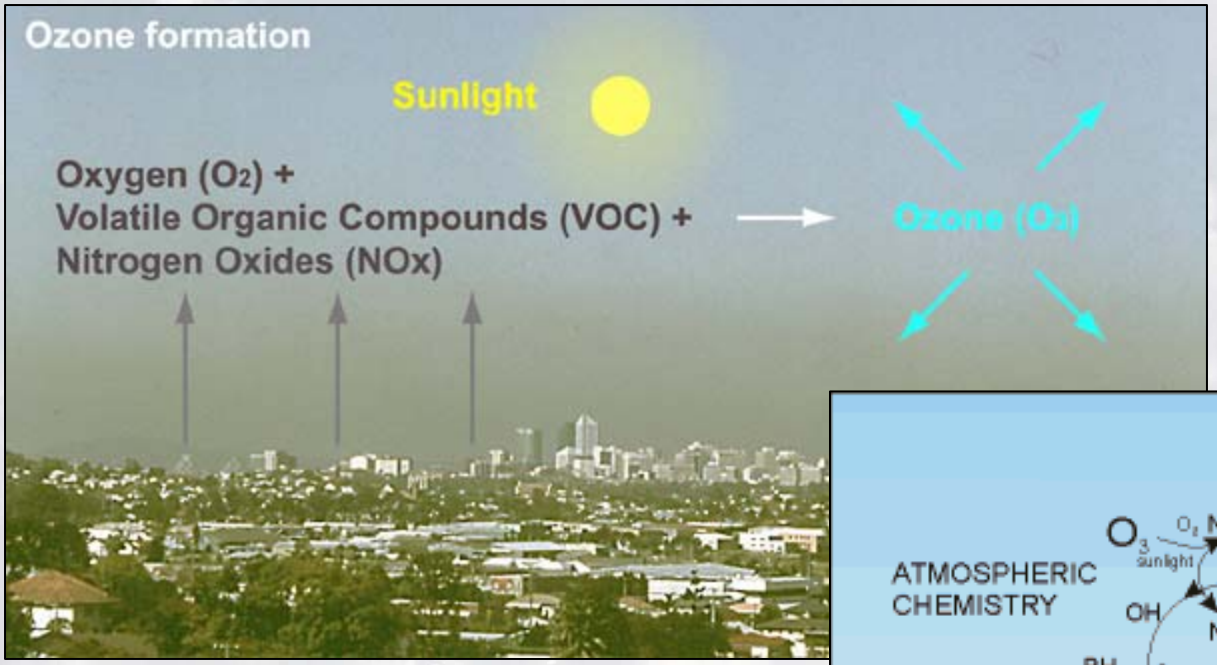
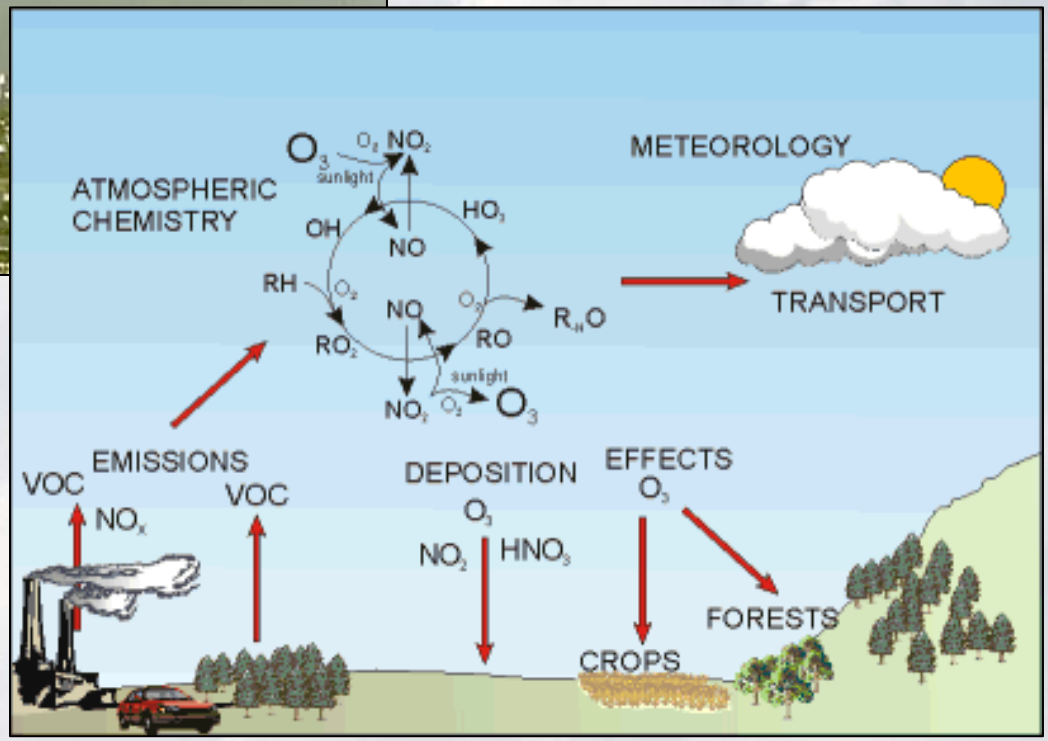
Ozone Formation





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Air Pollution & Health

- **Ozone**
  - Irritates eyes, nose, throat and lungs
  - Exacerbates and can cause asthma
  - Contributes to heart and lung disease and early death
- **Particle Pollution**
  - All of the above, and
  - Can have serious effects on those with heart ailments
  - Penetrates lung tissue; small particles cannot be removed by body's defenses, disrupt lung cell function
  - Cause or contribute to poor pregnancy outcomes
  - Have additional and very serious adverse effects on children
- **Toxic Air Pollution**
  - Acute (short term) and chronic (long term) effects
  - Some cause cancer
  - Some have non-cancer effects, such as causing birth defects, sterility, nerve or brain damage, or damage to eyes, skin, organs and organ systems

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Air Pollution and Children

Southern California Children's Health Study showed pollutants from fuel combustion:

- Slow lung growth in children
- Decrease lung function in children
- Increase asthma rates in children
- Some effects could not be reversed (will effect children for life)
- Other effects included increased hospital admissions, more missed school days, and greater care costs for affected children

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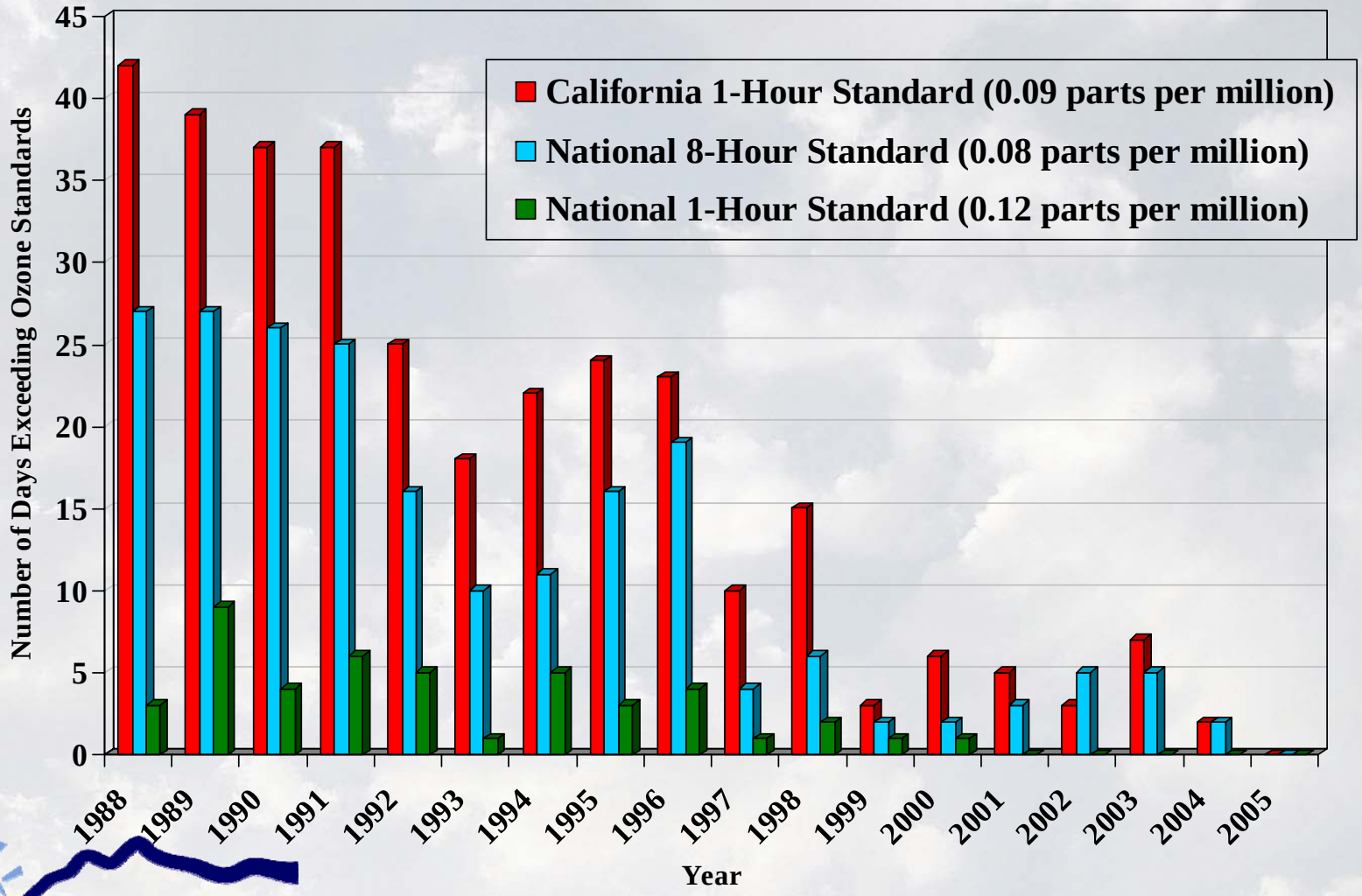
Our Air Quality

Bad Ozone Days 1988-2005



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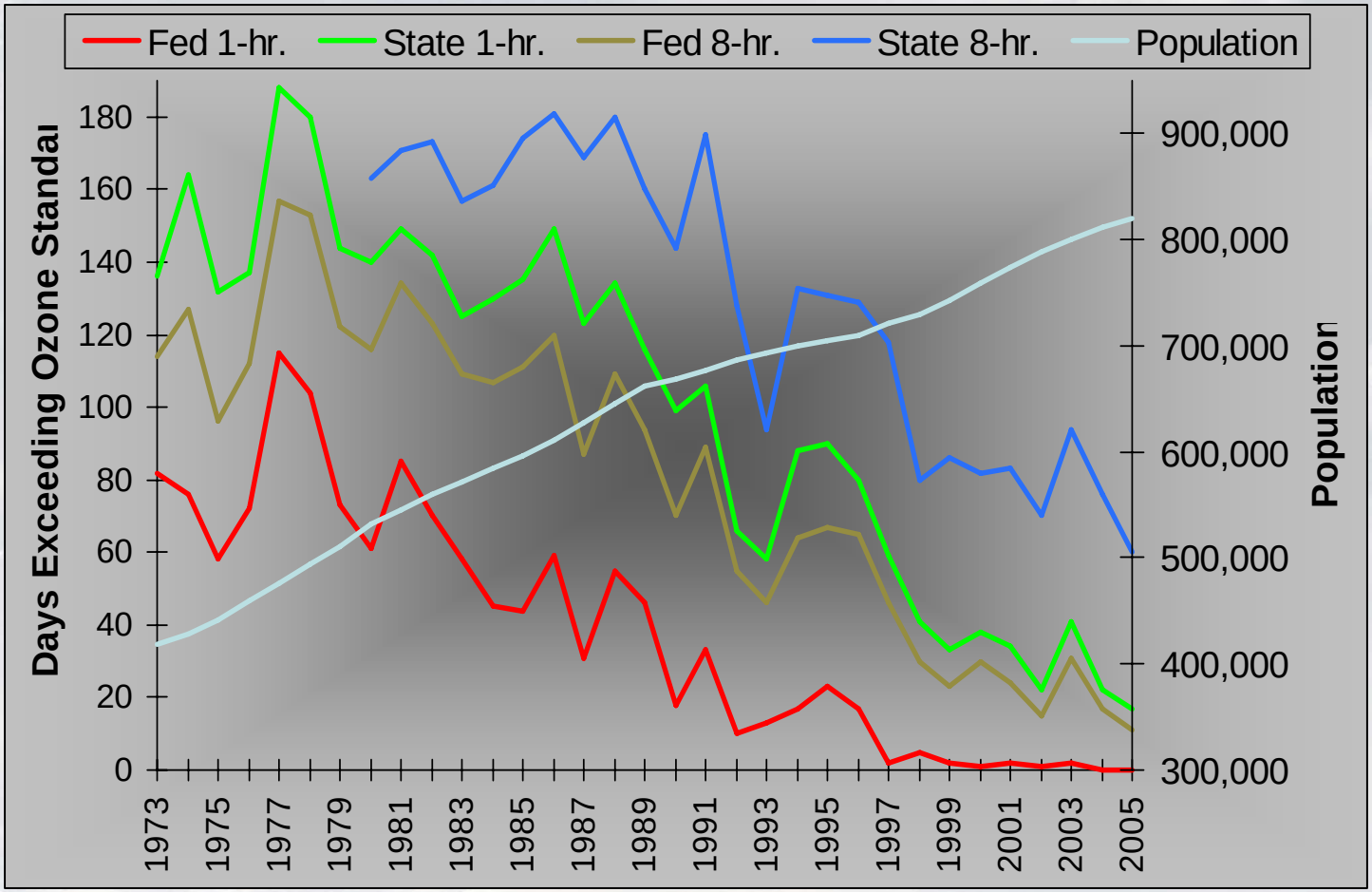
Ventura County
Days Over Federal & State Ozone Standards



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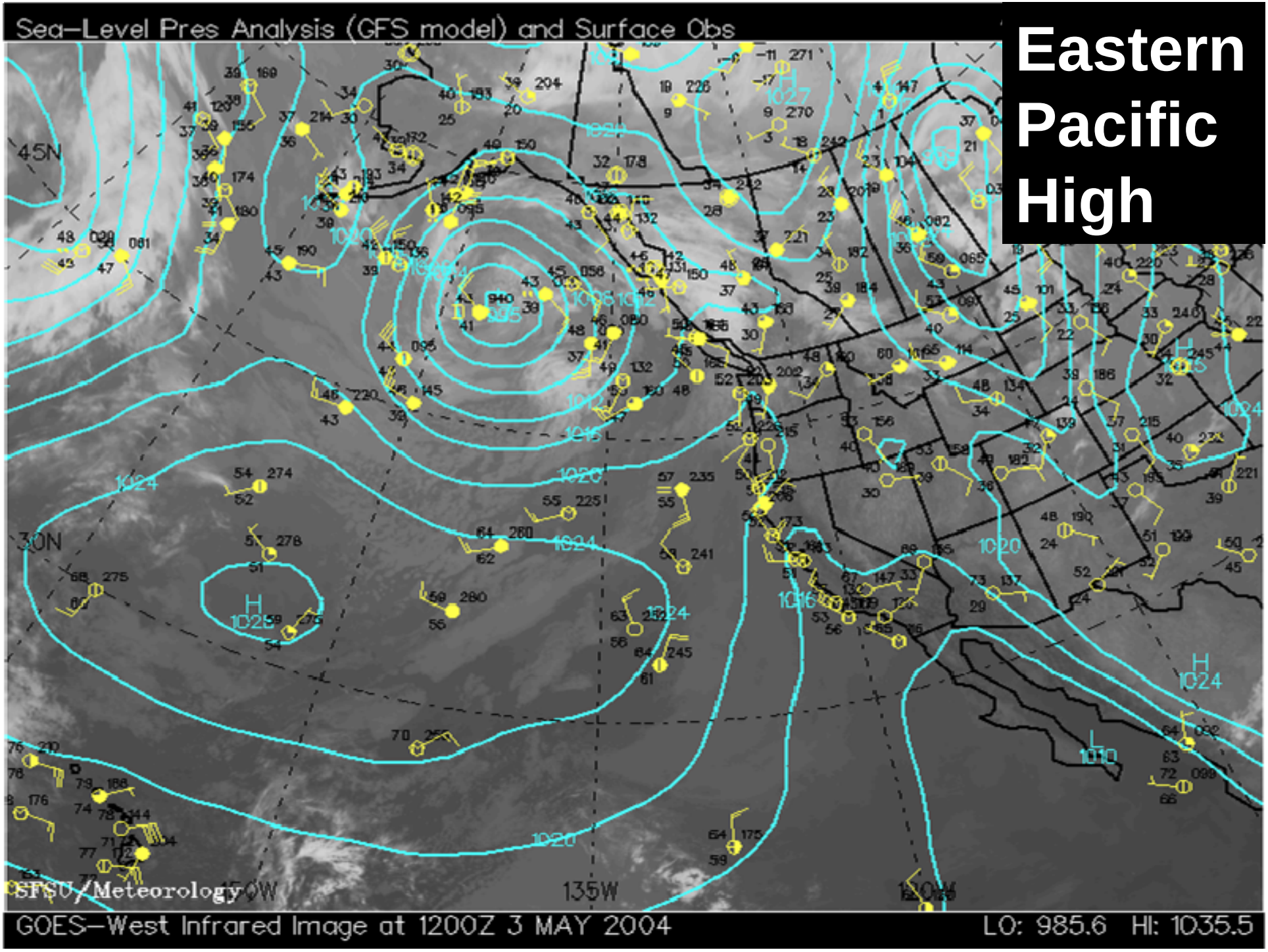
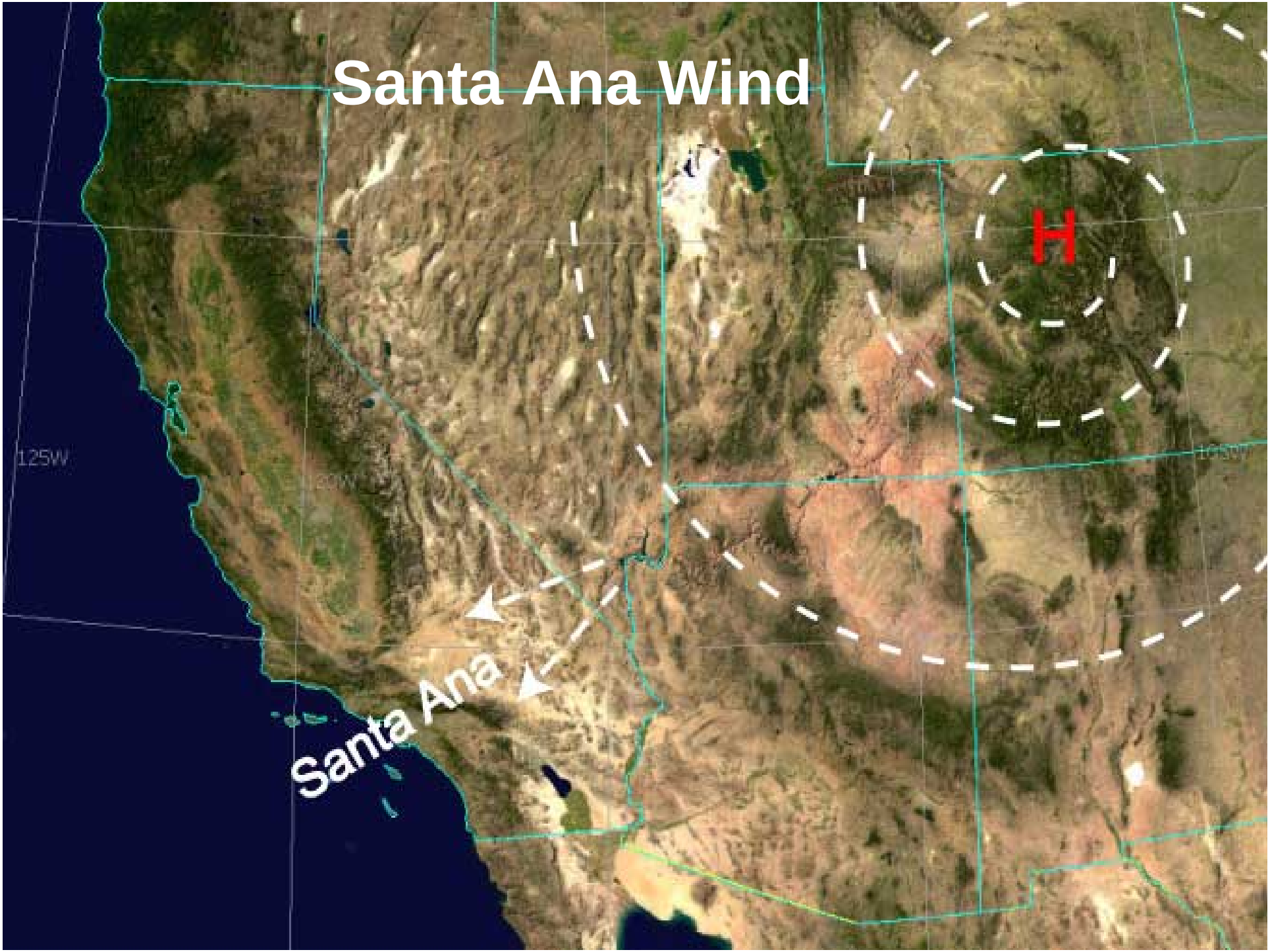
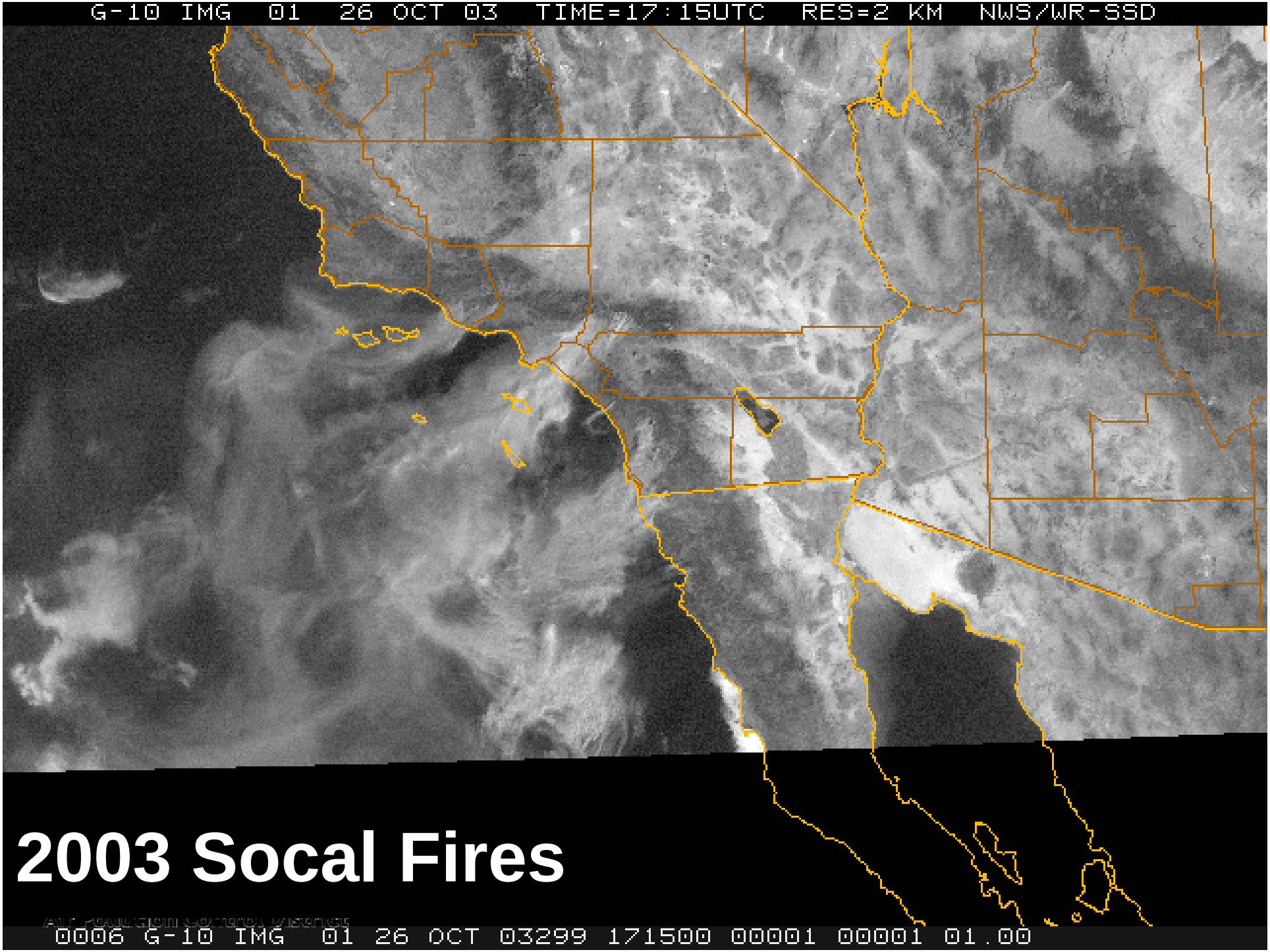
Sources: California Air Resources Board and California Department of Finance.


Sea-Level Pres Analysis (GFS model) and Surface Obs
Eastern Pacific High
45N
30N
150W
135W
120W
GOES-West Infrared Image at 1200Z 3 MAY 2004
LO: 985.6 HI: 1035.5

Catalina Eddy

.E (CH 01) - 15:03 UTC 06 JUN 2002 - CIMSS


Santa Ana Wind
H
125W
Santa Ana


G-10 IMG 01 26 OCT 03 TIME=17:15UTC RES=2 KM NWS/WR-SSD
2003 Socal Fires
0006 G-10 IMG 01 26 OCT 03299 171500 00001 00001 01.00

Ventura County Fire

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Shipping in the SB Channel

Santa Barbara Case Study

- Over 7,200 annual traverses
- 130 miles of coastline
- Large 2-stroke engines
- Vessels burning heavy bunker fuels
- Slow turnover rates
- Majority of the vessels are foreign flagged
- Trade volumes expected to continue increasing

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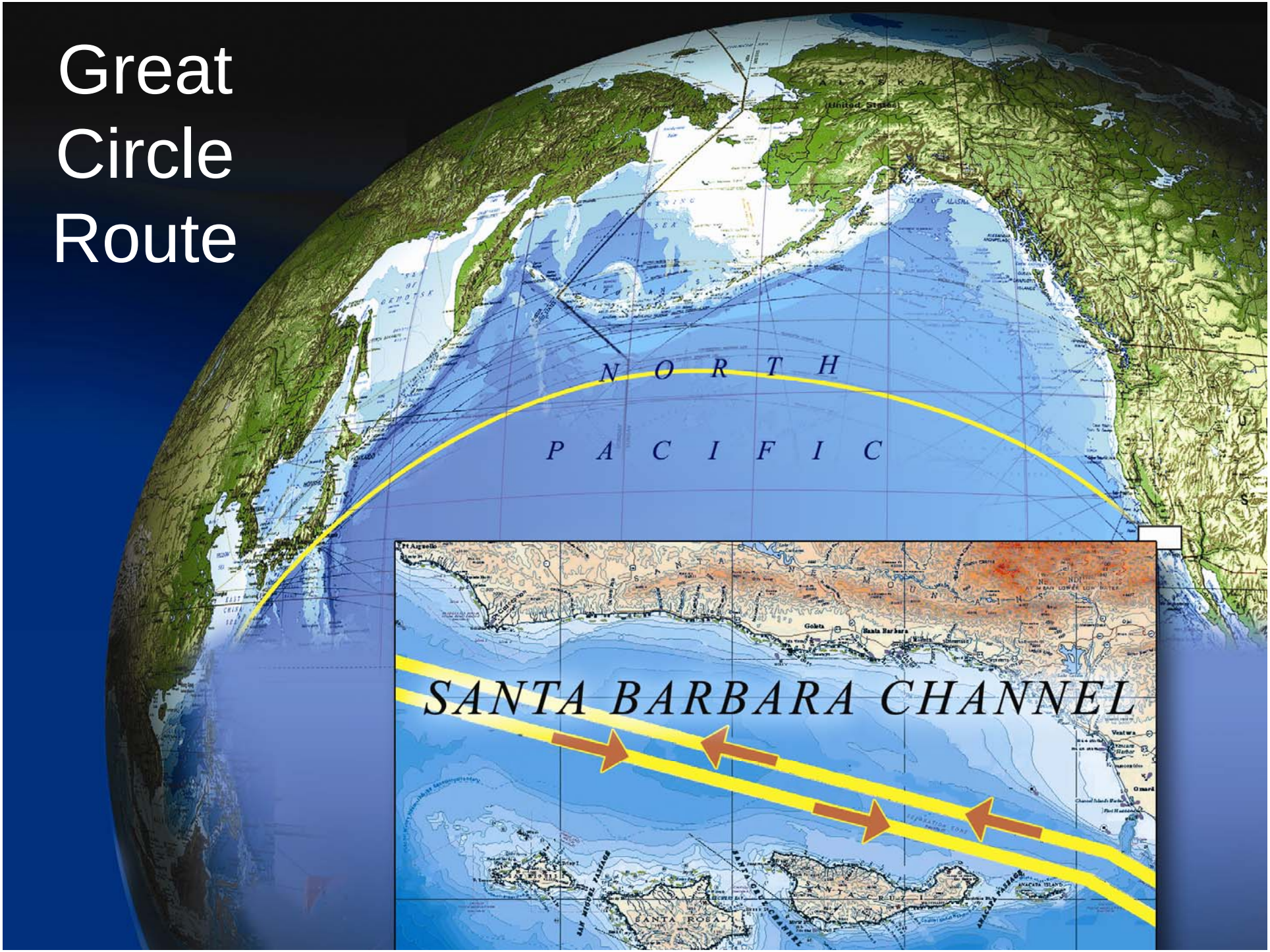
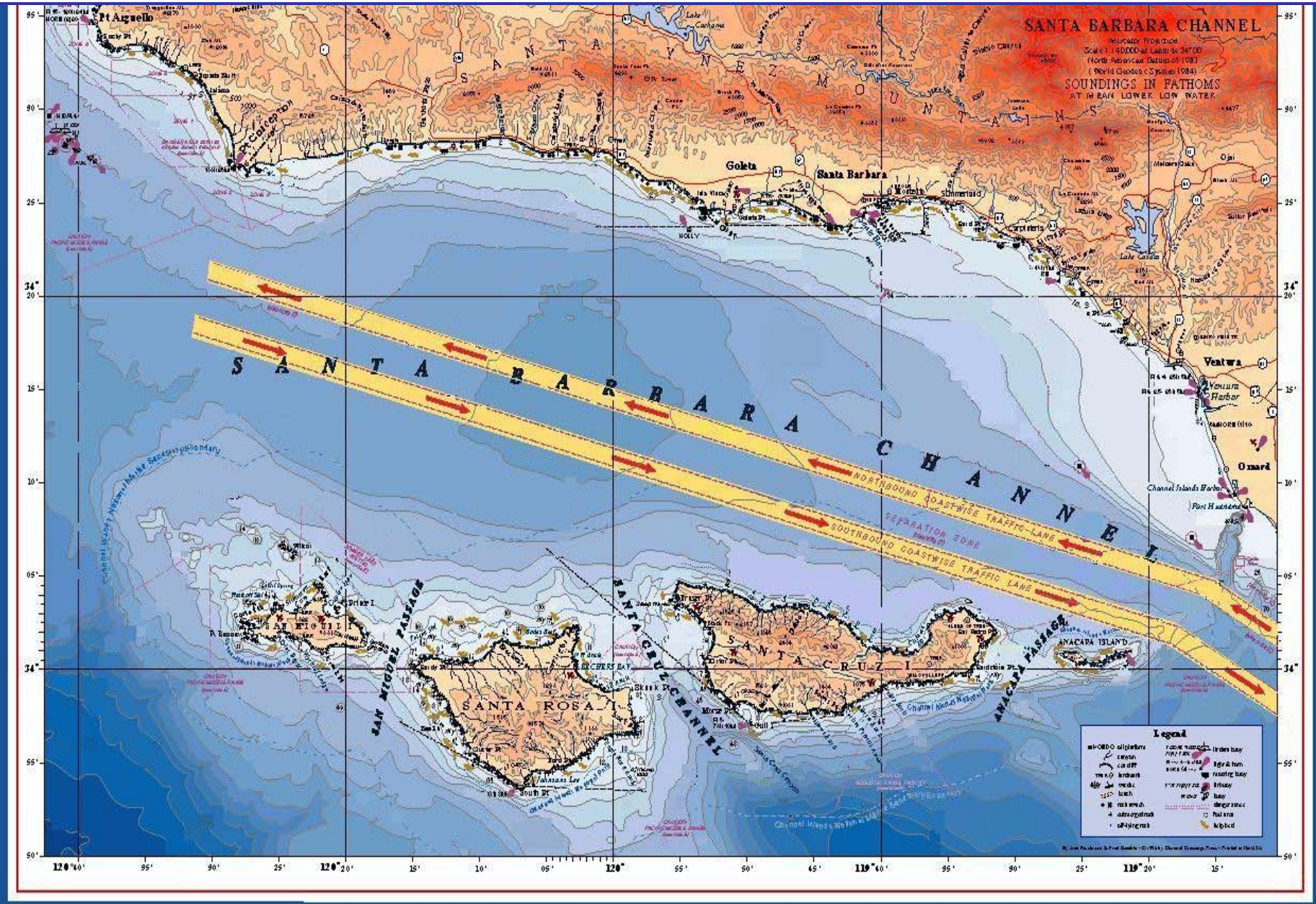
Great Circle Route



Santa Barbara Shipping Lanes



Clean Air Planning Process

- Attainment state and federal standards
- Develop emission inventories
- Evaluate emission control measures
- Forecast emissions
- Marine shipping contribution: Large and growing
- June 2007 – Next Clean Air Plan

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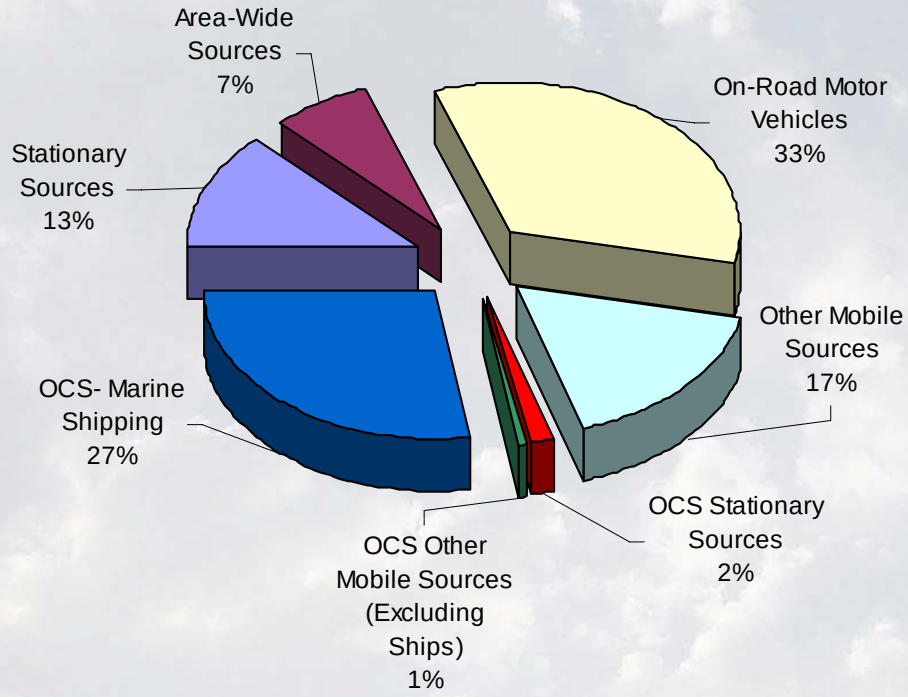
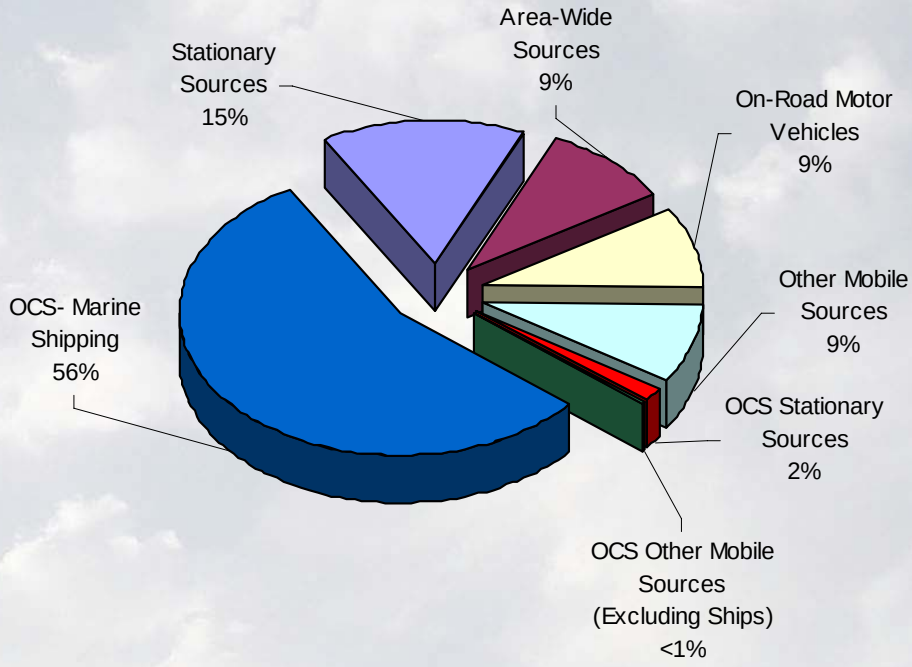
ROC & NOx Emission Sources *

2000 Santa Barbara County ROC & NOx Emissions
122 Tons per day



2020 Santa Barbara County ROC & NOx Emissions
120 Tons per day



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* Includes both Onshore & OCS Emissions

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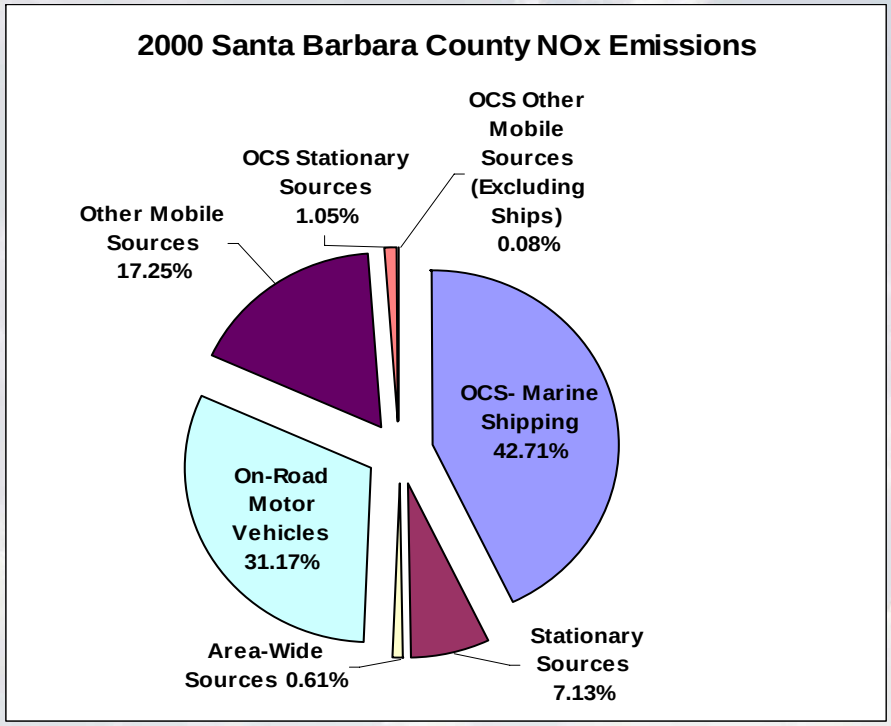
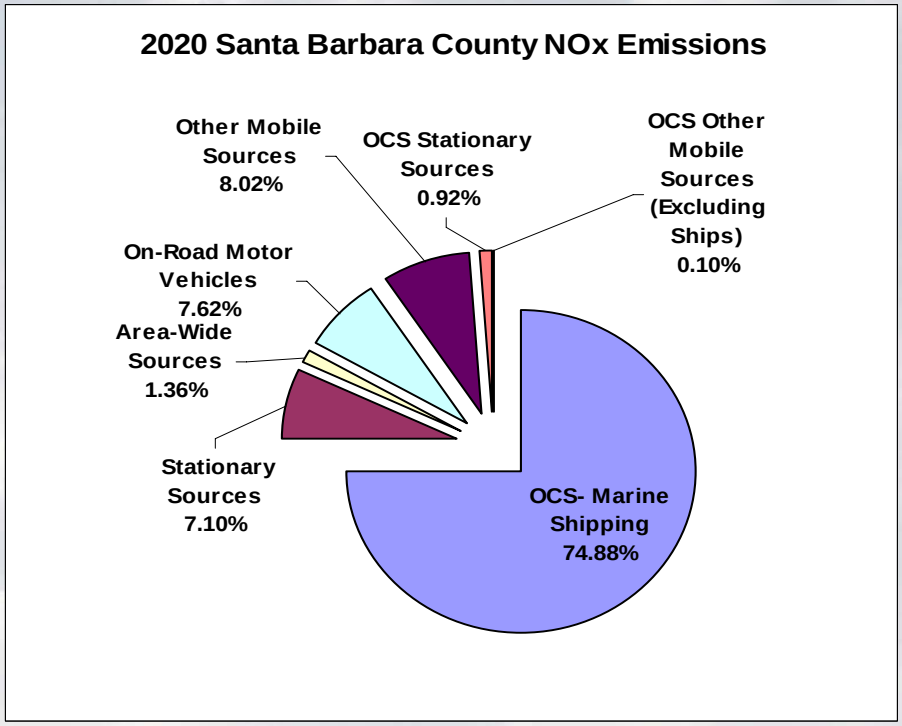
NOx * Emissions Comparison





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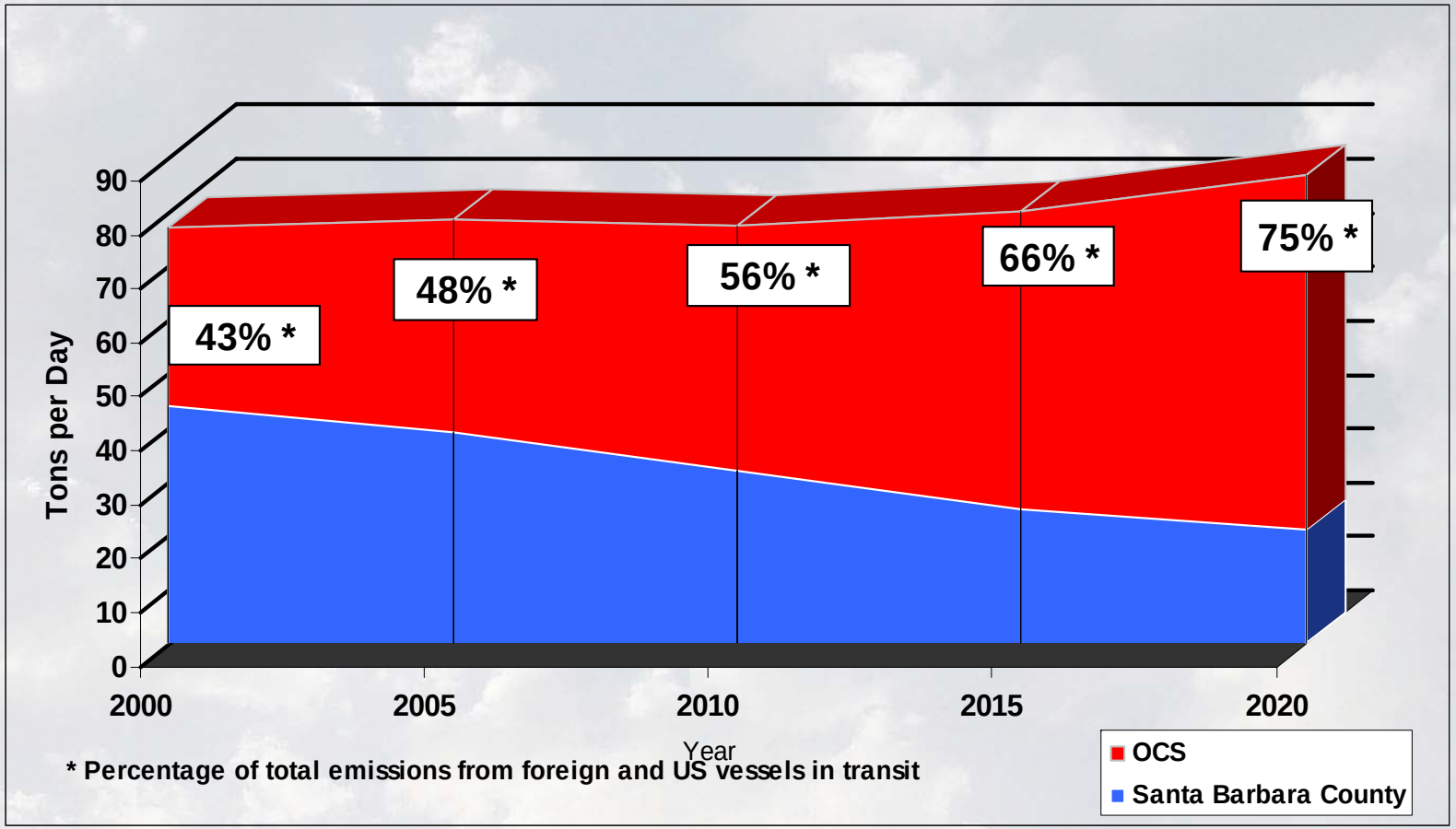
* NOx = Onshore + OCS

Santa Barbara County
NOx * Emission Forecast



* Percentage of total emissions from foreign and US vessels in transit

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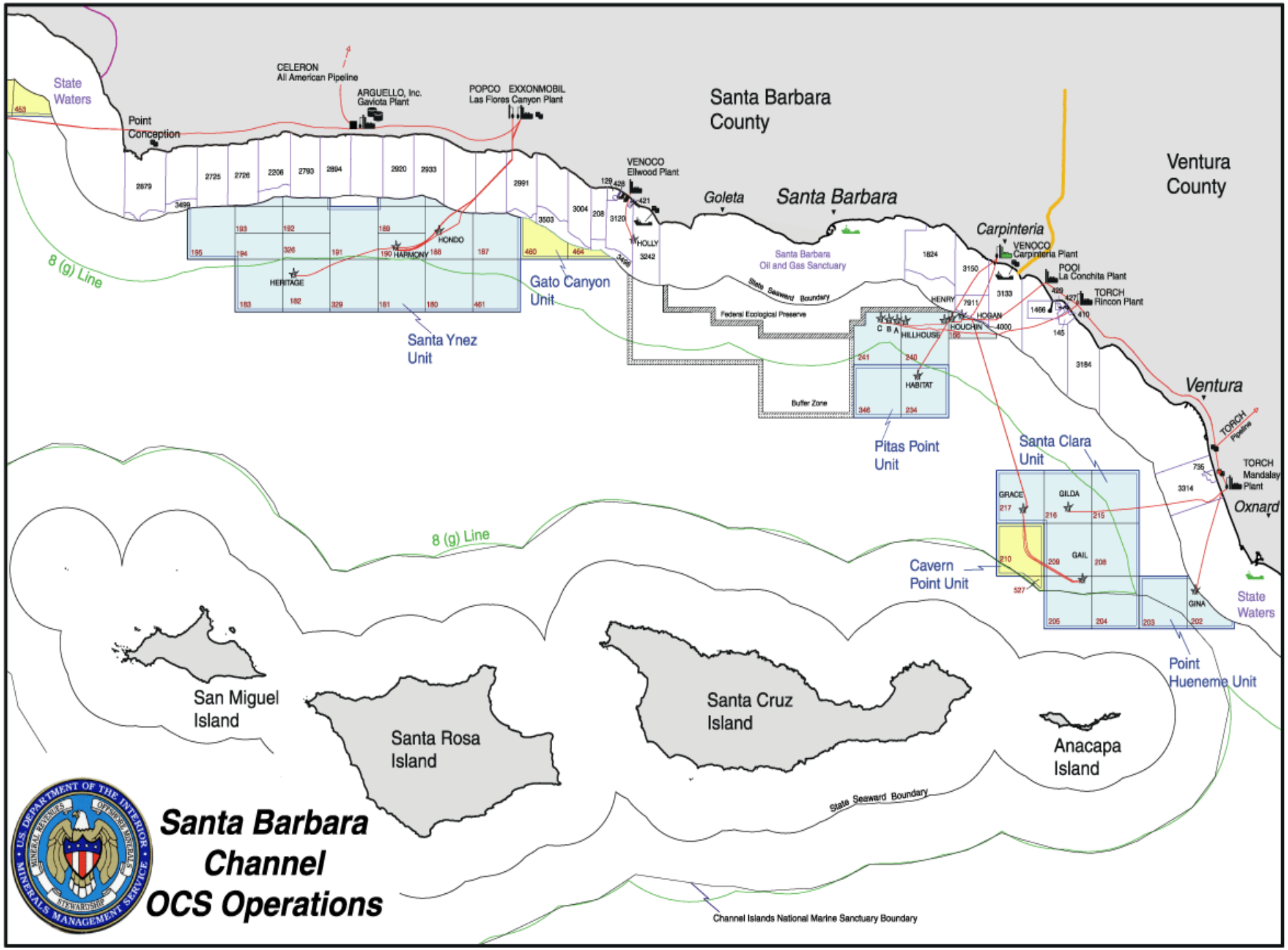
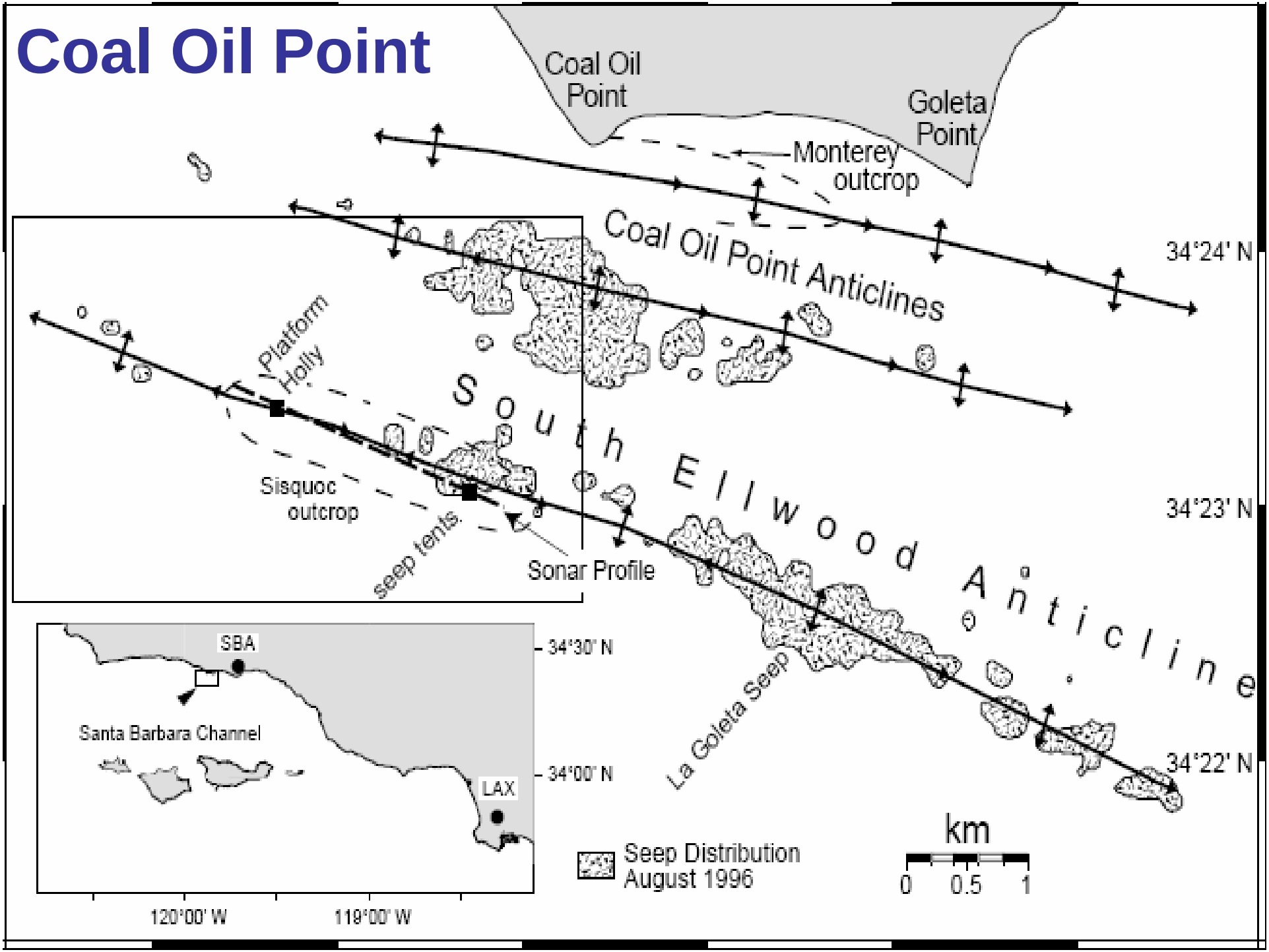
* NOx = Onshore + OCS


Platform Gilda
DANGER
GILDA


Santa Barbara Channel OCS Operations
State Waters
Point Conception
CELERON
All American Pipeline
ARGUELLO, Inc.
Gaviota Plant
POPCO
Las Flores Canyon Plant
EXXONMOBIL
Santa Barbara County
Ventura County
VENOCO
Ellwood Plant
Goleta
Santa Barbara
Carpinteria
VENOCO
Carpinteria Plant
POOI
La Conchita Plant
TORCH
Rincon Plant
Ventura
Oxnard
TORCH
Mandalay Plant
TORCH
Pipeline
8 (g) Line
Santa Ynez Unit
Gato Canyon Unit
Santa Barbara
Oil and Gas Sanctuary
State Seaward Boundary
Federal Ecological Preserve
Buffer Zone
Pitas Point Unit
Santa Clara Unit
Cavern Point Unit
Point Hueneme Unit
HONDO
HARMONY
HERITAGE
HOLLY
HENRY
HOGAN
HOUCHIN
HILLHOUSE
HABITAT
GRACE
GILDA
GAIL
GINA
San Miguel Island
Santa Rosa Island
Santa Cruz Island
Anacapa Island
Channel Islands National Marine Sanctuary Boundary

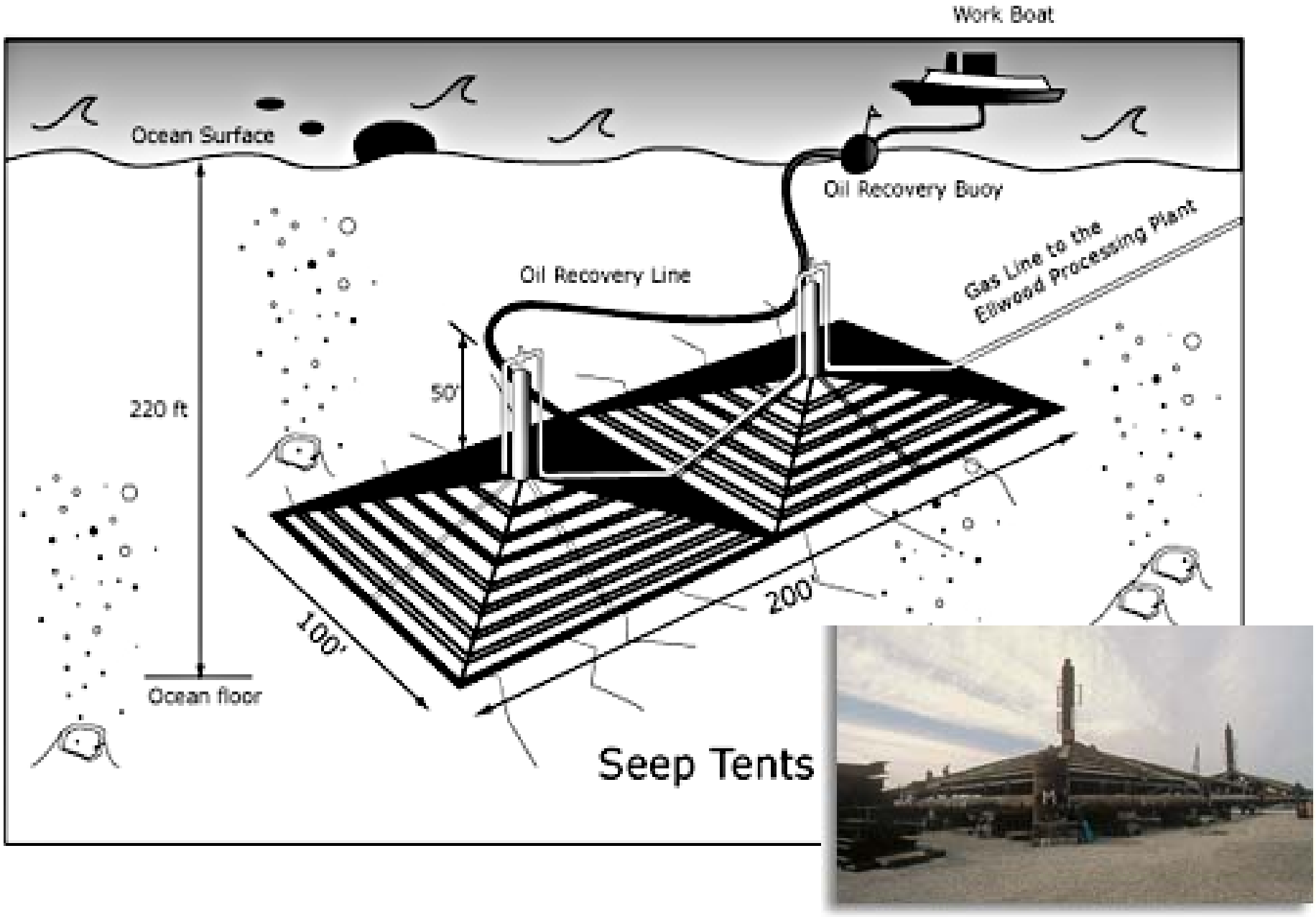
Natural Oil and Gas Seeps

Coal Oil Point



Installation of a Seep Tent

Seep Containment Devices -- 1982



2005 Marine Shipping Inventory

- Over 7,000 transits
- 10% of vessels = 56% NOx emissions
- 76 vessels over 50 tons of NOx
- 92% of NOx from foreign flagged vessels
- About 19 transits per day
- About 40 tons of NOx and 3 tons of PM emitted daily

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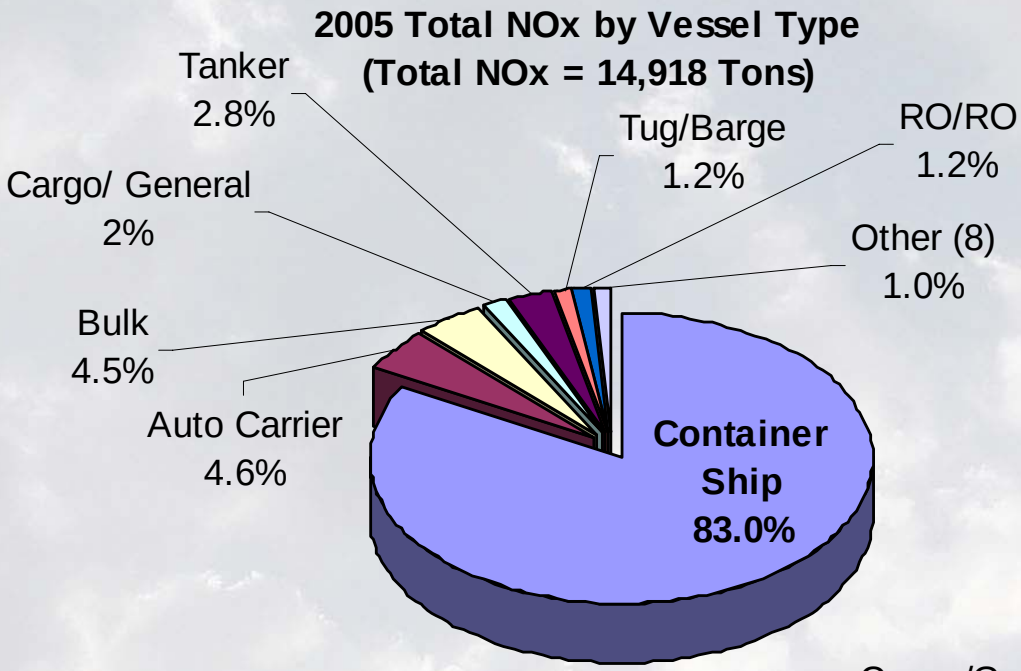
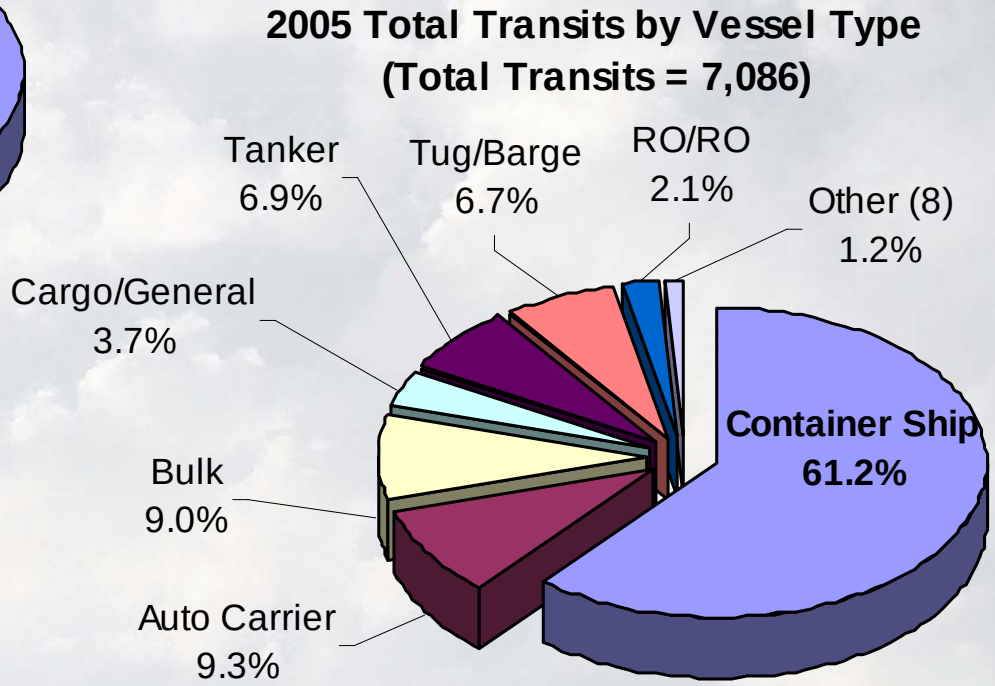
Ship Type Analysis





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Regulatory Efforts

IMO

- MARPOL Annex VI
  - Entered into force on May 19, 2005
  - Sets limits for SOx and NOx from vessels built or modified after 1/1/2000
  - Currently 35 countries have ratified
  - US, Canada & Mexico have NOT ratified treaty yet
  - By 2007 revisions that will be considered include:
    - PM, VOC, GHG limits & tougher NOx & SOx limits
    - In-use engine applicability

US EPA

- Category 3 Engine Rulemaking
  - Tier 1 standards = IMO standards
  - Tier 2 standards expected 2007
- SECA application development

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Regulatory Efforts

California Air Resources Board (ARB)

- Air Toxic Control Measures (ATCM)
  - Adopted aux. engine ATCM
  - Cargo handling equipment ATCM
  - Cruise ship on-board Incineration ATCM
  - Frequent flyer vessel ATCM
- Research
  - CA ocean-going vessel emission inventory
  - Modeling & Health / Ecological impact
  - SECA development collaboration with EPA

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Demonstration Project

Objectives

- Demonstrate emission controls
- Develop support for potential economic incentive programs
- Develop in-use testing protocol

Participants

- U.S. EPA, MARAD
- ARB, Ports, CA Air districts
- Ship operator
- Engine manufacturer
- UC Riverside

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Demonstration Project (cont'd)

- **Emission Control Technologies**
  - Fuel-water emulsification
  - Slide Valves
- **Detailed Emissions Testing**
- **Project Costs**
  - About $780,000 for hardware
  - About $100,000 for emissions testing
- **Annual Emissions Reductions in CA Waters**
  - 66 Tons of NOx
  - 4 Tons of PM
- **Project to be complete by July 2007**
- **Challenges**

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Port Hueneme

- "Niche" Port
  - #1 port in nation for citrus exports
  - Top ten in imports of autos & bananas
- Nearly tripled cargo weight and value between 1990 & 2001
- 35' depth limits vessel types
- Vessel types: Reefer, ro-ro, older containerships
- About 340 calls in 2004
- About 7% of total US vehicle carrier port calls and capacity (DWT x calls) in 2004

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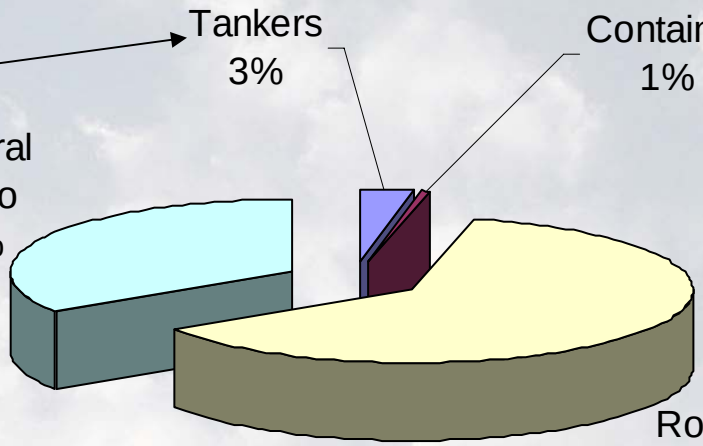
Common Ship Types



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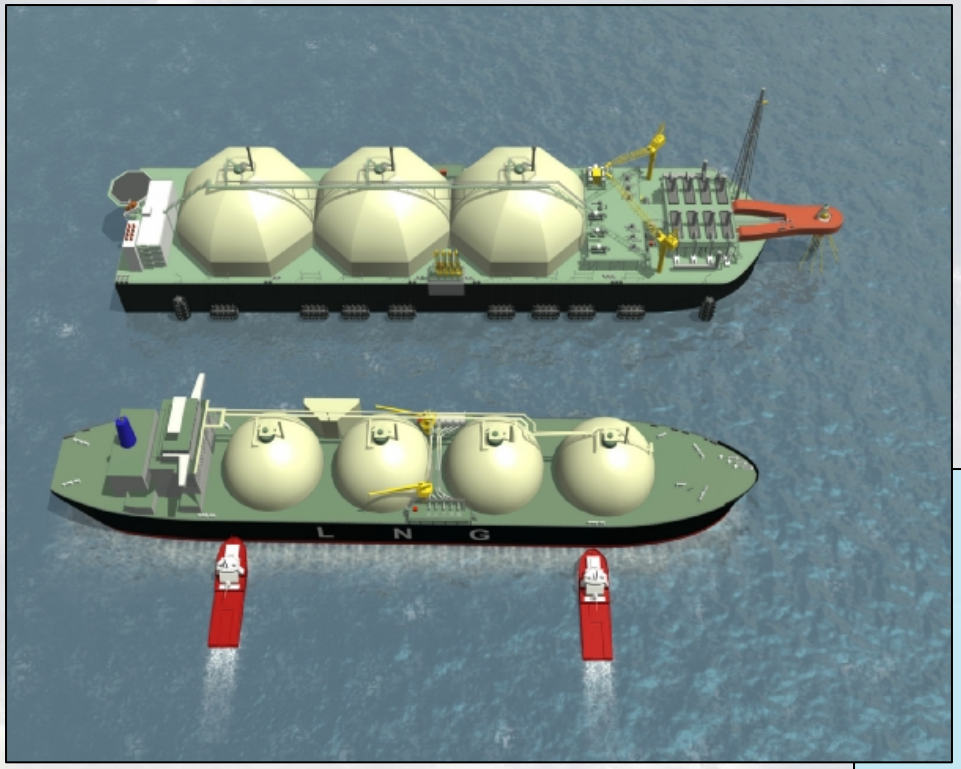
Proposed Cabrillo Port Project



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Containership Evolution

	Length	Draft	TEU
First Generation (1956-1970)			
 Converted Cargo Vessel Converted Tanker	135 m 200 m	< 9 m	500 800
Second Generation (1970-1980)			
 Cellular Containership	215 m	10 m	1,000 – 2,500
Third Generation (1980-1988)			
 Panamax Class	250 m 290 m	11-12 m	3,000 4,000
Fourth Generation (1988-2000)			
 Post Panamax	275 – 305 m	11-13 m	4,000 – 5,000
Fifth Generation (2000-?)			
 Post Panamax Plus	335 m	13-14 m	5,000 – 8,000

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Containerships

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General Cargo Ships

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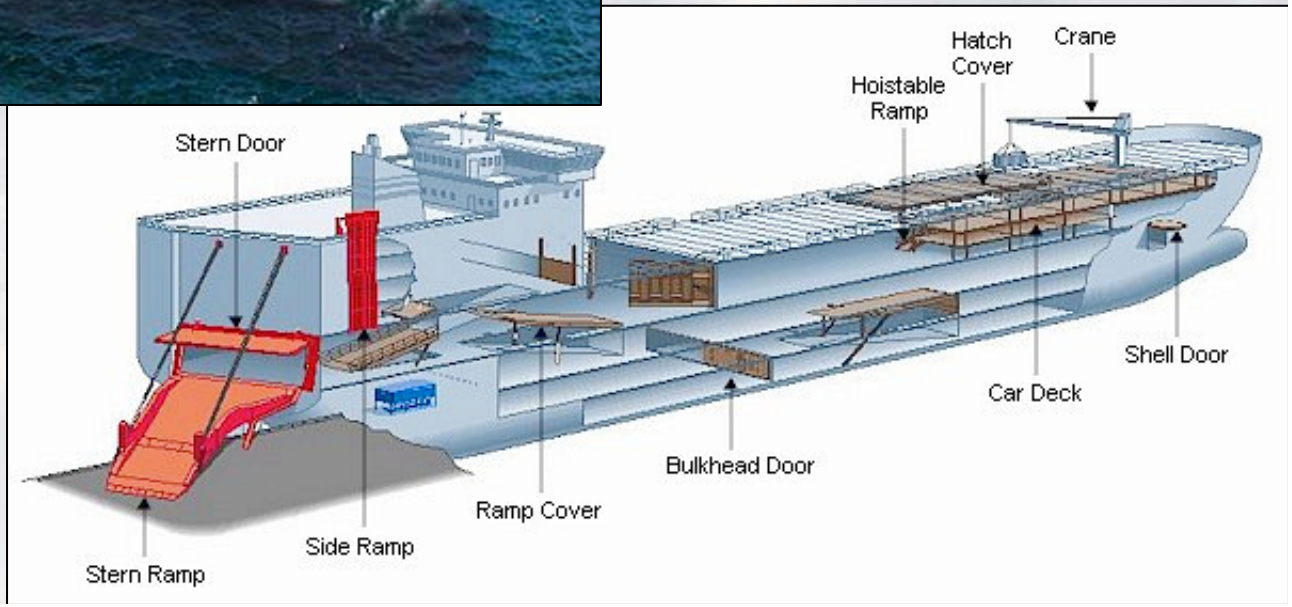
Ro-Ro Ships



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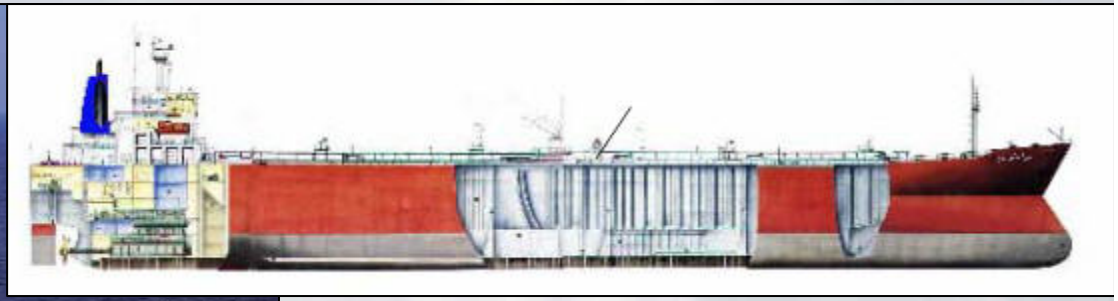
Tankers



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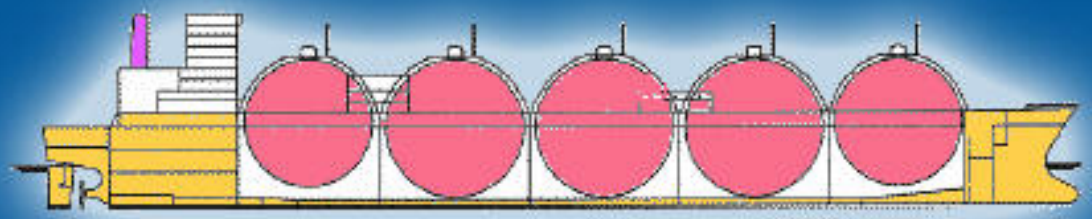
LNG Tankers

135,000 cubic metre LNG carrier with membrane tanks.



137,000 cubic metre LNG carrier with type B tanks.

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Bulk Carriers

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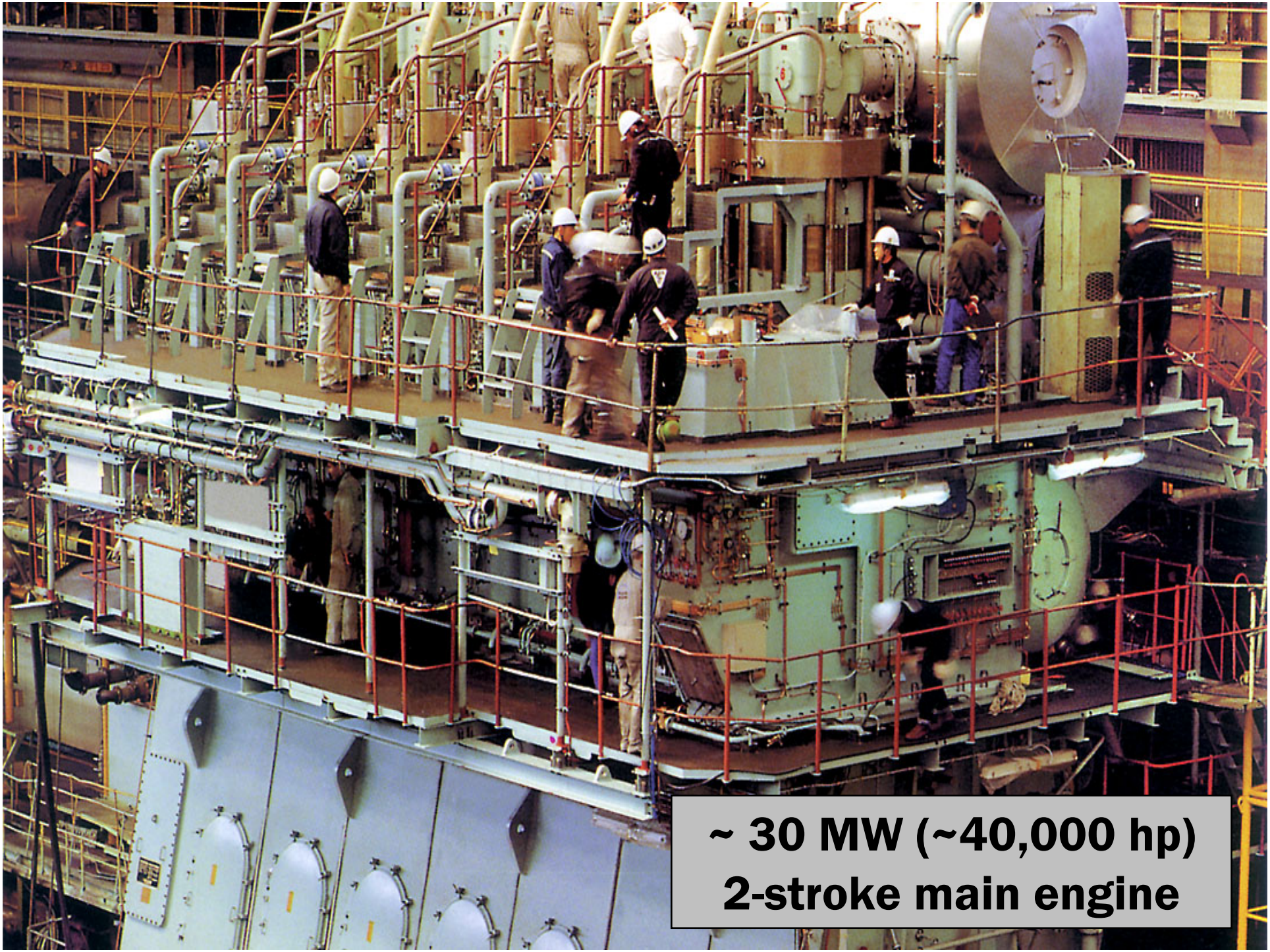
~ 30 MW (~40,000 hp)
2-stroke main engine


Questions ?
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Photo by Steve Ringman, The Seattle Times