Complying with Emission Control Areas: Practical Realities

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Key Issues

- Technical – engine operations
- Compliance - Tracking & Reporting
- Fuel cost differential
- ECA expansion elsewhere

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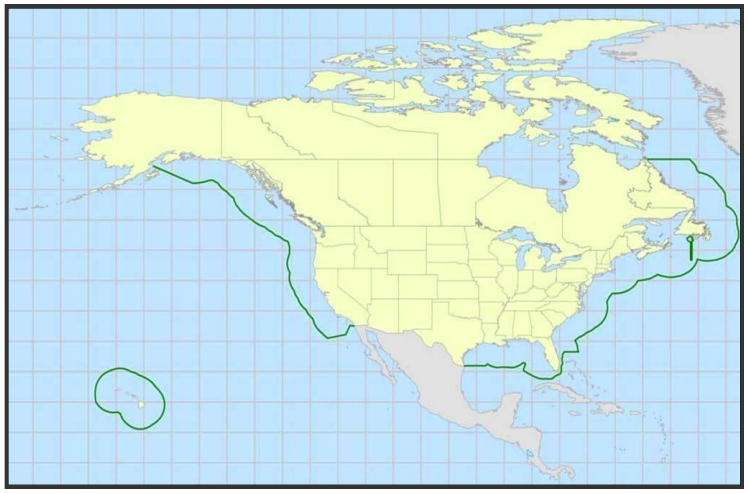
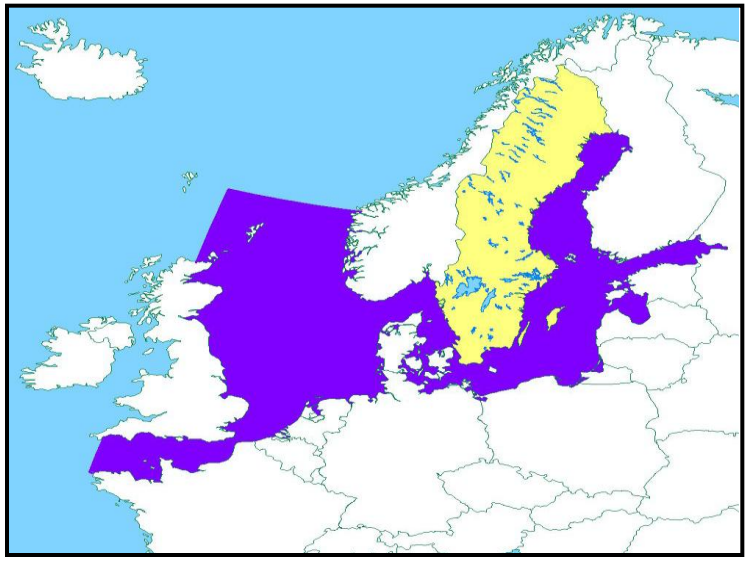
World Emission Control Areas (ECA)



- Goes in to effect on August 2012 and covers 200 nautical miles around US and Canada(includes Hawaii and Puerto Rico)
- Sulfur content should be less than 1% (Limit drops to 0.1% on 2015)



- Effective from January 2009 , Sulfur content capped at 1.5%, dropping to 1% in July 2010 (Limit will fall to 0.1% in 2015) engulfing North and Baltic sea and English channel
- EU regulation requires 0.1% Sulphur fuel to be burned in Aux. and boilers while at dock or anchorage

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Challenges

- No significant problems encountered to date on Maersk vessels due to fuel switch.
  - Engines run on LSDO for short periods of time, so it will not be necessary to change the cylinder oil type. In case of longer running, manufacturers suggest change over of cylinder lubrication oil with lower base number.
- Low-sulfur distillate oils have a lower lubricity compared with normal heavy fuel and may lead to sticking in pump elements and nozzles.
- Timely data collection needs more attention in the early months.

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API's Guideline on Fuel Switching*

In order to avoid engine(s) failure , ships need to consider the following operational concerns:

- Crankcase and Cylinder lubricating oil:
- Reduced Viscosity and Lubricity of low Sulfur Distillate Oil
- Reduced Density of Distillate Oil
- Temperature
- Incompatibility of fuels
- Liner lacquering

* *API Marine Technical Issues Workgroup - June3, 2009*

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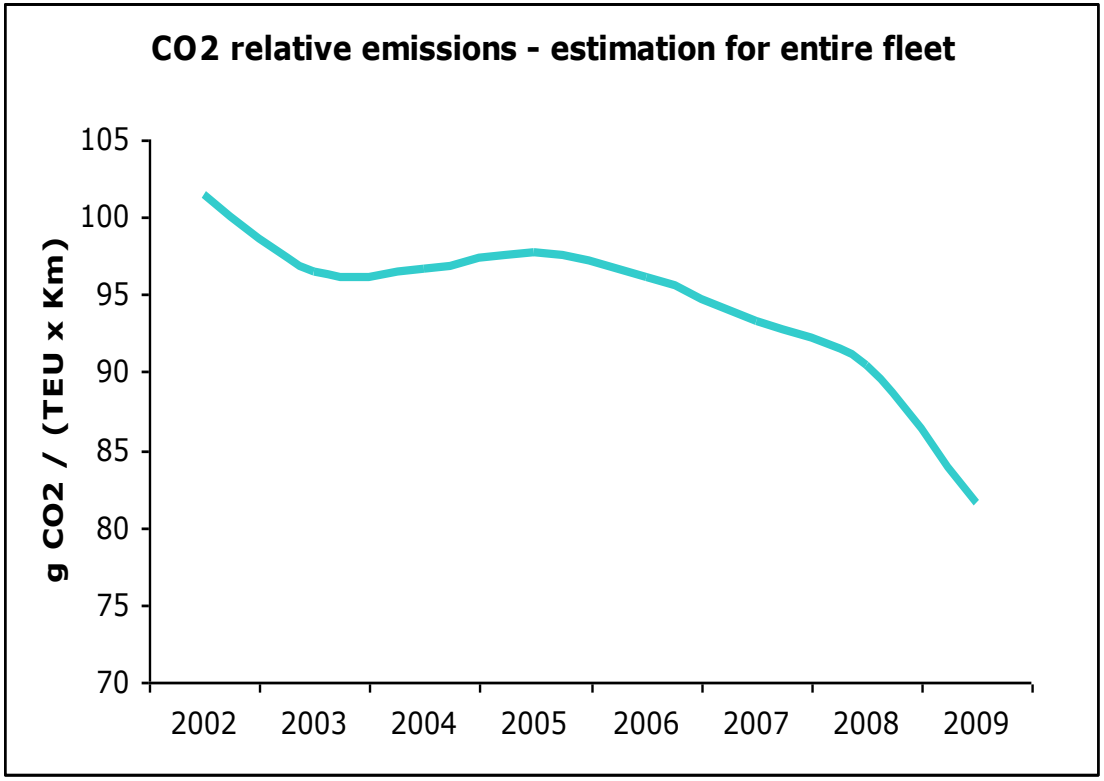
Vessels Becoming More Energy-Efficient

Due to

- **Technologies**
- **Operations**
- **Speeds**
- **Vessel size**



- Reduced over two million tonnes CO_2 plus other emissions
- Reduction target for 2020 is 25% below 2007 levels

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Technical Innovation

- *Propeller, hull & trim optimization*
- *Waste heat recovery system*
- *Slow steaming and super-slow steaming*

Other Initiatives

- ✓ *Alternative fuel tests*
- ✓ *New propulsion technologies*
- ✓ Crew awareness and engagement
- ✓ *Modified bulbous bow*
- ✓ *QUEST: Low energy chilled containers*
- ✓ *Ballast water optimization and treatment systems*
- ✓ Maintenance of hull and propeller
- ✓ Voyage Efficiency System (VES)
- ✓ *Micro bubbles*
- ✓ ISO 14001 certified
- ✓ SOx scrubber studies
- ✓ Antifouling hull paint
- ✓ Waste heat recovery system
- ✓ Electronically controlled injection in engines

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Current Emission Reduction Initiatives

- **Electronically controlled injection in engines**
  - Improved combustion in low-load condition
  - No visible smoke – less PM emission
  - Less fuel oil consumption due to better combustion
- **Voyage Efficiency System**
  - Sharing of sea current data between ships
  - Voyage optimization based on input from MET services, sea current and other sources
  - Less fuel oil consumption due to less distance traveled at high speed
- **Maersk Ship Performance System**
  - Monitor propeller and hull efficiency
  - Optimize hull and propeller cleaning intervals
  - Monitor trim optimization
  - Monitor engine performance

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Fuel Switching in North America

California:

- ✓ **Voluntary** from March 2006 to July 2009
- ✓ Switching main and aux. engines and boilers within the 24nm zone from the coastline
- ✓ Going Beyond compliance since Maersk policy is to burn fuel with less than 0.2% Sulfur content which is well below legal requirement

Houston:

- ✓**Voluntary**- A cooperative agreement with Port of Houston as part of DERA program by EPA
- ✓ Complete switch on main, aux. engines and boilers within 24 nm zone of port of Houston
- ✓ Average Sulfur content burned less than 0.15%, Contract requires less than 0.2%

Seattle/Vancouver:

- ✓ **Voluntary**
- ✓ Low sulfur fuel while at dock

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Fuel Switch Costs & Implementation

- No capital investment required – vessel or port
- Rapid implementation (weeks vs. years)
- No personnel safety or training issues

BUT:

- **Fuel cost** differential is substantial
  - Differential cost from $318/ton in 2008 to $240/ton in 2010 (Bunker world)

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Fuel Switch Summary

Number of vessels	More than 130 different vessels to October 2010 Owned and charter participate
Number of fuel switchings carried out	- Over 1700 fuel switches carried out - Phase-in started with Sine Maersk on March 31,2006 - Fuel Switch mostly done on voluntary basis
Consumption of LSDO per Switch – Main & Auxiliary Engines	30.3 MT Based on 2006-10 fuel consumption
Reported sulfur content of fuel	HFO: 2.7% LSDO: 0.12%
Emissions reductions (April2006 -October 2010)	SOx: 2730 MT – 95% Reduction NOx: 262 MT - 12% Reduction PM: 640 MT - 86% Reduction *Data analysis by ENVIRON*

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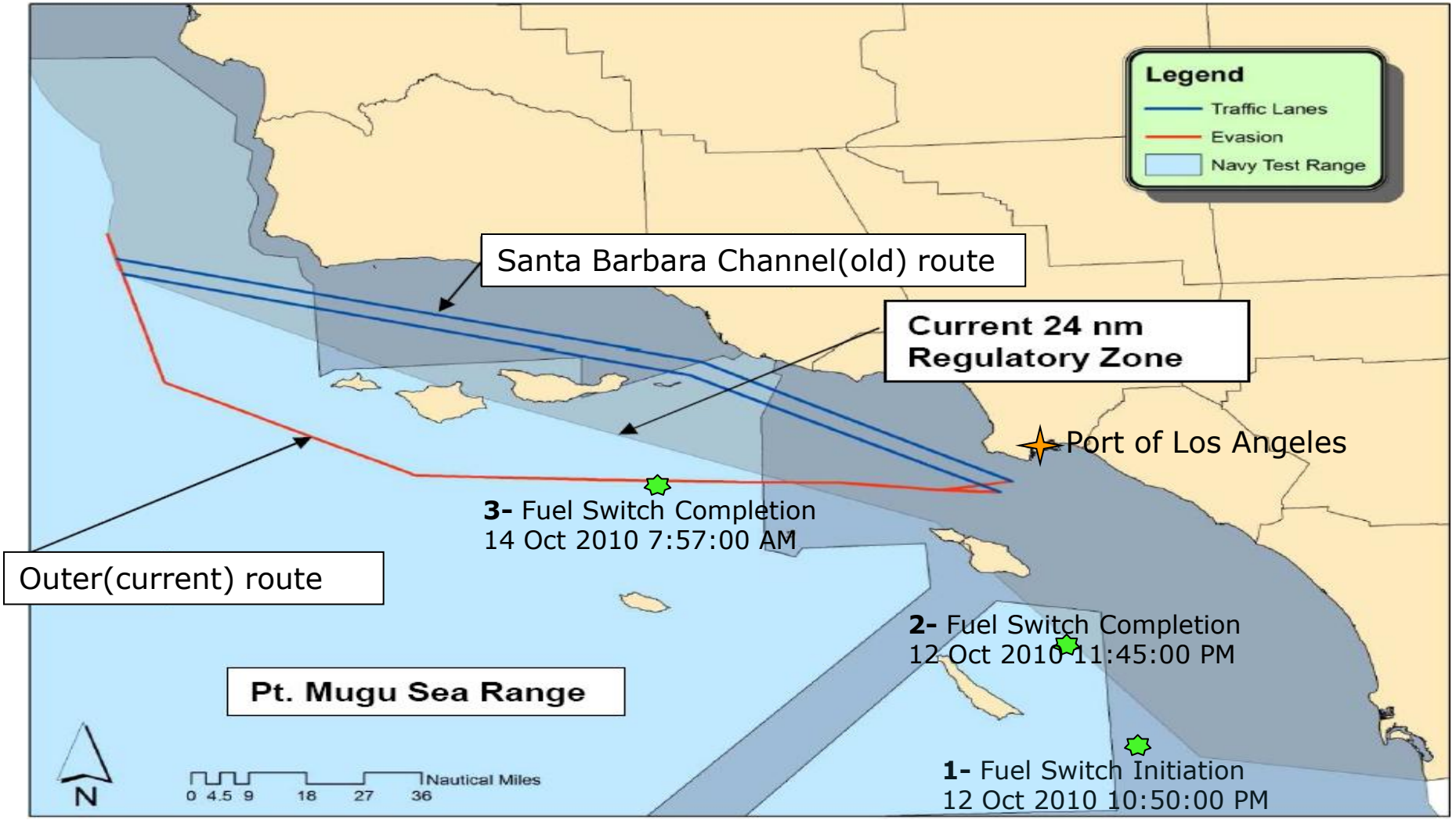
Typical Fuel Switch Map :
Marie Maersk Calling Port of Los Angeles



Data by ENVIRON

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Fuel Switch Around the Globe

- **North America**: Vancouver, Seattle, All Californian ports, Houston
- **Latin America**: Progresso Mexico
- (Demonstration switch)
- **Europe**: All EU ports at dock or anchorage plus all engines within EU ECA
- **Asia:** Hong Kong (voluntary)

Mærsk Mc-Kinney Møller stands on the dock at Pier 400 in Los Angeles with the Sine Maersk at berth behind him. The vessel was the first to perform a fuel switch as part of a Maersk Line pilot environmental initiative in California, started on 31 March 2006

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Summary

- No major problems anticipated
- Early fuel switch demonstrations help
- When ECA is in effect, low sulfur fuel costs will be paid by all
- Reporting requirements will ultimately grow
- Measurable environmental benefits

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Thank You

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