SHORE POWER ALTERNATIVES
AAPA ENVIRONMENT COMMITTEE
SEPTEMBER 17, 2015

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CARB SHORE POWER RULE

REGULATORY DEVELOPMENTS

- International Maritime Organization designated waters within 200 miles of North American Coast as Emissions Control Area
  - <1% fuel sulfur beginning in 2012
  - <0.1% fuel sulfur beginning in 2015
- California Air Resources Board's At-Berth Toxic Control Measure
  - Requires conversion to shore power or alternative control technology that achieve equivalent reductions to reduce NOx and PM10
  - Phased in starting January 2014
  - Amendments scheduled for 2016

Shore Power

Source: California Air Resources Board, Shore Power Photos, http://www.arb.ca.gov/ports/shorepower/photos/photos.htm

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FLEET REQUIREMENTS FOR REDUCED ONBOARD POWER GENERATION

- One of two compliance options for the At-Berth Regulation
- Must adhere to the following requirements:
  - Auxiliary engine operating limits must be satisfied for a percentage of visits.
  - Power produced by auxiliary engines in the fleet must be reduced by a percentage.
  - If a vessel is equipped to use shore power and compatible shore power is available, the vessel must use shore power.

Start Date	Requirement	Compliance Period
1/1/2010	Shore-power equipped vessels that are part of an affected fleet must use shore power while visiting a compatible shore-power berth.	Applies at all times
1/1/2014	1) **50** percent of the fleet's visits to a port must be shore-power visits* 2) Auxiliary engine power generated by the fleet must be reduced by **50** percent.	Quarterly**
1/1/2017	1) **70** percent of the fleet's visits to a port must be shore-power visits* 2) Auxiliary engine power generated by the fleet must be reduced by **70** percent.	Quarterly**
1/1/2020	1) **80** percent of the fleet's visits to a port must be shore-power visits* 2) Auxiliary engine power generated by the fleet must be reduced by **80** percent.	Quarterly**

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EQUIVALENT EMISSIONS REDUCTION OPTION

- Under this option, a fleet may reduce emissions using vessel-side and shore-side control technologies, including grid-based shore power.
- Fleets can use any method of control, but must provide a detail description of the technology and emission testing information for the control of NOx and PM.
- Under the recent CARB Advisory, Option 1 fleets may use an alternative.
- ARB Must issue an Executive Order for the alternative technology

Start Date	Requirement	Compliance Period
1/1/2010	10 percent at-berth emission* reductions	Annual
1/1/2012	25 percent at-berth emission reductions	Annual
1/1/2014	50 percent at-berth emission reductions	Quarterly**
1/1/2017	70 percent at-berth emission reductions	Quarterly**
1/1/2020	80 percent at-berth emission reductions	Quarterly**

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TERMINAL REQUIREMENTS

- Submit Terminal Plan updates by July 1 in 2013, 2016, and 2019.
- Each terminal operator must keep the following records:
  1. Monthly utility bill for shore power use.
  2. Document electrical service interruption by the utility.
  3. Date, time, and description of equipment failure that affected fleet compliance with the At-Berth Regulation.
  4. Record of each vessel that did not operate its auxiliary engines while docked at the berth. The information includes the following for each visit:
     A. Name of vessel.
     B. Date and time each vessel was initially tied to the terminal.

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PORT REQUIREMENTS

- Each California port must provide wharfinger information by April 1 of each year for the previous year. At a minimum, the wharfinger information shall include for each vessel visiting the port:
  1. Name of the vessel.
  2. Vessel Type.
  3. Company operating the vessel.
  4. Lloyd's number for each vessel.
  5. Berth used by the vessel.
  6. Dates and time the vessel was initially tied to the berth and subsequently released from the berth.

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AMECS SYSTEM AND STATUS

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AMECS CONCEPT

- An alternative to shore power
- Does not require any modifications to the berth or the vessel
- Use proven emission control technology with a new system to connect to the vessel.
- Initially tested on railroad locomotives,
- Then as a dockside installation
- Now installed on a barge to allow it to be used where needed

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COOPERATIVE DEVELOPMENT EFFORT

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CONNECTION TO EXHAUST PIPES

- Now using a direct connect system
- Can connect to two stacks
- Vessels typically have more, but normally operate only 1 or 2 at a time
- Uses a seal in combination with negative pressure to capture the emissions at ~100%

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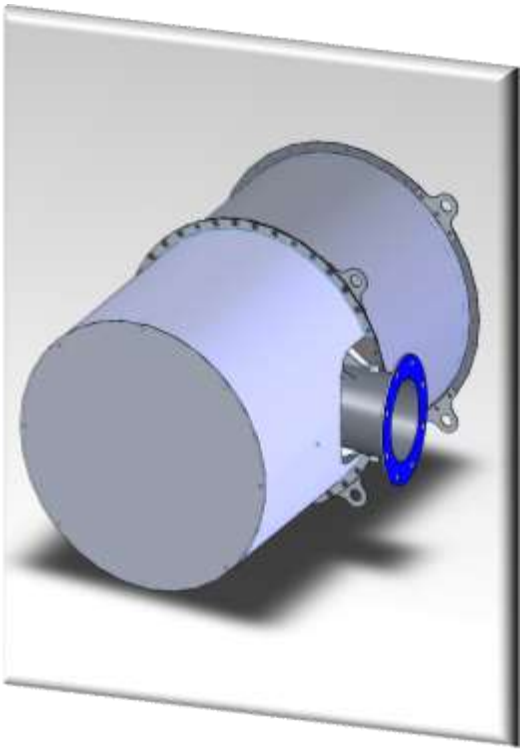
PM – 9 DIESEL PARTICULATE FILTERS (DPF)

PM -DIESEL PARTICULATE FILTER (DPF)

- AMECS 2 - Replaced Pre-cool Chamber (PCC) & Three Cloud Chambers
- Same 95% PM removal efficiency
- 80% Less Energy
- 80% Less Maintenance
- No waste water
- 50% less footprint
- Already CARB approved



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NO_X – SELECTIVE CATALYTIC REDUCTION

- 99% NO_X Removal Efficiency
- 650F gas stream converts injected urea to ammonia
- NO_X & ammonia converted to harmless nitrogen and water vapor
- Spent catalyst sent to manufacturer for recycling

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SO_X - PACKED-BED SCRUBBER

- Optional SOX Scrubber
- 99% removal efficiency
- Required for South Coast AQMD
- Not for ARB Rule

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1200 HOUR SHORESIDE DURABILITY TEST

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BARGE BASED AMECS

- Moved unit to a barge
- Using new remotely controlled crane
- Serves vessels from the side opposite the dock or at anchor
- Have operated over 300 hours on the barge

BARGE BASED AMECS

- Able to control vessels at anchor, not possible with shore power
- Significant benefit, particularly for situations such as occurred at PoLA / PoLB with up to 45 ships at anchor

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AMECS STATUS

- Submitted test report to ARB Spring 2015
- ARB Reviewed, additional test data submitted September 2015
- Awaiting final Executive Order for the system, likely very soon
- One Executive Order issued to CAEMI
  - We understand that it will only be operated at TraPac in PoLA

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