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Retrofit of a Tugboat
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NOx Emissions in 2023 with Adopted Standards
Commercial Harborcraft Rule

Applies to:
- tugs, towboats, excursion boats, ferries, dredges, barges, crew/supply boats

New Vessels:
- must use current Tier engine

In-use Vessels:
- replace Tier 0 through 2016
- replace Tier 1 engines through 2022
- if replacement engine is Tier 2, no further replacement or after-treatment is required
Marine Emission Standards

Marine NOx Standards (g/bhp-hr)

Marine PM Standards (g/bhp-hr)
Tugboat Retrofit Overview

• **What**  - Demonstrate Tier 4 retrofit system
  - Support verification of technology

• **Why**  - CHC regulation does not require Tier 4 retrofit or Tier 4 levels on new smaller (<800 hp) engines
  - Retrofits would provide significant additional NOx and PM emission reductions
  - Incentive funds may be used

• **Where**  - Port of Long Beach/Los Angeles

• **How**  - AB118 marine technology grant
  - Co-funding from technology provider
Retrofit Project Scope

• Design, fabricate, and install active DPF/SCR system

• Conduct emission tests of system
  – Baseline, initial installation, final test (>1000 hours)
  – NMHC, CO, NOx, NO₂, PM, NH₃, CO₂, fuel consumption

• Demonstrate and monitor system performance
  – NOx reduction efficiency
  – regeneration frequency
  – urea consumption
  – operational experience

• Verification application
  – system description
  – test protocol
  – baseline and initial test data
Retrofit Technology

• Vessel
  – Twin 600 hp DDC engines
  – Rebuilt with DDC Clean Cam Tier 2 kit

• Hug after-treatment systems
  – DPF
  – Fuel burner DPF regeneration system
  – Regeneration at any engine load condition
  – Urea SCR system
Hug DPF/SCR Illustration

(b) Burner-technology assembly incl. SCR for active PM and NOx regeneration

Particle Filter - DeNOx System (SCR)
for Diesel Engines on Ships
150 kW - 3'000 kW
Typical Marine Engine with DPF/SCR System
DPF/SCR Control Cabinets
Fuel Burner and Urea Injection
DPF/SCR Housing
Tug Boat Retrofit Status

- AB118 contract executed
- Hug subcontract pending execution
- Hug/AQMD meeting with CARB
  - Preliminary application content
  - Test protocol
  - Schedule
- Planned installation January 2013
- Planned completion January 2014
- AB118 funds expire June 2014