



Pilot Retrofit Program for Drayage Trucks Serving the San Pedro Bay Ports



Presentation to:

**West Coast
Collaborative,
Trucking Sector**



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Retrofits are a Key Strategy for Reducing Emissions from Pre-2007 Trucks

- The SPBP Clean Truck Program, which will be announced in mid September, is expected to target the retrofit of thousands of port trucks (per HDV-1 of CAAP)
- In parallel, ARB is pursuing Fleet Rules for all heavy-duty trucks across the state, including independently owned / operated port trucks)
- Not all on-road trucks are good candidates for retrofit; numerous factors come into play
- Screening of the targeted truck population for suitability is essential



Internal view of a DPF

General Suitability Tests for Retrofitting On-Road HDVs

- Considerations and selection criteria include:
 - Is there a CARB-verified device for the engine make/model year?
 - Are NOx reductions sought in addition to PM reductions?
 - Does engine have EGR, for which no passive DPF is currently verified?
 - Does intended duty cycle / application generate sufficient exhaust temperatures for a passive DPF? If not, can an active DPF work? Or, would a Level 2 flow-through filter be better for the application?
 - Are there horsepower restrictions? Does truck have dual exhaust?
 - Is targeted end user group conducive to using / maintaining device properly?
 - Can they afford higher operational costs (e.g., maintenance, fuel economy penalty)
- Additional considerations for retrofits:
 - Infrastructure requirements
 - Failure mode of the device
 - Variability of driver workload and duty cycle

Specific challenges for retrofitting container port trucks include:

- Average daily mileage varies among drivers (from 50 to 300 miles per day)
- Driver's cargo and load constantly change (20,000 – 80,000 lbs GCVW)
 - 20' vs. 40' containers
 - Bobtailing (tractor with no trailer) or returning empty containers
- Workloads can change seasonally
- Drivers may change carriers, drive for multiple carriers, drive to the port part time, and/or temporarily leave for another trucking vocation
- Engine may not be properly maintained
- **These factors affect the average exhaust temperature and/or PM generation rates of the engine, which partly dictate viability of a given retrofit device**
- **Port truckers can least afford higher operational costs that may result from retrofitting an existing truck**



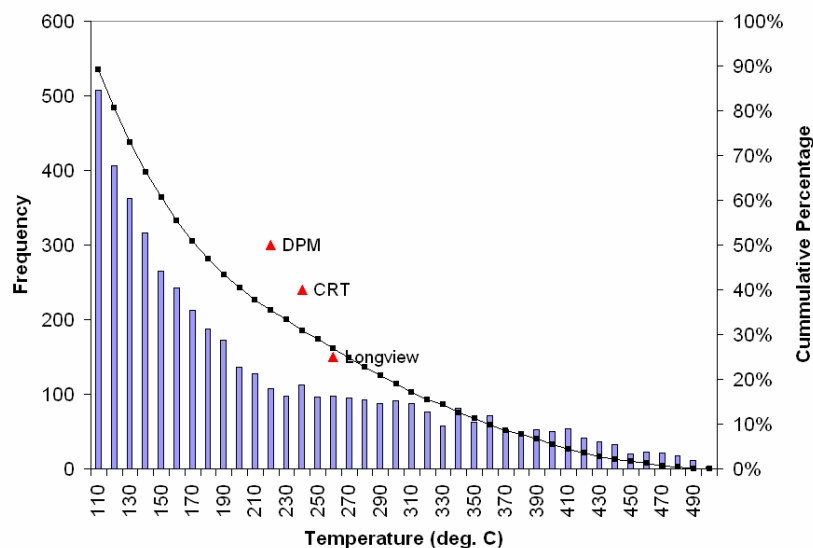
Overview of Cleaire Longview[®]

- The Longview system includes a diesel particulate filter (DPF) and NOx reduction catalyst
- Verified by CARB as a level-3 VDECS (verified diesel emission control strategy)
- Emission Reductions (from baseline)
 - PM >85%
 - NOx ≥25%
- DPF regeneration for Longview[®] is classified as “passive,” but it’s actually “semi-active”
 - DPF regeneration requires exhaust temps ≥ 260°C for at least 25% of drive cycle
 - Longview[®] uses diesel fuel combustion for NOx reduction (Lean NOx Catalyst); this also imparts heat to DPF, assisting with regeneration



TIAX conducted exhaust temperature testing of port trucks for POLA / POLB

- **Objective:** determine if container trucks generate enough exhaust heat to meet verification requirements of Longview[®] (and other **passive DPF systems**)
- **Test Plan:** data log a representative sample of drayage trucks serving the SPB Ports (MY '93 to '06, various engine makes, models, etc.)
- **Test Parameters:** mileage, exhaust temperature, driver workload (survey), engine on/off time (estimated)
- **Results:** 30 port trucks were successfully datalogged in Q1 of 2007
- **Key Conclusions:** Longview[®] DPF system can work for a large percentage of port trucks, with careful pre-screening for daily mileage, engine condition, etc.



Example exhaust temperature histogram for port truck showing suitable duty cycle for Longview's DPF

Overview of Pilot Retrofit Program

- **Funding / Oversight:** Port of Long Beach, with POLA support
- **Program Management:** Gateway Cities COG (fiscal and administrative), TIAX (technical)
- **Participating Cleaire Longview[®] Vendors:** Cummins Cal Pacific, Ironman Parts
- **Cooperating LMCs:** Cal Cartage, possibly others (e.g., Southern Counties Express, Inc.)
- **Targeted Number of Retrofits:** up to 50 port trucks for pilot program
- **Available Funding to Date:** approximately \$1.275 m for hardware and installation
- **Immediate Objectives:**
 - Demonstrate feasibility of Longview[®] retrofit device in port drayage operations
 - Advance the “learning curve” for all stakeholders (LMCs, truckers, device vendors, program managers) in preparation for much larger program (potentially involving multiple aftertreatment technologies)
- **Specific Goals:**
 - Validate and/or improve port truck pre-screening tools
 - Fine tune procedures and requirements (e.g., inspection, installation)
 - Collect actual cost data
 - Identify potential issues for large-scale program under CAAP

Procedure for Drivers Applying to the Pilot Retrofit Program

- Truck owners must meet minimum requirements that include:
 - Own/operate a heavy-duty truck (Class 8) used in port applications
 - Proof of history performing regular trips (3 to 7 / week) to POLB and/or POLA terminals
 - Truck has a MY1999-2002 engine (subset of future program)
 - Proof of CHP Biennial Inspection of Terminals
 - Proof of insurance for past 24 months
 - Indication that driver anticipates receiving Transportation Worker Identification Card (“TWIC”)
- Trucks that pass “pre-screening” by TIAX are steered to vendors for physical inspection
- Trucks that pass initial mechanical inspection by vendors receive typical 3-day datalogging to characterize exhaust temperatures
- Once Longview is installed, truck owners agree to the following obligations for five years:
 - Allow AVL (Automatic Vehicle Locator) installation
 - Apply clean air decals
 - Return in 90 days for check-up / data download
 - Comply with applicable motor vehicle laws
 - Stay in port trucker vocation
 - Provide annual updates (insurance, registration, etc.)
 - Properly maintain retrofit device and truck

Program Status

- Applying findings from datalogging tests, candidate port trucks are pre-screened for strong likelihood to generate sufficient exhaust temperatures for Longview[®]
- TIAX and device vendors have worked with LMCs to ID candidate trucks
 - Better vehicle records
 - Mileage reports
 - Single point of contact
- Result: so far, all trucks steered to vendors for datalogging have passed temperature requirements
- First Longview installed on July 20th, 2007
- As of August 24, 2007: 4 retrofits completed, 7 in progress
- Overall, positive response and progress
- Challenges include:
 - Drivers slow to schedule appointments
 - Some vendors do not stock retrofit devices (4 week lead time)
 - Trucks that fail mechanical inspection must be repaired before continuing



This shows an atypical “underframe” Longview installation

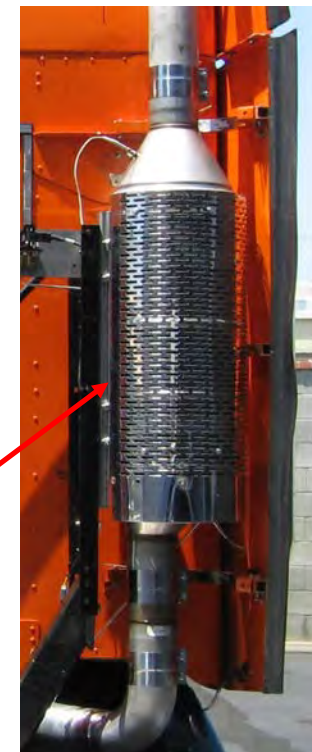
Typical Installation of Longview device on a Class 8 truck



Fuel Pump

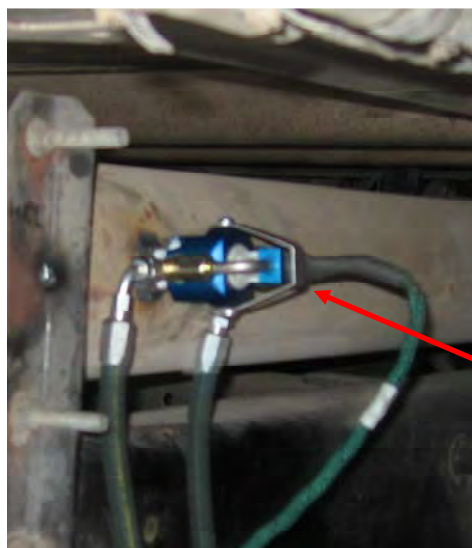


Longview ECU



NOx reduction catalyst & DPF

Typical installation (cont'd)



Upstream Fuel Injector



Rear View of Longview



Pressure Taps & Thermocouple

As expected, unique real-world challenges arise when retrofitting non-fleet port trucks:

- Engine Condition
 - Prior to retrofit installation, trucks are required to meet minimum performance criteria (no exhaust leaks or excessive oil consumption, etc.)
 - Performance tests must be conducted by approved retrofit installer
 - Significant problems require repair before installation can begin
 - Truck owner is free to choose where he wants the repair work performed
 - Challenge in verifying actual repair work performed
 - Was mechanic and/or shop competent?
 - What work was actually performed?
 - Requires assurances that *necessary* repairs were adequately performed
- Installation Issues
 - Different Cleaire Longview models (J,K) have DPF sized for various engine power ratings
 - An undersized DPF can result in excessive exhaust backpressure
 - Poor truck performance results i.e. excessive fuel consumption, overheating
 - Results in unnecessary downtime for truck owner
 - Some truckers are likely to claim post-retrofit problems, which can be real or perceived
- With more retrofit installs, mechanics will become more familiar and comfortable with the product installation procedure
- Future issue?: truckers will realize higher O&M costs (reduced FE, increased maintenance)

Conclusions

- The San Pedro Bay Ports have asked the Gateway Cities COG and its technical team to implement a 50 truck pilot program to demonstrate feasibility of the Cleaire Longview retrofit device in the unique drayage vocation
- Value of a Pilot Program:
 - Opportunity to work through unforeseen problems/challenges
 - Efficient distribution of program funds
 - Receive valuable feedback from participants i.e. drivers, owners, vendors
 - Prepare for much larger CAAP retrofit program potentially involving multiple exhaust aftertreatment technologies
- Results to Date:
 - Pilot program is proceeding well, albeit slowly
 - Pre-screening tools have proven to be effective
 - Truckers and LMCs have responded well, and seem to relish their direct role in reducing local PM emissions
 - Valuable lessons are being learned, and challenges are being addressed
- Stay tuned for Phase 2, on a much larger scale!

Thank You For Your Attention!



TIAX wishes to thank the following **program sponsors and **vendors**:**

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- **Port of Los Angeles**
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- **Cummins Cal Pacific**
- **Ironman Parts**

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