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ADVANCED EMISSION CONTROLS

Controlling Diesel Emissions

**Air & Waste Management Association
Marine Port Air Quality Impacts**

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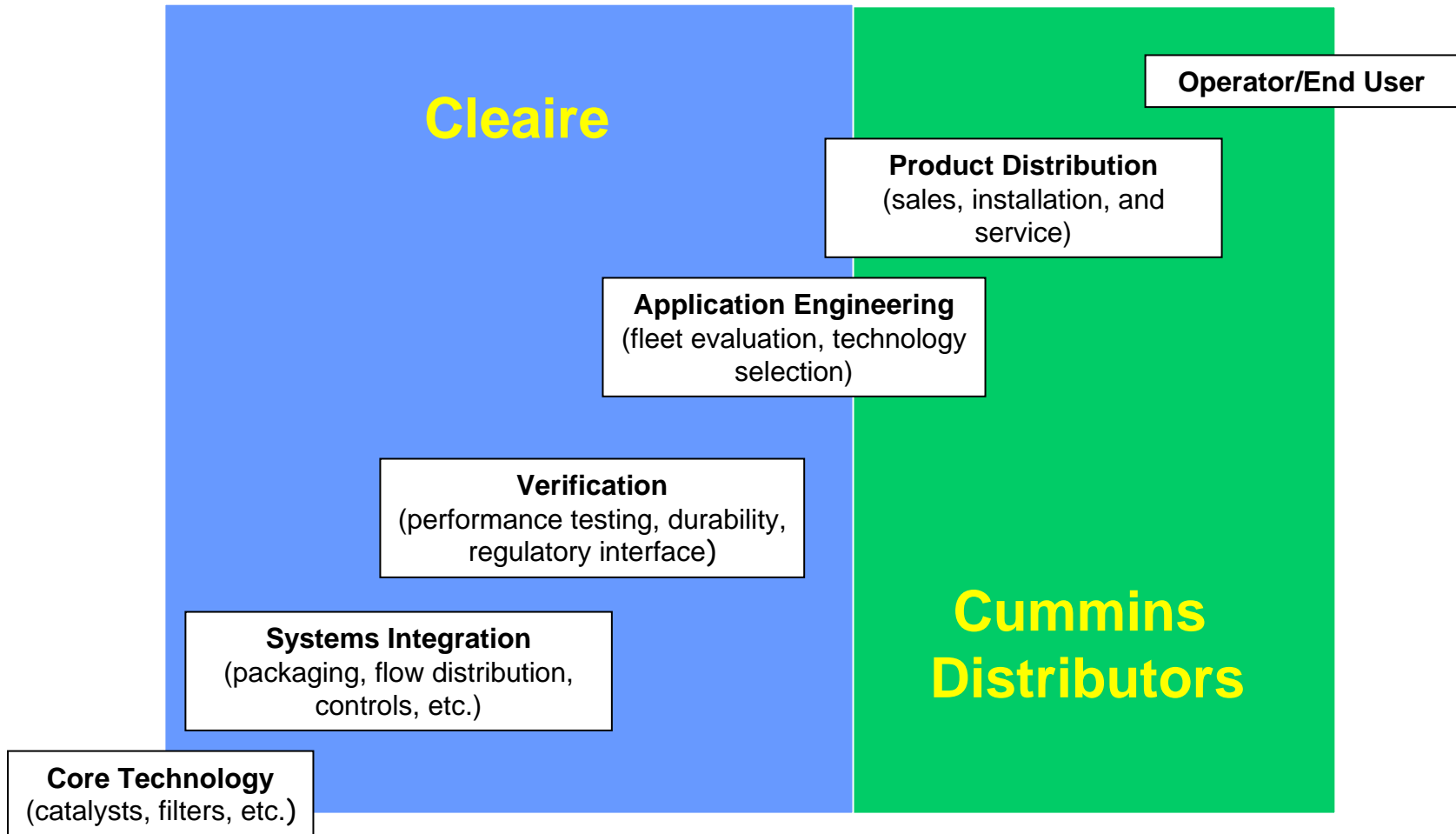
Ports and Air Quality

- Why worry about emissions from Port facilities?
 - Ports are a huge source of air emissions
 - Regional air agencies must reach mandated attainment goals and all the easy fixes are gone
 - Local residents and port employees have health concerns
- Diesel Engines are a major contributor to port emissions
 - Marine Vessels
 - Hotel Power, Harbor Craft
 - Port Operations
 - Yard Hostlers, Top/Side Picks, Forklifts, Cranes
 - Container Hauling
 - Port haulers

Controlling NOx & PM Emissions from In-Use Diesel Engines

- Strategies selected should be:
 - Cost-effective
 - \$/ton or lb. should be the evaluation metric
 - Practically engineered for real world applications
 - Built to OEM factory standards for maximum durability
 - Tested using CARB & EPA approved protocols to prove real, quantifiable air quality benefits
 - Accepted and used by equipment owners
 - If they can't make it work, it won't solve your problem!
 - Sold, installed and supported locally by a vendor your engine owners will trust

Product Development & Distribution



Controlling NOx and PM (cont.)

- Controlling PM
 - Oxidation catalysts
 - Modest overall reductions (15% - 20%)
 - Little ultra-fine PM reduction
 - About the same cost-effectiveness as filters without the health protection
 - Filters
 - Dramatic overall reductions (85% - 95%)
 - Controls ultra-fine PM
 - Requires use of Ultra Low Sulfur Diesel (ULSD)

Controlling NOx and PM (cont.)

- Controlling NOx
 - Traditional approach: retard timing – up to 10% reduction
 - Emulsified Fuel (Water + Diesel) – 14% reduction
 - Only one CARB-Verified retrofit technology - Cleaire Longview® - 25% reduction
 - “Fit and Forget” muffler replacement system
 - Does require annual cleaning

What is the ideal retrofit?

- Readily Deployable
- Immediate Reductions
- Accepted by Operators
- Easily Maintained
- Serviced and Supported Locally



Retrofits should integrate seamlessly with the vehicle.

(Cleaire Longview® on a wheeled bucket loader at the City of Fresno)

Operator Concerns

- Safety
 - Fire Safety
 - Ammonia or other fluids
 - Personnel safety
- Machine Performance
 - Throttle response
 - Noise issues
 - Operator visibility
 - Balance points on machine change
 - Elimination of smoke DOES NOT mean engine detuned
- Maintenance
 - Any change maintenance requirements
 - OEM warranty
 - Maintenance requirements, frequency, costs, accessibility
- Removable
 - At time of sale – transfer to new equipment



Retrofits in Service

Over 1,000 systems installed in:

- Transit
- Vocational
- Non-road
- Stationary
- Refuse
- Linehaul



Off-Road is a huge opportunity



Motorgrader - Sacramento



Agricultural Tractor - Fresno



Small Wheeled Bucket Loader - Fresno



Large Wheeled Bucket Loader - Fresno

Best Available Technology: Examples

Application	Longview	Lonestar	BUGtrap	DOC
Wheel Loader	X			
Top Pick	X			
Side Pick	X			
Fork Lift	X			
Air Compressor	X			
Conveyer	X			
Hotel Power Generator	X			
Crane		X		
Back Up Generator			X	
Backhoe Loader				X
Skid Steer Loader				X

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Other Useful Information about Cleaire's Technologies

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ADVANCED EMISSION CONTROLS

Cleaire Retrofit Systems



The **Longview**® is CARB Verified to reduce both NOx and PM emissions from in-use diesel engines.

Percent Reduction ⁽¹⁾
NOx PM

25-35

85+



The **Lonestar**™ is currently undergoing EPA Verification for NOx and modest PM reductions

25-35

15-20



The **BUGtrap**™ virtually eliminates PM, visible smoke and nuisance odors from Back Up Generators (BUGs).

N/A

85+

1) Dependent on fuel type and test cycle

Emission Data – Longview®

On-Road

Percent Reduction

Engine	System	Fuel	Cycle	HC	CO	NOx	PM
1994 DT466	LV	CARB	UDDS	95.5	98.9	28.7	89.7
1994 DT466	LV	GTL	UDDS	89.4	100.0	41.7	93.0
1997 M11	LV	ULSD	UDDS	99.3	99.7	30.0	95.0
1999 ISM	LV	ULSD	UDDS	100.0	97.9	38.9	85.7
2000 ISM	LV	ULSD	UDDS	95.2	98.3	41.0	86.8

Non-Road

Percent Reduction

Tier 0 LTA 10	LV	CARB	ISO 8178D2	98	99	35	64
Tier 1 C8.3	LV	ULSD	ISO 8178D2	96.1	97.7	34.2	87.7

Emission Data – Lonestar™

On-road

Percent Reduction

Engine	System	Fuel	Cycle	HC	CO	NOx	PM
1999 ISM	LS	ULSD	UDDS	48.6	100.0	36.6	18.4

Non-road

Percent Reduction

Engine	System	Fuel	Cycle	HC	CO	NOx	PM
Tier 1 C8.3	LS	ULSD	ISO 8178D2	48.5	96.7	33.6	12.8

Emission Data – BUGtrap™

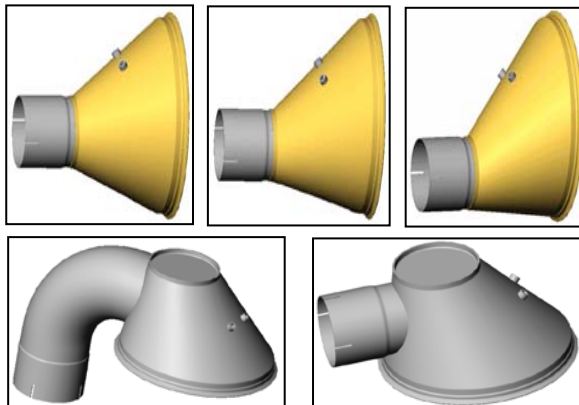
Percent Reduction

Engine	System	Fuel	Cycle	HC	CO	NOx	PM
Tier 0 LTA10	BUGtrap	CARB	ISO 8178D2	25	16	N/A	92

Advanced Technology



Modular design



Flexible End Sections



Advanced diagnostics and controls



Rugged components

Support

- **Backed by Cummins**

- Developed by Cleaire, a division of Cummins West
- Approved by Cummins and Fleetguard

- **Service and Support**

- Supported by your local Cummins Distributor
- Expert installation
- Environmentally responsible filter cleaning
- Full warranty coverage with local administration and support

Best Available Technology: Criteria

- Engine size & power
- Engine age and certification standard
- Engine condition
- Duty cycle