Cummins Metropower

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Fleetguard®

EMISSION Solutions™

“Go for the Green”

Objectives

- Overview of FGN Emission Solutions Business
- Review Technology
- Review Products
- Questions?

Fleetguard Emission Solutions History

Oct. 2000	Cummins Inc. evaluates exhaust aftertreatment business case
Jun. 2001	Cummins Inc. decides to enter into the exhaust aftertreatment business
Jul. 2001	Decision is made to incubate this new business within Fleetguard due to synergies with Nelson, a subsidiary of Fleetguard
Jan. 2002	Leadership team in place
Jan-Now	Two key areas of focus - Retrofit technology onto existing fleets - Develop products for first fit applications in support of customer requirements and legislated emission limits

The full range of Aftertreatment Technologies

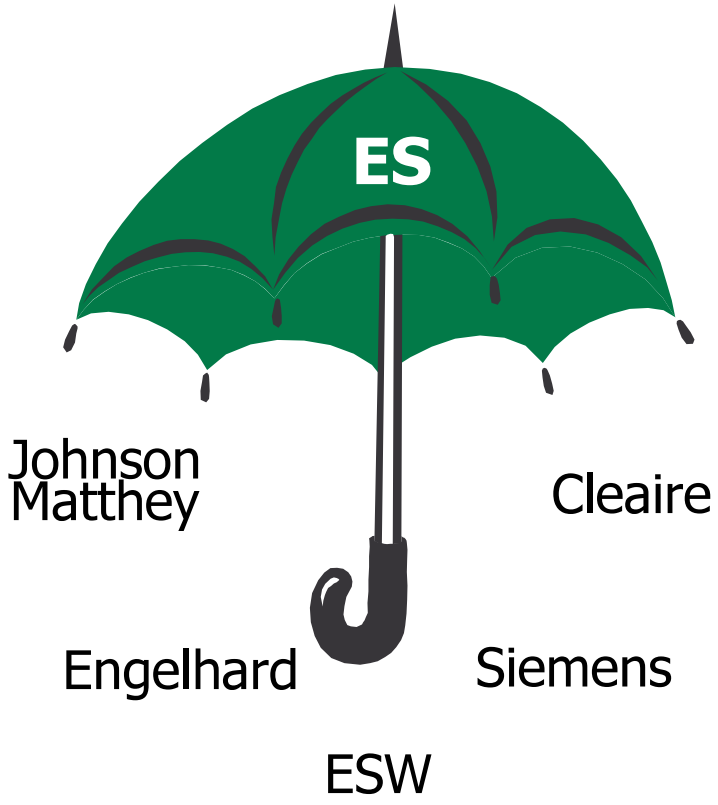
- Nitrogen Oxides
  - In-cylinder combustion improvements
  - Exhaust Gas Recirculation
  - Selective Catalytic Reduction
  - NOx Adsorbers

- PM
  - In-cylinder combustion improvments
  - Traditional DOCs
  - High performing DOCs & metallic substrates
  - Soot filters, CRT's

"The Right Technology matters"

Emission Solutions Approach to Aftertreatment

- ES offers a portfolio of emission control systems based on best in class technology & cost for given emission control performance requirements and operating conditions



Emissions 101: 2 Key regulated by-products

- Nitrogen Oxides
  - Air quality - smog
  - Non-attainment areas - low attainment areas
  - Tied to federal highway funds
    - Incentive programs to lower NOx so that states don't lose the highway funding
  - 50% of NOx emitted from mobile sources attributable to diesel

- PM - health effects
  - 56% of PM emitted attributable to diesel
  - California
    - 90% of Californians breathe unhealthy air some of the time
  - School buses - Good Morning America

Retrofit Products

PM Control

• Diesel Oxidation Catalysts (DOC)	~25% efficient	In Production
• Passive Catalyzed Soot Filters (CSF)	85-99% efficient	In Production

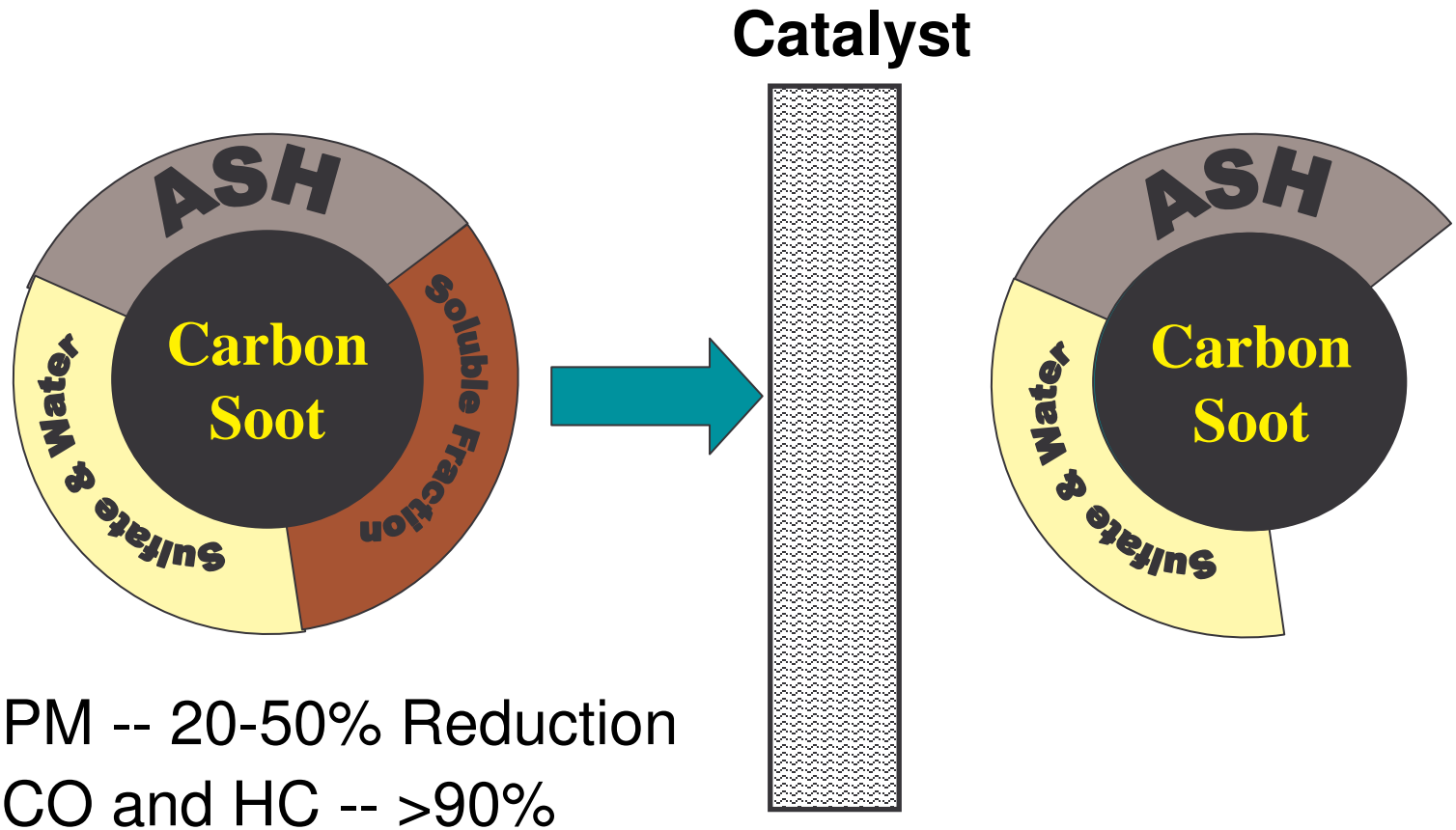
NOx Control

• Selective Catalytic Reduction (SCR)	~90% efficient	In Production for PG
• Lean NOx Reduction Catalyst (NRC)	>25 % efficient	In Production
• Exhaust Gas Recirculation (EGR)	40 - 60 % efficient	In Verification Process

Diesel Oxidation Catalyst

- Cummins and diesel industry have extensive experience with this technology
- Effective at removing unburned fuels and lube (soluble organic fraction)
- Compatible with higher level sulfur fuels
- Maintenance free
- Through flow design

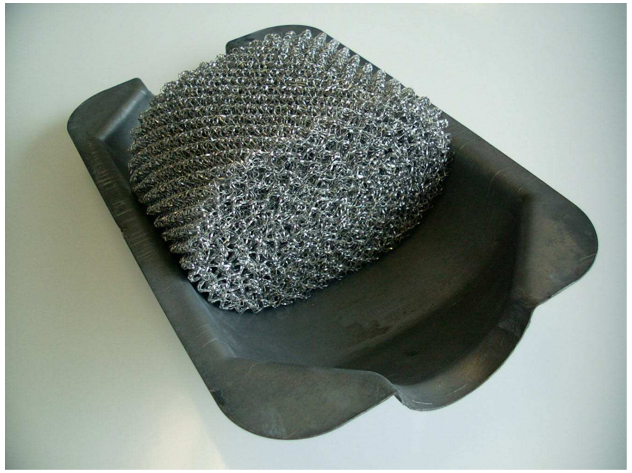
Diesel Oxidation Catalyst



- PM -- 20-50% Reduction
- CO and HC -- >90%
- Toxic HCs -- >70%

Advanced Diesel Oxidation Catalyst

- In verification process
- Effective at removing unburned fuels and lube (soluble organic fraction)
- Compatible with ULSF and 500PPM sulfur fuels
- Maintenance free in most situations
- Through flow design (tortured path)
- Up to 50% reduction of PM on older engines



Advanced Diesel Oxidation Catalyst

DOC Additional Information

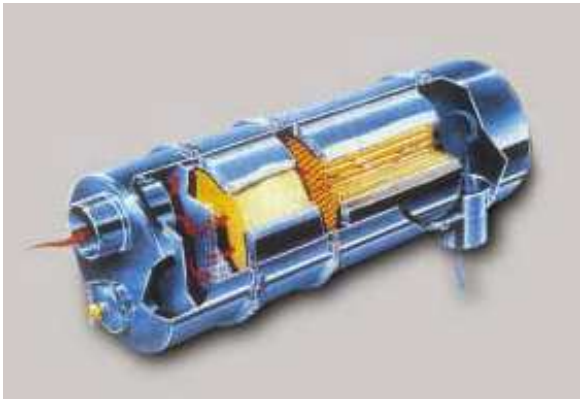
- Proven low-cost technology
- Combined catalyst and muffler to provide sound attenuation and emission benefit
- Significant PM reduction - does not remove carbon
- PM reduction depends on composition of particulate (how much SOF is present)
- PM reduction is dependent on test cycle, engine type and fuel sulfur level
- Easy to retrofit on existing vehicles
- No required maintenance
- Variety of sizes and shapes for different applications

Diesel Particulate Filter

Continuously Regenerating Technology (CRT)

Johnson Matthey

- Contains a Platinum (Pt) catalyst and a particulate filter.
- The fuel sulfur level must be 30ppm average, 50ppm max
- The device is made up of two chambers
- The CRT filter is capable of converting > 90% of PM, HC and CO.
- Temperature profile sensitive, must have adequate exhaust temperatures and application sign off to function properly
- Certified by the US EPA per the voluntary retrofit program



Typical CRT Particulate Filter

Outlet

FilterSection

Catalyst Section

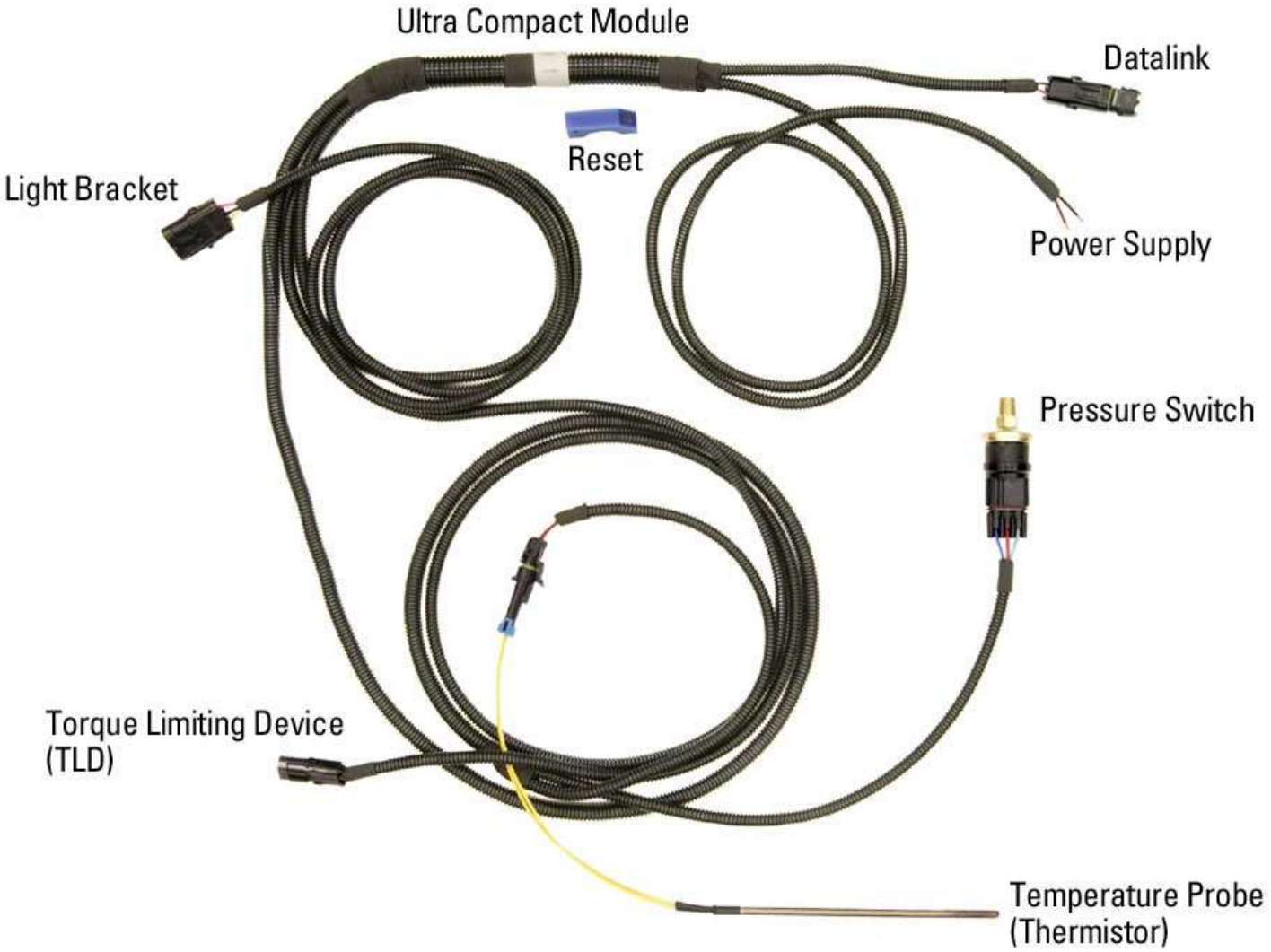
Inlet Section

V-Clamps

CRT Monitor

- Monitor required by EPA / CARB
- Reduces the following risks:
  - Plugging
  - Uncontrolled regeneration
  - Catalyst poisoning / deactivation
  - Engine progressive damage protection
- Maintenance alarm for the CRT / DPF
- Datalogs data for warranty / product development
- Derate Option:
  - Alarm 1 - Yellow light at 80% of limit
  - Alarm 2 - Red light with derate (No turbo boost-20% loss of power)

Ultra Compact Module



Longview NRC

- Reduces NOx by 25%, PM by 85%
- Reduces CO by 90%, HC by 65%
- Requires ULSF
- Uses Diesel fuel injection as reductant
- Modular device contains NOx catalyst and filter sections
- Monitor-Logger-Controller (MLC) datalogs and determines precise amount of diesel fuel to inject
- Temperature profile sensitive, must have adequate exhaust temperatures and application sign off to function properly
- Does require cleaning to remove ash

Retrofit Process

The local Cummins distributor will determine your emission reduction needs and evaluate the fleet

- Datalog
- Fleet profile
- Review operation

Fleetguard Emissions Solutions will design the system including any application hardware

- Exhaust pipe
- Mounting
- Insulation

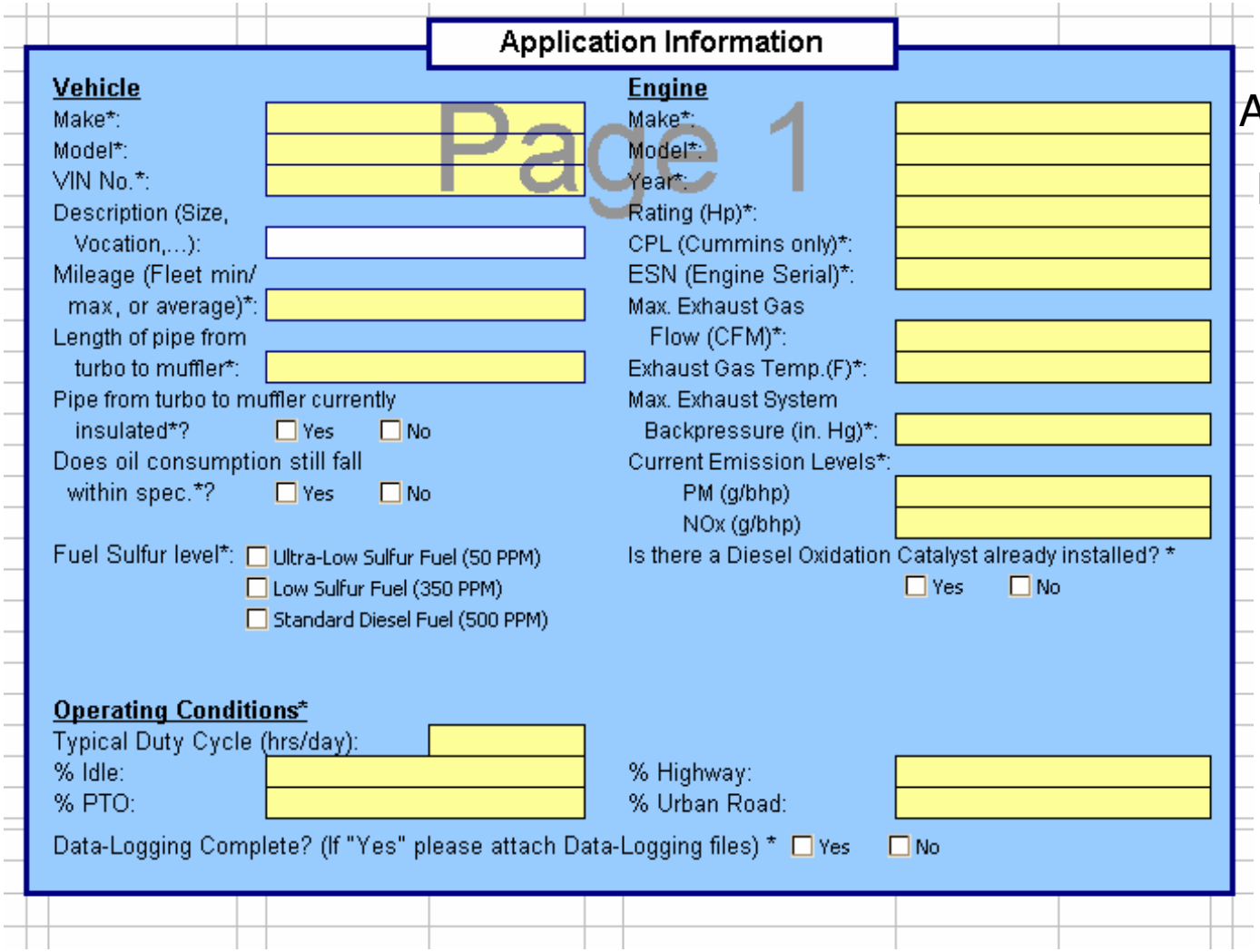
Prototype installation (if necessary)

Sales or application questions call:

Rusty Graham 860-529-7474

Ed Hall 800-443-7884

Retrofit Application Form



Application Information

Vehicle

Make*:
Model*:
VIN No.*:
Description (Size, Vocation,...):
Mileage (Fleet min/ max, or average)*:
Length of pipe from turbo to muffler*:
Pipe from turbo to muffler currently insulated*? ☐ Yes ☐ No
Does oil consumption still fall within spec.*? ☐ Yes ☐ No

Fuel Sulfur level*: ☐ Ultra-Low Sulfur Fuel (50 PPM) ☐ Low Sulfur Fuel (350 PPM) ☐ Standard Diesel Fuel (500 PPM)

Engine

Make*:
Model*:
Year*:
Rating (Hp)*:
CPL (Cummins only)*:
ESN (Engine Serial)*:
Max. Exhaust Gas Flow (CFM)*:
Exhaust Gas Temp.(F)*:
Max. Exhaust System Backpressure (in. Hg)*:
Current Emission Levels*:
PM (g/bhp)
NOx (g/bhp)
Is there a Diesel Oxidation Catalyst already installed? * ☐ Yes ☐ No

Operating Conditions*

Typical Duty Cycle (hrs/day):
% Idle:
% PTO:
% Highway:
% Urban Road:
Data-Logging Complete? (If "Yes" please attach Data-Logging files) * ☐ Yes ☐ No

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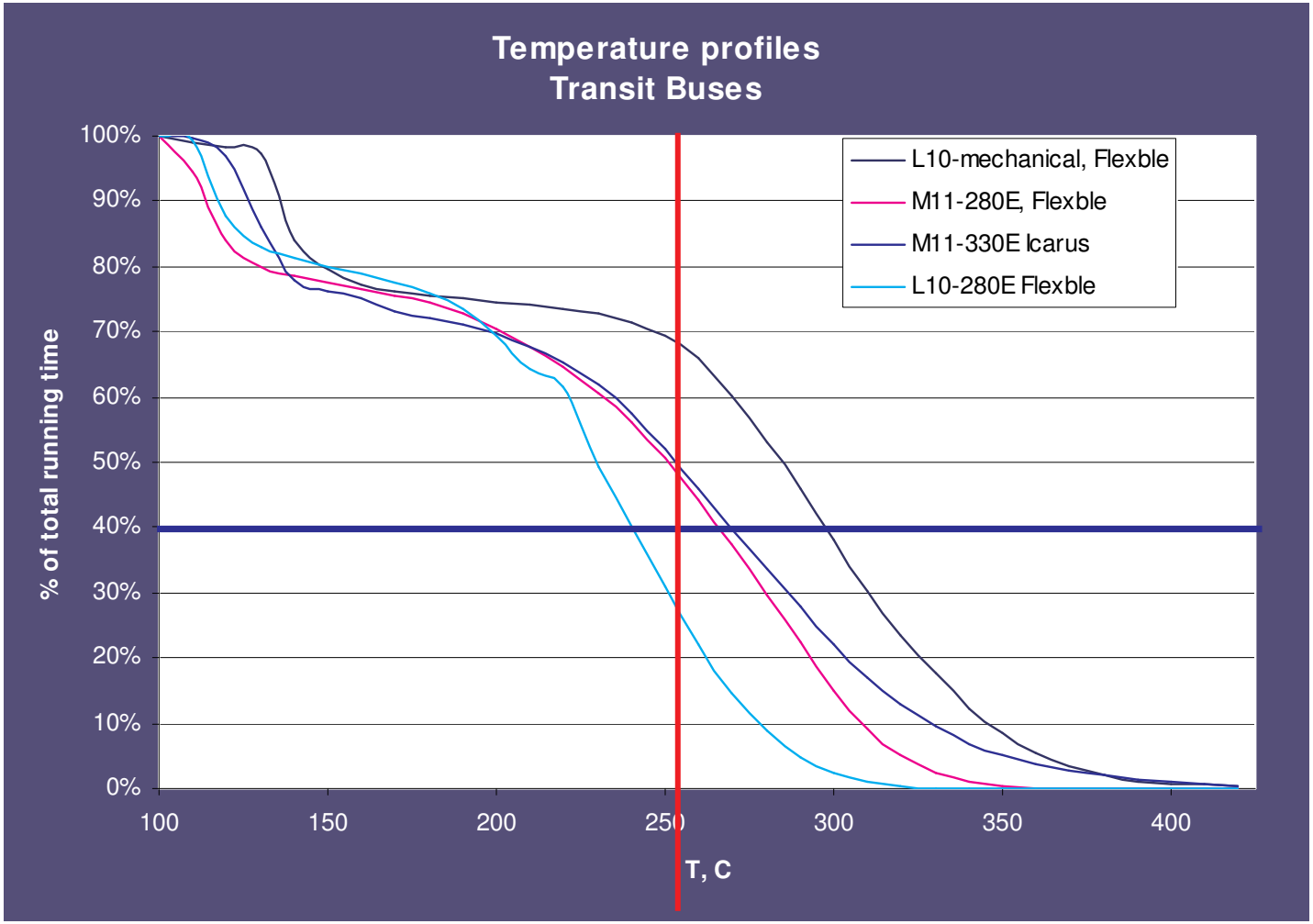
Available now on Lotus Notes Database

Reduced Data and Design Criteria



- Retro Fit Projects

Norwich BOE- 33 DOC's 9 CRT's 10 more CRT in progress

Alliance Bus- 3 CCRT's

Johnson Sweeper- 25 DOC's

NJ Transit – 5 CRT's

NY Power Authority- 100 DOC's 5 ESW's

Emission Solutions Retrofit Experience