LOW-EMISSION LOCOMOTIVE PROJECTS

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Technology Demonstration

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OUTLINE

1. **SCR demo on Metrolink EMD locomotive**
2. **DPF-SCR demo on Metrolink EMD locomotive Head-End-Power (HEP)**

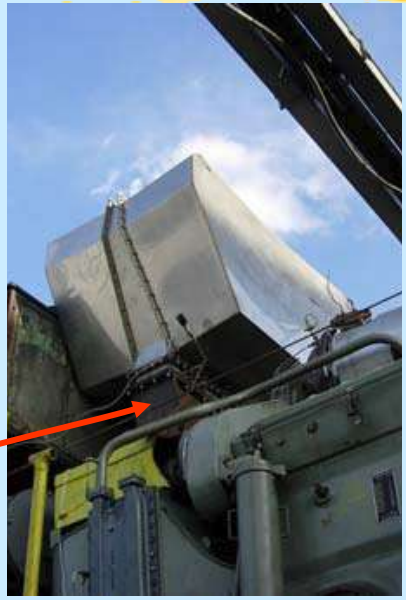
SCR: Selective Catalyst Reduction (NOx, PM)
DPF: Diesel Particulate Filter (PM)

1. SCR ON METROLINK # 865 EMD F59PH LOCOMOTIVE

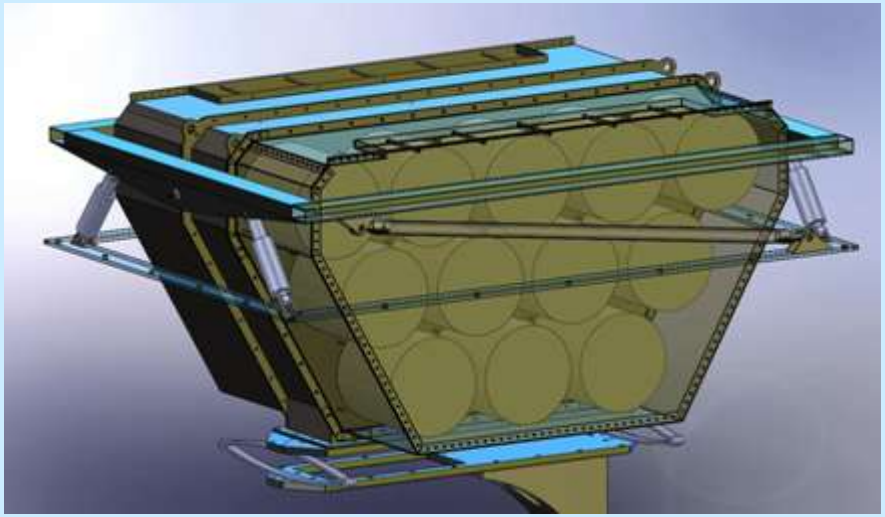
- Demo SCR converter – uses 24 off-the-shelf truck catalysts
- Heavy-duty urea injection from trucks & off-road equipment
- Contractor: Engine, Fuel, & Emissions Engineering

SCR ON METROLINK # 865

SCR converter replaces silencer



Turbo outlet

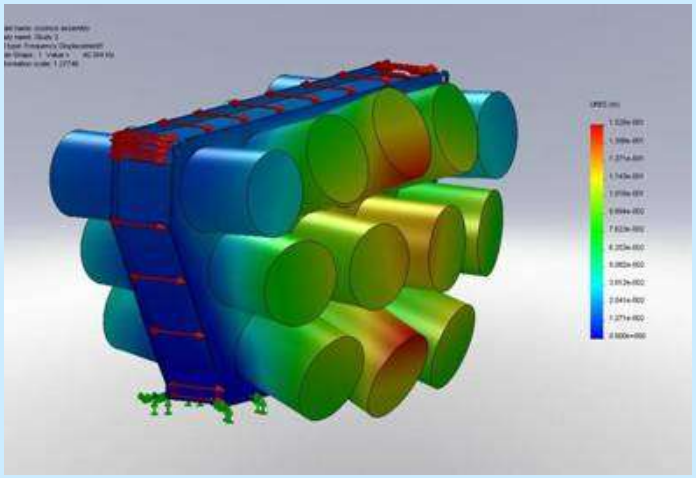


Improved SCR design

- **Stronger housing**
- **Increased support**
- **Flexible turbo coupling**
- **Revised urea injection**

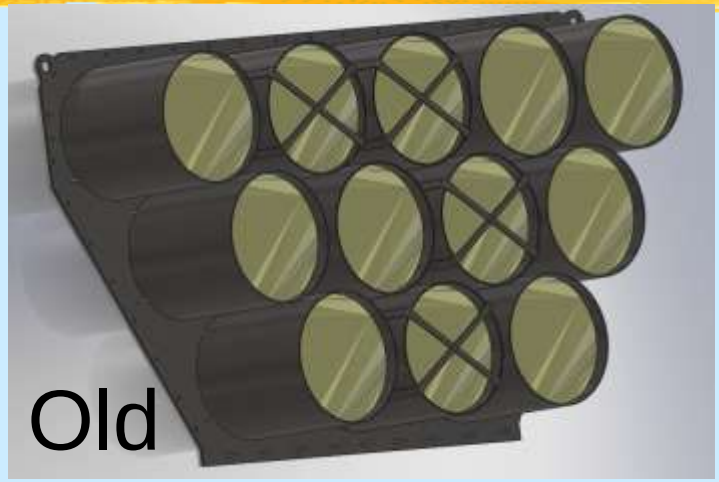
STATUS – SCR ON METROLINK # 865 (EMD 710-12 ENGINE)

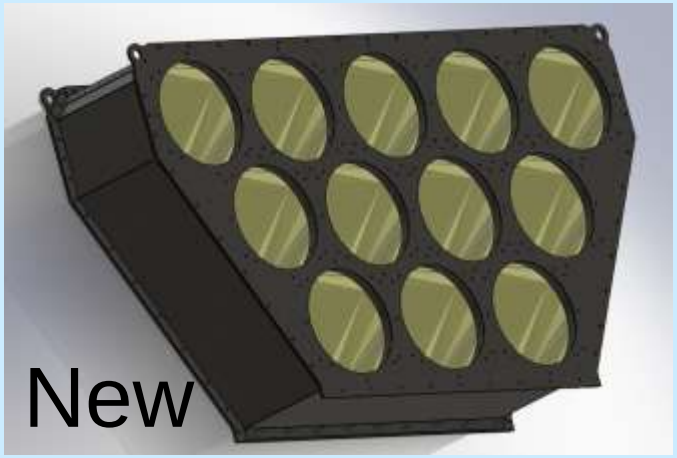
- **Installed SCR: 2-21-09**
- **Substrate found cracking after 600 hours**
- **Vibration analysis: resonance at idle**
- **Added connectors between base plates**
- **Reinstalled SCR: 5-28-09**



STATUS - CONTINUED

- **Substrate found cracking again after one month**
- **Re-design to support cantilevered catalyst ends with new support**
- **Reinstall SCR: mid 9-09**





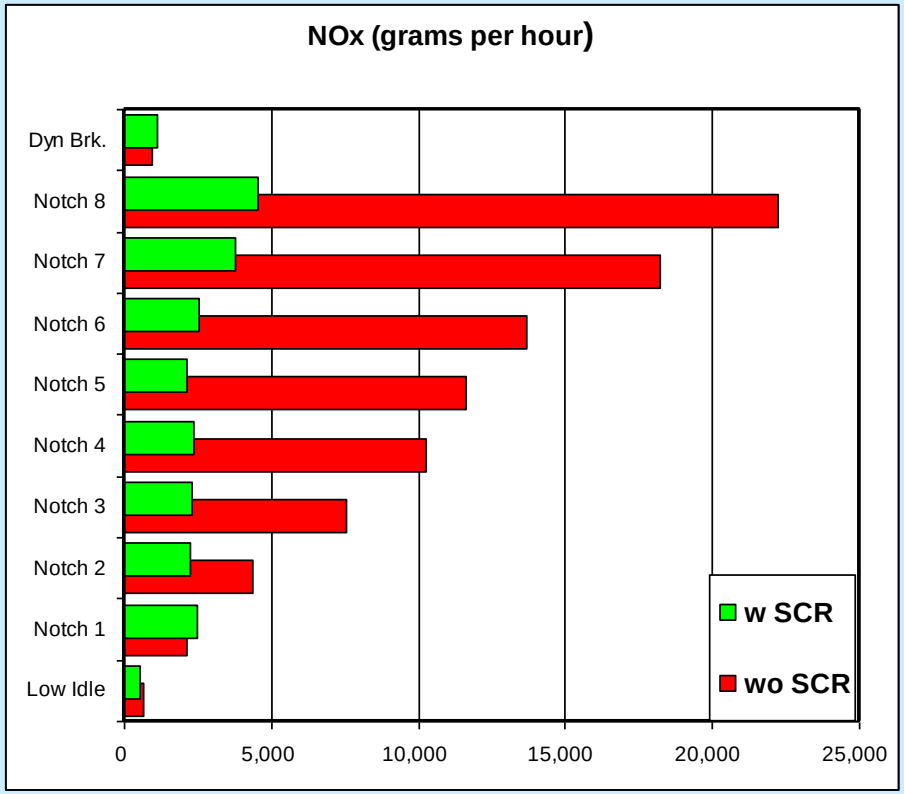
SCR EMISSION TESTING AFTER 100 HOURS OF OPERATION

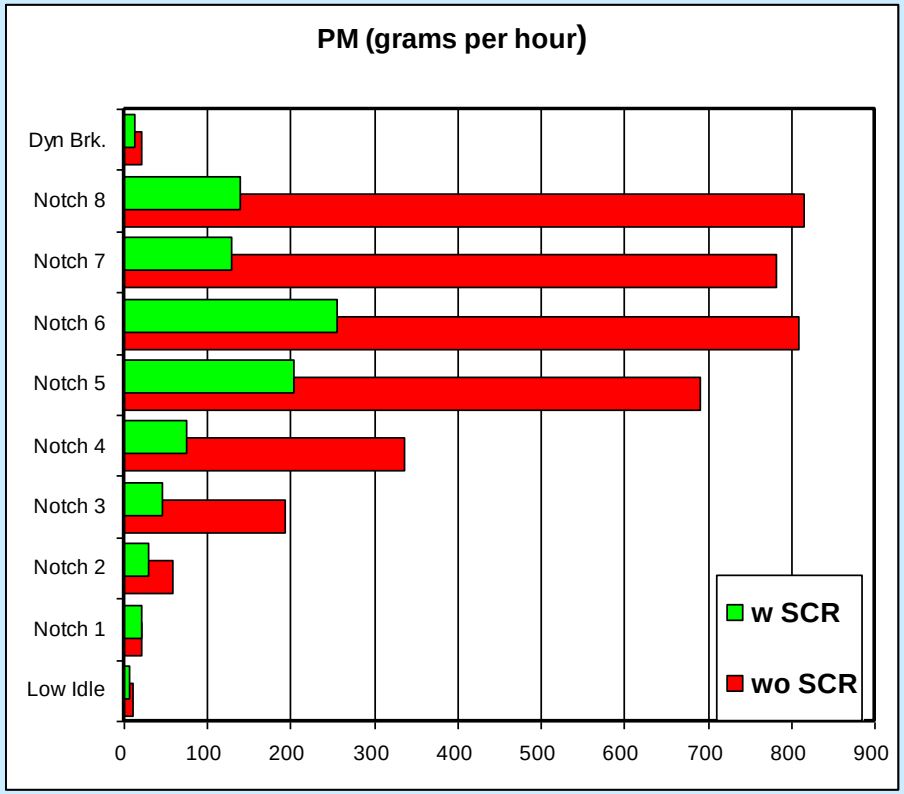
Emissions measured with RAVEM System 40 CFR 92 protocol and weighting, g/hp-h

	NOx	PM	HC
Baseline	9.2	0.34	0.2
w/ SCR	2.6	0.08	0.0
	-72%	-76%	-100%

- Ammonia slip <5 ppm, low levels of N_20
- Urea rate at 6% of fuel consumption

EMISSIONS BY NOTCHES





2. DPF + SCR ON METROLINK HEP EMD F59PHI LOCOMOTIVE

- Head End Power (HEP) unit provides passenger hotel power (~500 HP)
- HEP account for about 25% emissions due to continuous full power running
- Demo Hug Engineering combination DPF + SCR System (urea)
- Contractor: Miratech Corp.

DPF+SCR ON CAT 3406 HEP METROLINK # 883

Cat 3406 HEP

Urea tank on left floor & wall

with DPF + SCR

Urea Totes

STATUS – DPF + SCR ON HEAD END POWER

- **Unit installed with electronic controls, datalogger and dial-up link 2-17-09**
- **Baseline and de-greened testing completed 3-17-09**
- **Design Issues**
  - **Higher temperature than original design (>500°C)**
  - **Higher temperatures led to off-spec performance**

STATUS - CONTINUED

- **Design Modification**
  - **System reprogrammed to stop urea injection at 500°C**
  - **Below 500°C, the system is reducing NOx by 88-93%**
  - **During maintenance, DPF clogged due to low temp yard operation**
  - **DPF bricks replaced**
- **1000-hr emission test planned late 2009**

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