

LOW-EMISSION LOCOMOTIVE PROJECTS



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Management District**

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SCAQMD BACKGROUND IN LOCOMOTIVES



- **Regional Enforcement of Smoking and Nuisance Locomotives (1985-present)**
- **Railroad Electrification Study (1992)**
- **GasRail USA (1993-2000)**
- **Fuel Cell Locomotive Study (1998)**
- **Incentivized Low-NOx Engines (2003-6)**
- **SCAQMD Rule 3500 et seq (2006)**
- **Remote Sensing of Locomotives (2006)**

THREE EMISSION TECHNOLOGY DEMONSTRATIONS



In 2006, planning following projects:

- **Demo DPF + SCR on Head End Power**
- **Demo DPF on Switch Locomotive**
- **Demo SCR on EMD Pass. Locomotive**

DPF: Diesel Particulate Filter (PM)

SCR: Selective Catalyst Reduction (NO_x, PM)

DEMONSTRATE DPF+SCR ON HEAD END POWER

- **Passenger locomotives have gen-sets called Head End Power (HEP) which provide passenger hotel power (~500 HP)**
- **HEP account for about 30% emissions due to continuous full power operation**
- **Demo Hug Engineering combination DPF (burner) + SCR System (urea)**
- **Expect 90% reductions in NOx and PM**
- **Contractor: Miratech Corporation**

DEMONSTRATE DPF+SCR ON HEAD END POWER

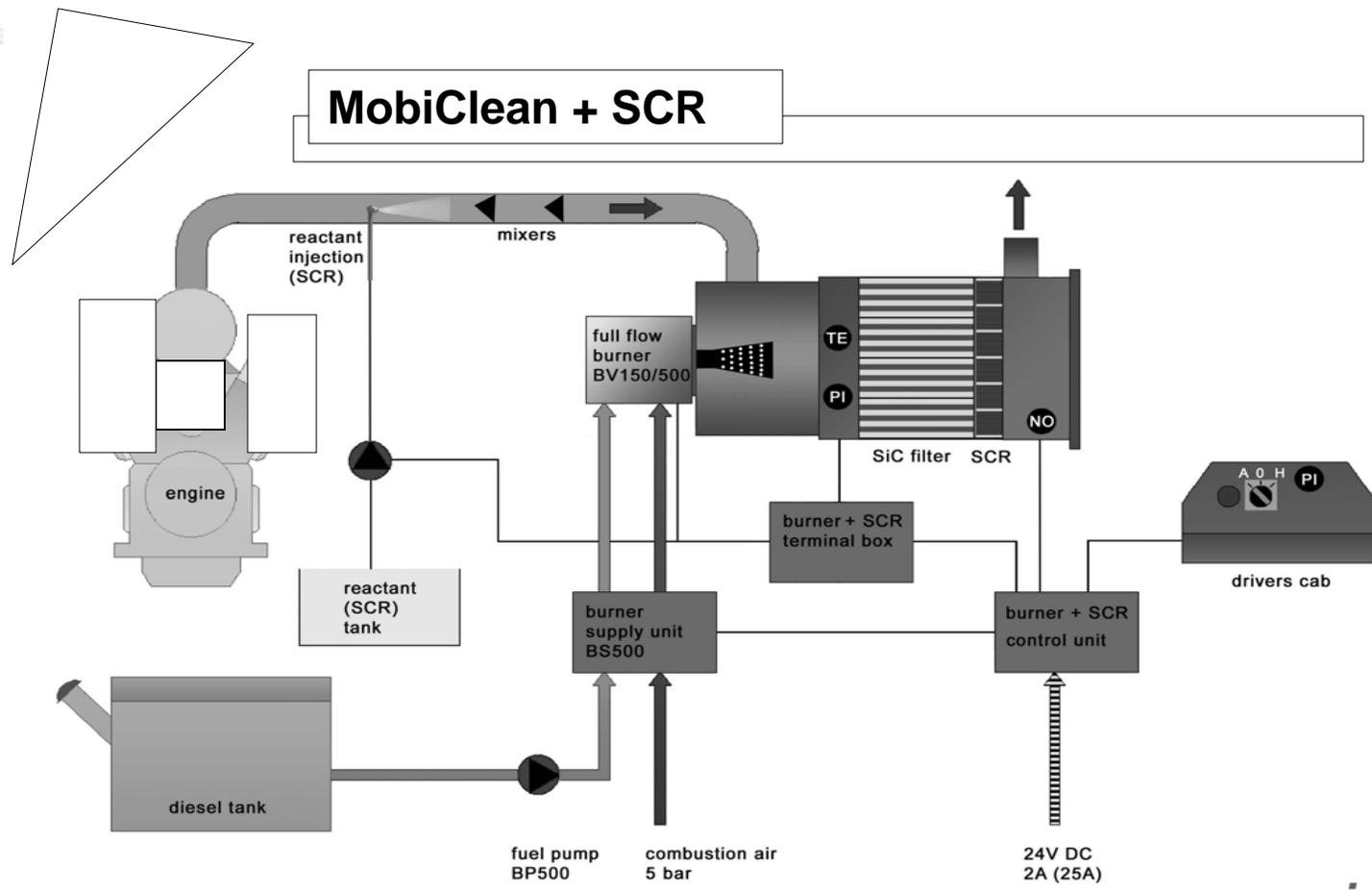


EMD F59PHI Locomotive

CAT 3406 HEP



DEMONSTRATE DPF+SCR ON HEAD END POWER



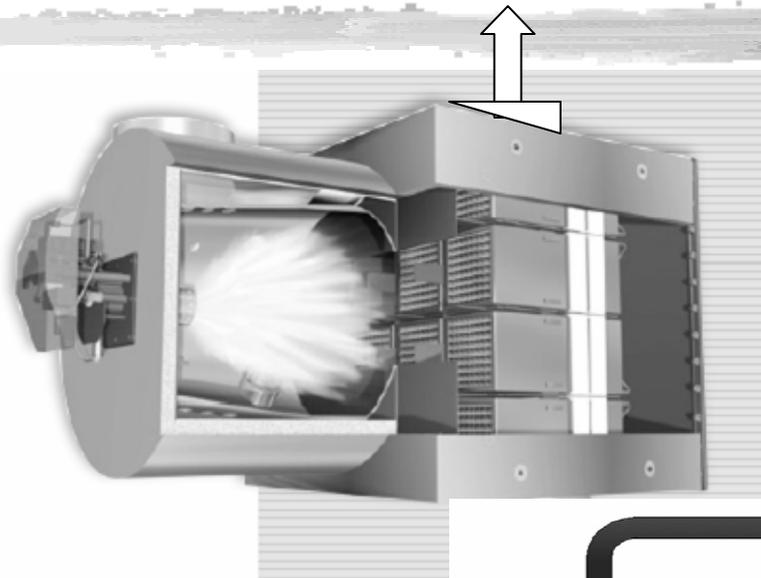
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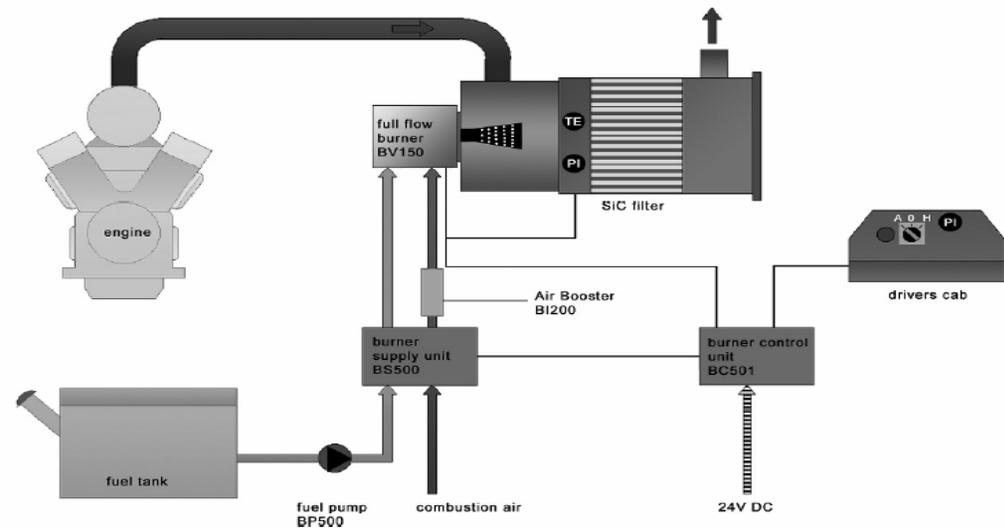
DEMONSTRATE DPF ON SWITCH LOCOMOTIVE

- **Pacific Harbor Line (PHL) is repowering 16 switch locomotives**
- **PHL-contractor MotivePower is replacing EMD 2-cycle engines with 4-cycle DDC/MTU 12V4000 engines (2000 HP)**
- **Demo one Hug MobiClean DPF system**
- **Expect 90%+ PM reduction**
- **Contractor: Miratech Corporation
Subcontractor: MotivePower**

DEMONSTRATE DPF ON SWITCH LOCOMOTIVE



**Hug MobiClean DPF
and diesel-fueled burner**



DEMONSTRATE SCR ON PASSENGER LOCOMOTIVE

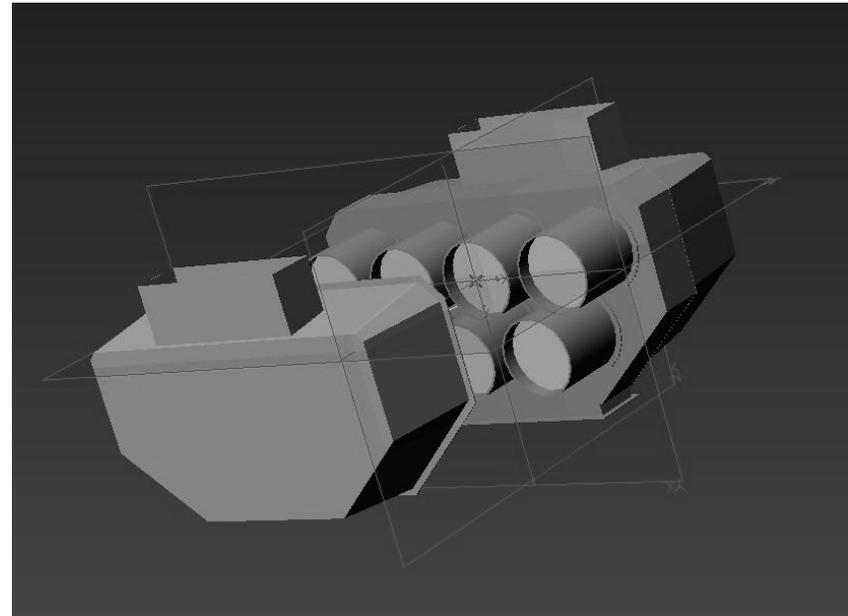
- **EMD F59PH locomotives use 12-cyl engines similar to 16-cyl freight engines**
- **High cell-density European SCR catalyst developed for mobile use**
- **“Hardened” urea injection control system qualified for heavy-duty trucks & off-road equipment**
- **Contractor: Engine, Fuel & Emissions Engineering, Inc.**

DEMONSTRATE SCR ON PASSENGER LOCOMOTIVE

Compact urea-SCR system components



DEMONSTRATE SCR ON PASSENGER LOCOMOTIVE



Catalyst will fit inside existing carbody, replacing silencer

Cost Effectiveness of SCR on Passenger Locomotives

| | NOx | PM |
|--------------------------|------------|--------|
| Annual Emissions (tpy) | 29.2 | 1.0 |
| Emission Reduction (tpy) | 23.4 | 0.5 |
| Capital Cost | \$ 150,000 | |
| Annualized | 36,584 | |
| Liters Urea/Year | 42,048 | |
| Operating Cost | \$ 47,048 | |
| Total Annual Cost | 83,632 | |
| Cost-Effectiveness | \$ 2,949 | \$/ton |

SCAQMD

Technology Advancement

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