Controlling Diesel Locomotive Start-Up and Idle Exhaust Emissions at SNCF l'Ourcq (Paris)

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May 2006

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Background

- SNCF operates diesel-powered locomotives in non-electrified regions
- Primarily East and Southeast from Paris
- Power up to 2,250 kW (3,000 hp)
  - Some locomotives recently repowered with MTU 16V-4000 UIC II engines

The Problem

- Seven years of complaints about noise, visible smoke, and odor from diesel locomotives Idling and during engine starting.
- Problem area was at Paris East train station, in a very urban environment, with a school located very close.
- City of Paris passed regulation forcing SNCF action.

ENVIRONNEMENT

Une panoplie de mesun anti-Diesel a Paris-Est

Voila sept ans que la pollution des locomotives Diesel de la gare de l'Est alimente la chronique. Une panoplie de mesures est en passe d'en venir about.

Des temps de fonctionnement des Diesel reduits de 25%.

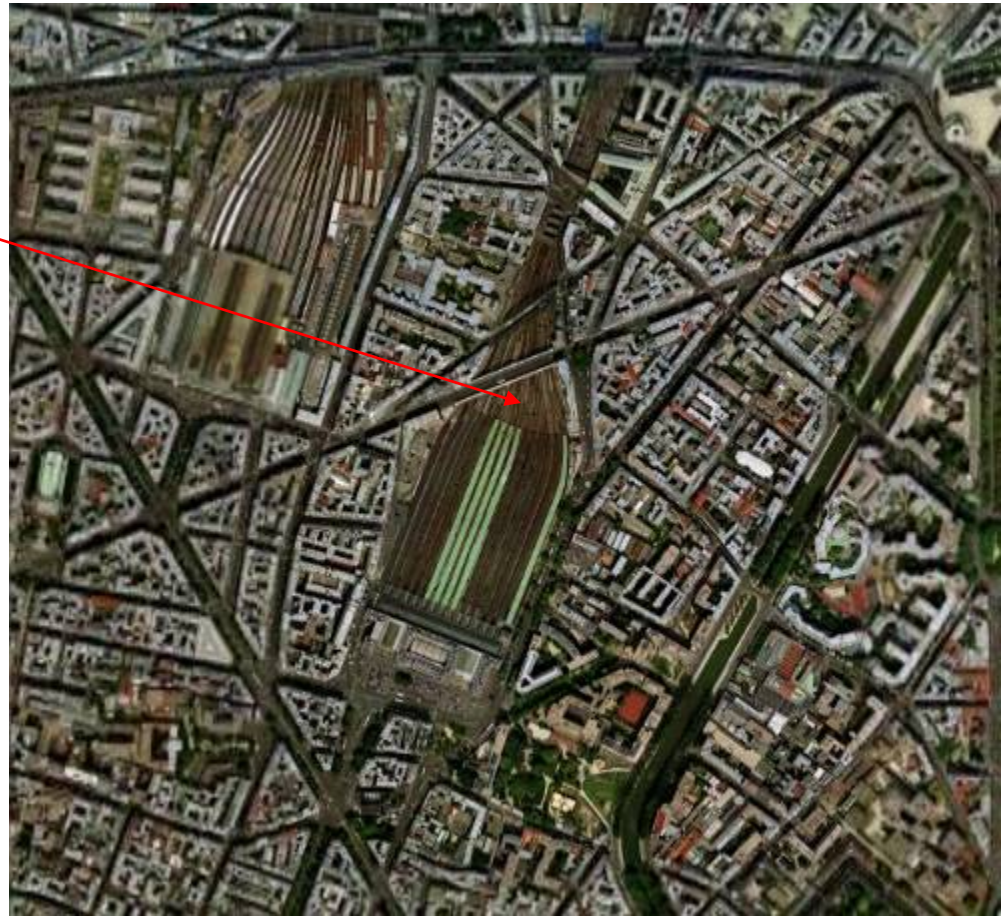
Temoignage

En attendant l'electrification

Paris East Train Station

East train station

Very urban environment,
With a school nearby



l'Ourcq to East Station Move

3.8 mile move = 6.1 km from hood facility to East station
Diesel locomotives moved with electric shunters

Exhaust scrubber location

Facility Description

- Designed, fabricated, and installed by Exocat
  - Hug Engineering DPF and SCR system components
- System in regular use starting late-April, 2006
  - System had been in service for 2-weeks at time of SwRI visit.

SNCF Facility Location

Photo taken before facility installed

Step 1. Capture Exhaust

Step 2. Send Exhaust to Scrubber System

Designed to reduce:
+ HC
+ CO
+ NO_X
+ PM (soot)

Shut-Off Valves

- Hoods not in use are shut off using damper valves

Damper valve closes off suction to unused hood

Align Exhaust with Hood

- Hoods do not move
- Locomotives must be precisely spotted
- Not suitable for applications with many types of locomotives
  - Hoods would have to be moveable

Heat Recovery

- Large heat exchanger
- Pre-heat incoming exhaust with burner-heated cleaned exhaust

Two 120 kW Exhaust Fans

One fan for two stacks,
Two fans for facility

Big 3-phase power cables,
120 kW = 160 hp.....each

Condensate Collection and Treatment

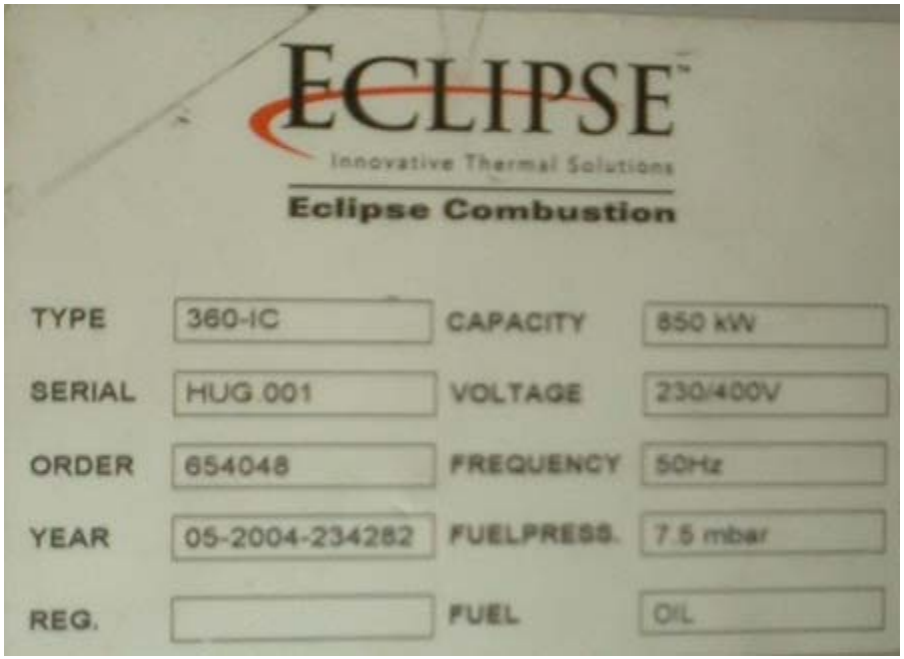
- Condensate (acidic water) from cooling exhaust is collected
- Disposal of this water was a problem
  - Could not simply drain to sewer
- Condensate is injected into burner system and exits system as water vapor
  - Everything downstream of burner is warm enough to prevent additional condensation

Condensate Collection & Processing

Next Step – Heat the Exhaust

- Exhaust is pre-heated in heat exchanger
- Primary heating is with a diesel-fired burner system
  - Propane pilot light
- Heats all the exhaust to 400°C for SCR reaction
  - Each of the two systems uses about 40 liters/hour of diesel fuel (10.5 gph).
- Second stage heater heats exhaust to 550°C for filter regeneration when needed

Diesel Burners



Each of the two systems has 850 kW Diesel burners (2 stage, one for SCR, and a second for DPF regeneration)

Diesel Burner Module

Diesel Burner Fuel Storage

Hug DPF

Glass fiber DPF, not SiC

Urea Storage

- Urea stored in heated ISO container to prevent freezing.

Urea Storage Tank & Dosing Pump

Container also houses air compressor for fuel burner (heater).

Urea Dosing System

UREA Mixing in Pipe

SCR Catalyst + Ammonia Slip Cleanup Catalyst

Last Step – Cleaned Exhaust Out the Stacks

How Cost Effective ?

- System tested extensively to verify performance
- What about the cost?
  - System as installed cost was € 1,500,000
    - Appx. $1.9M
  - Plus 10-year maintenance contract
  - Plus operating expenses
    - Urea
    - Diesel Fuel & propane for burner system
    - Significant electrical power, primarily for fans
- Detailed cost-effectiveness should to be performed

Maintenance Requirements

- Exocat has 10-year maintenance and service contract
  - Includes urea supply
- Exhaust piping will be cleaned annually
- Urea injectors replaced every 4 months
- DPF service interval (ash removal) - TBD

Monitor Progress

- SwRI intends to monitor SNCF l'Ourcq facility performance and maintenance.
- Through contacts at:
  - SNCF
  - UIC
  - ExoCat
  - Hug