SFMTA | Municipal Transportation Agency


# 2008 National Biodiesel Conference and Expo

2 | 4 | 2008 | ORLANDO, FLORIDA

# Overview

- Program Highlights
- Fleet Vehicles
- Emissions summary
- Brief history
- Overview of Cleaires devices and Hybrids
- Biodiesel program specifics
- Next steps

# Clean Fuel and Emissions Reduction Program Highlights - Vehicles

- Largest municipal biodiesel fleet in country
- Third largest hybrid-electric bus fleet in country
- PM+NOx reduction (Cleaire) devices installed on all non-hybrid buses
- Largest zero emission bus fleet in country
- Over 50% of SFMTA vehicles powered by zero emission hydro-electric power

# Fleet Vehicles

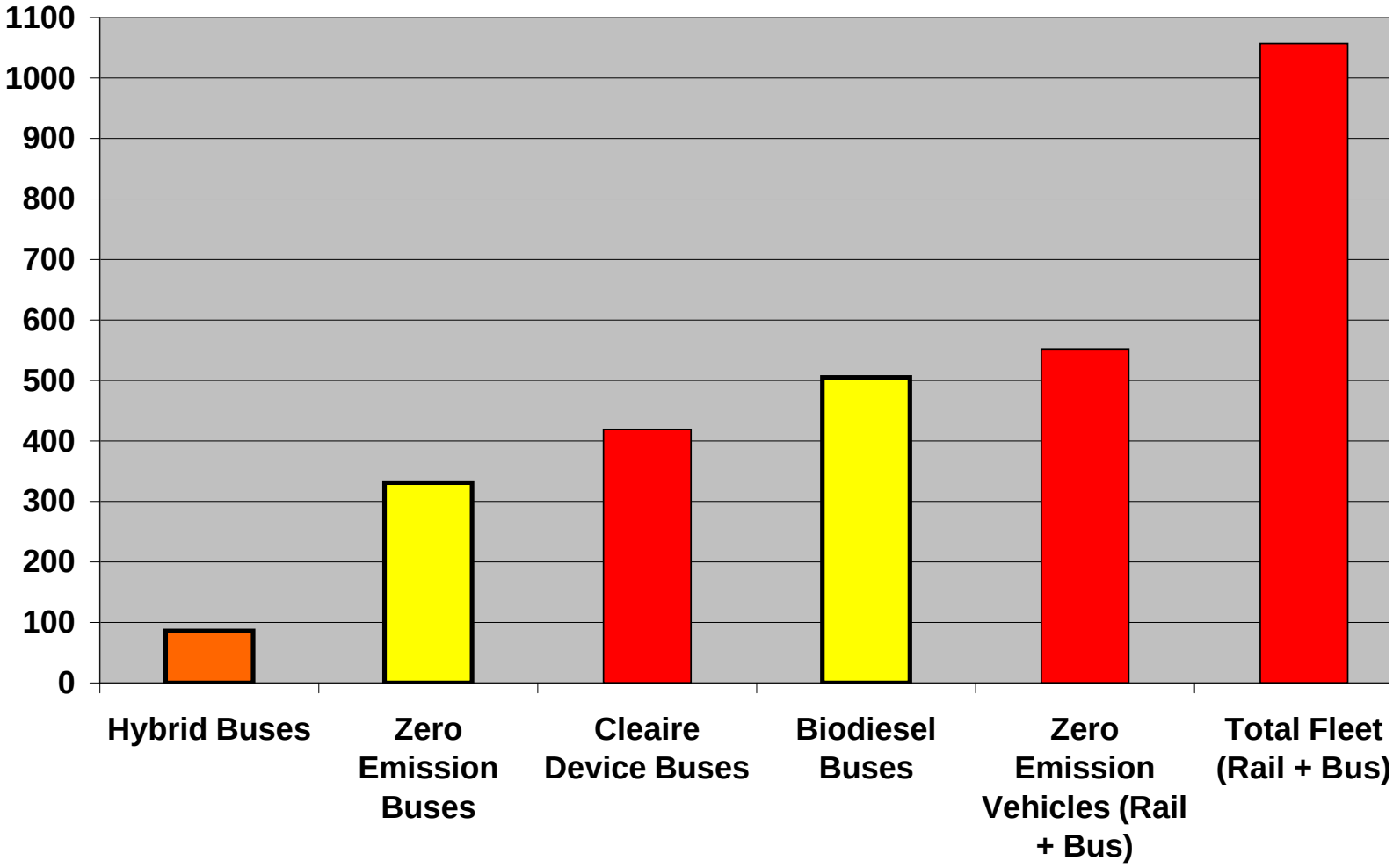
SFMTA operates:

- 500+ Motor coaches
- 331 Trolley coaches
- 151 LRVs
- 40 Cable Cars
- 30+ Historic streetcars

Notes:

- SFMTA 2nd largest alternative fuel (non-diesel) bus fleet in California
- SFMTA 2nd largest diesel bus fleet in California
- Emergency contingency vehicles must operate without electricity
- SFFD uses SFMTA diesel fuel tanks in emergency
- SFMTA moves almost population of City each day – largest % in country

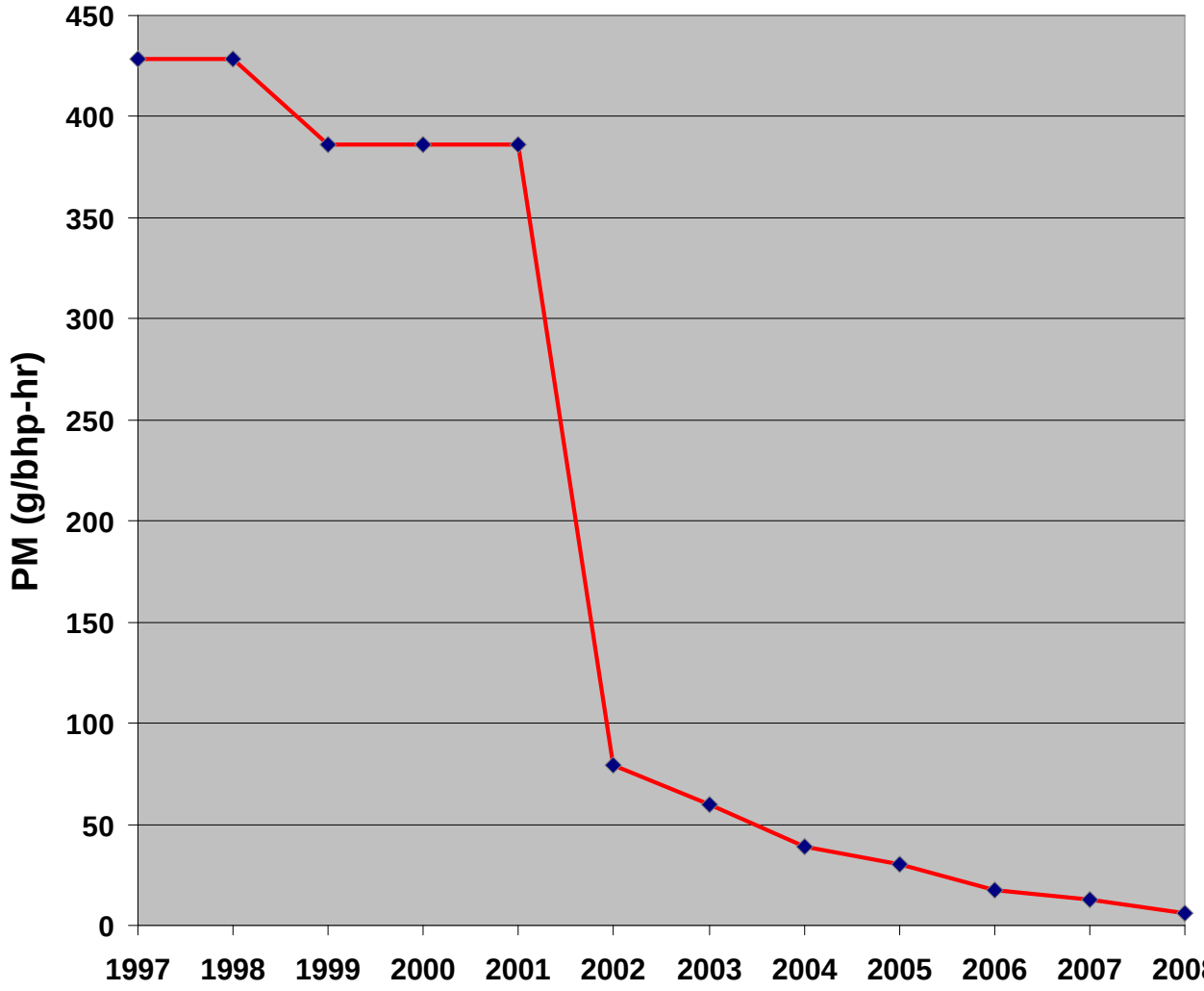
# Fleet Vehicles



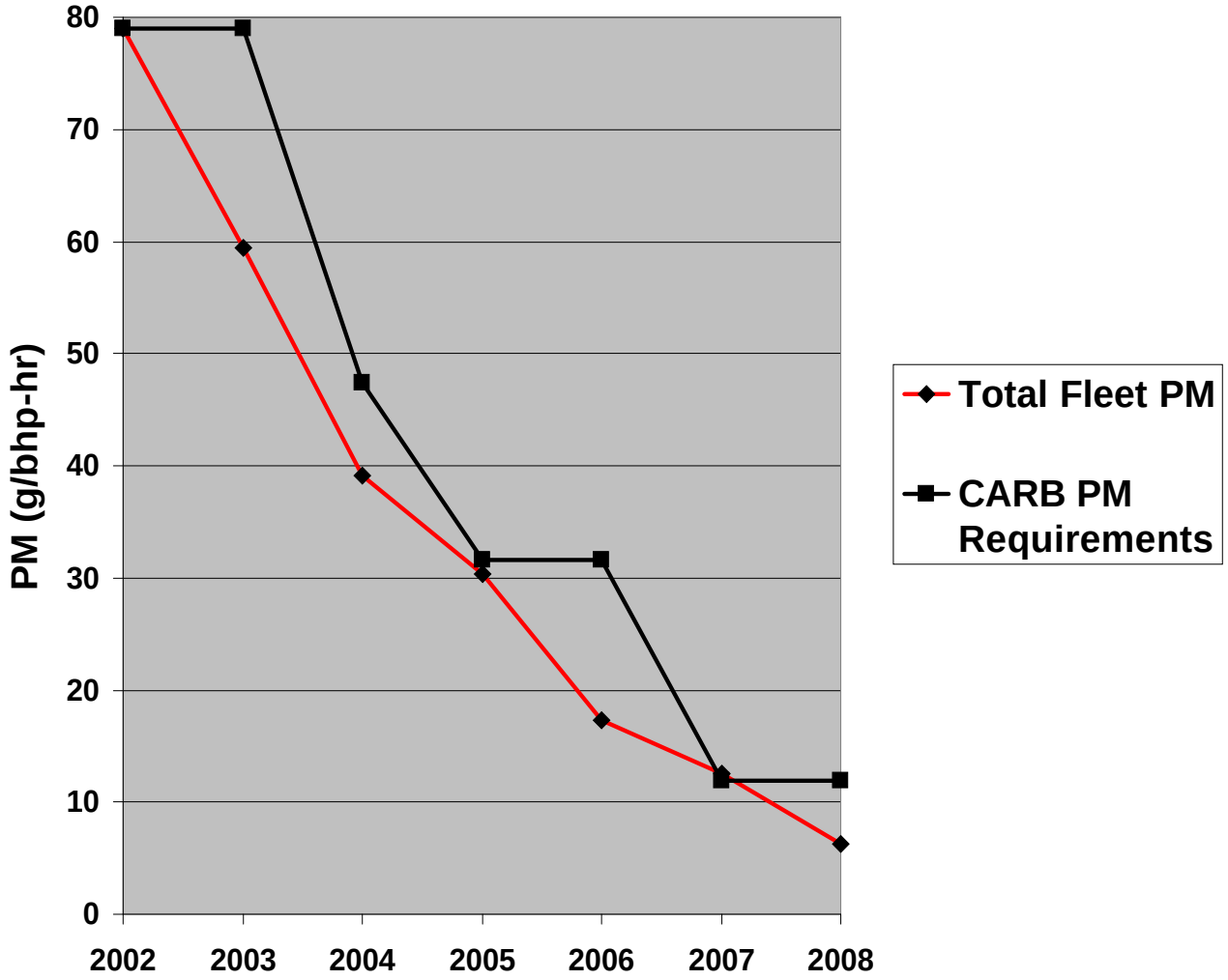
# Emissions Summary

- PM emissions reduced 98% since 1997
- Lowest per-passenger emissions in California

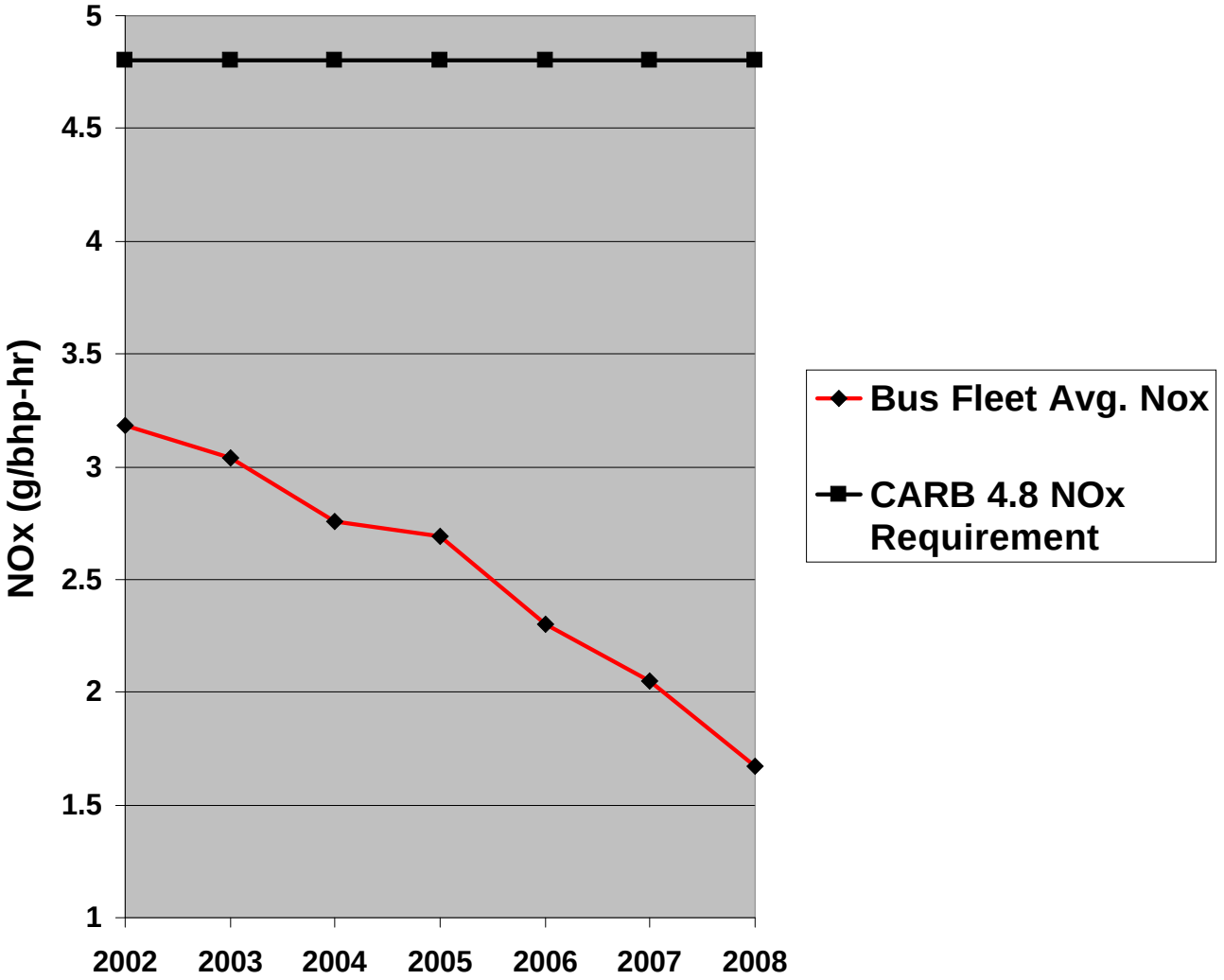

# 98% PM Reduction Since 1997



# California Air Resources Board (CARB) PM Requirements



# CARB NOx Average Requirement



# Alternative Fuel Pilot Program

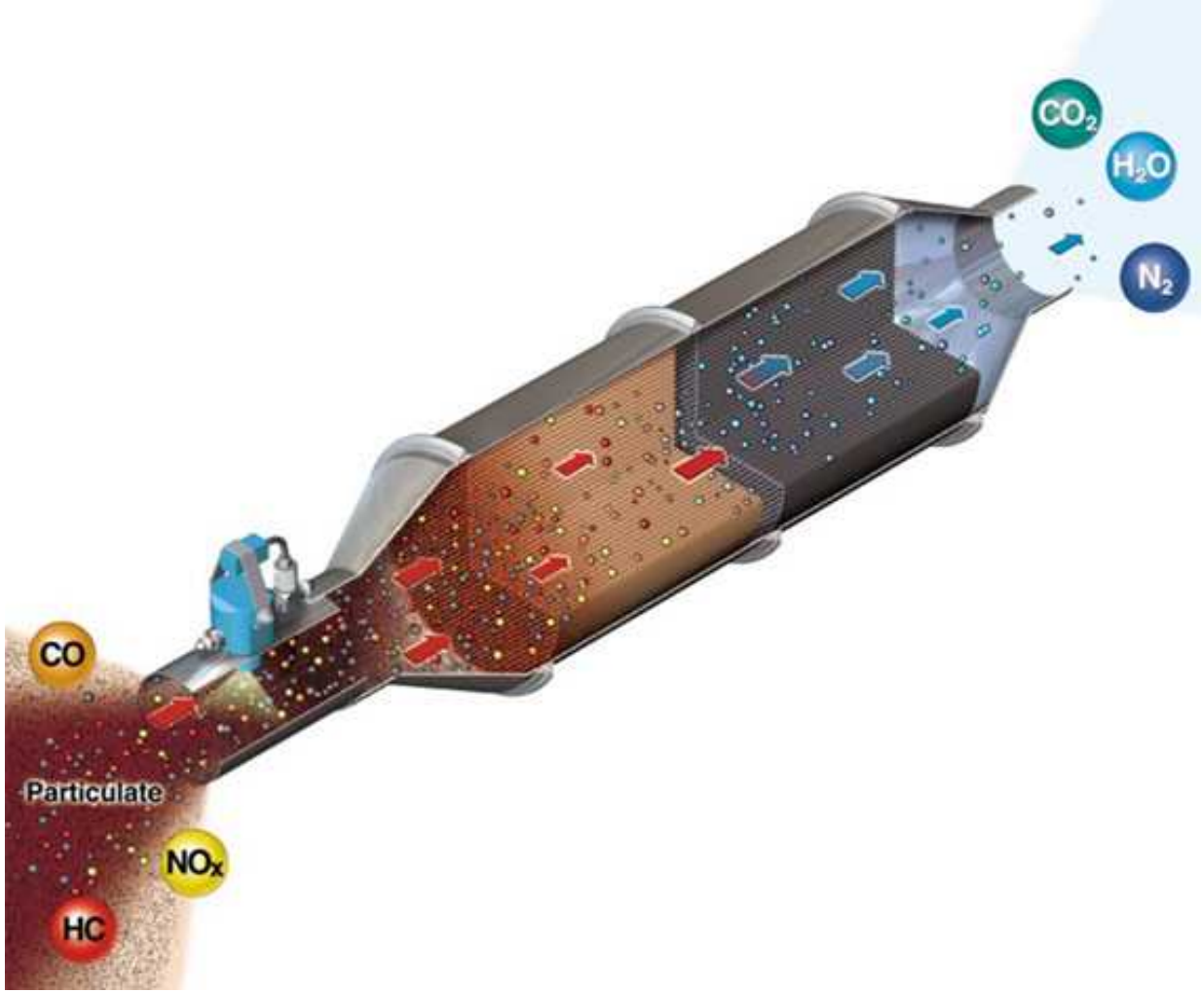
- 2001-2003
  $3.5M Alternative Fuel Pilot Program:

  2-year study: CNG, battery-electric, hybrid-electric buses; LNG engines; exhaust filters; and alternative diesel fuels
  - Goal was to determine technology path for future bus procurements
  - Study focused on Performance, Reliability, Emissions, Costs, and Safety
  - UC Davis Institute of Transportation Technology and UC Berkeley partnered in program design and study
  - Results: SFMTA purchased 86 diesel-hybrid buses, installed exhaust filters on remaining diesel buses, and now fuels all diesel buses with biodiesel


2001 Orion VI Hybrid

# "Cleaire" Exhaust Retrofit Devices

## Reduces PM 85% and NOx 25%



# Hybrid Buses

- "Series architecture" electric bus

- Superior hill climbing performance
- Run on biodiesel
- Engine is ½ size
- Ultra low emissions and upgradeable
- Less noise and smoother
- Increased reliability
- 35% Fuel economy increase
- Minor infrastructure modifications
- Lifecycle costs comparable to conventional diesel buses
  - Slightly higher purchase price ($500k vs $350k each)
  - Anticipated lower operating costs due to 35% better fuel economy and reliability


2006 Orion VII hybrid bus meeting a cable car at the top of Hyde Street - a 21% grade

# Hybrids

- Free rides when first biodiesel hybrid went into service
- Support from shop floor to Mayor's office and everywhere between

# Biodiesel

- Mayor's 2005 Executive Directive
  - Early B100 demonstration for biodiesel producer field trip
  - United Nations World Environment Day
- 6.5 Million gallons of B20 per year
  - 1.3M gallons of B100
- Roughly 17,500 gallons of B20 delivered per day
  - 3500 gallons of B100
- 198,000 gallons of storage total for 4 facilities
  - Must be kept at 75% minimum at all times
- SFMTA = 520 buses and 76 non-revenue vehicles
  - City of San Francisco = 1500 diesel vehicles

# Testing Programs

- SFMTA performed 6-month pilot program for compatibility with Cleaire devices
- CARB testing modern engines and HHD vehicles, including SFMTA bus with Cleaire device and Cummins ISM engine
- AC Transit (Oakland, CA) engine analysis as part of their pilot program

# Biodiesel Quality Control

- Fuel contract – vendor must:
  - Provide producer's "Certificate of Analysis" (COA)
  - Provide producer's "Certificate of Biodiesel" for ASTM D 6751
  - Perform industry standard testing of each batch of biodiesel
  - Pass all biodiesel through at least a 3-micron filter
  - Blend according to industry standards

  - Provide Loading Ticket ("rack tag") + B100 sample with each delivery
  - Deliver to facility storage tanks through 60-mesh screen
  - Be responsible for all spills

  - Provide notification ahead of time when new feedstock/source used
  - Keep storage tanks at least 75% full at all times
  - Conduct periodic testing of storage tanks for contamination/fuel degradation
  - Follow guidelines in NREL's "2004 Biodiesel Handling and Use Guidelines"
- Storage tank preparation
- High turnover
  - Good news: long term storage issues reduced
  - Bad news: constant oversight of daily deliveries

# Cost, NOx, and Warranty

- Cost
  - 5 to 30 cents incrementally higher for B20 (soy)
- NOx
  - New test results needed for modern engines
  - SFMTA reduced NOx by 25% on all non-hybrid buses
- Warranty
  - Not a concern due to age of engines and relative costs

# Next Steps

- Ramp up blend percentage from B20
  - First step was initial implementation
  - Must be sure quality fuel can be available daily for higher blends

- Public Utilities program
  - $4 million per year F.O.G. problem
  - Free restaurant collection
  - Feedstock sold to producers
  - Biodiesel purchased back from producer at savings