Options for PM, Dioxin/Furan and Mercury Control Using ePTFE Technologies

McIlvaine Hot Topics

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W. L. Gore & Associates, Inc.

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Agenda

- Overview of W. L. Gore & Associates
- ePTFE membrane filtration for PM/$PM_{2.5}$
- REMEDIA Catalytic Filtration System for D/F
- Carbon-Polymer Composite Material for Hg
- Conclusions

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Overview of W. L. Gore & Associates

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Company Overview

- Founded in 1958
- Inventors of ePTFE membrane (patented in 1963)
- Associate-owned
- 8,500 associates
- 45 plants and sales locations globally
- Manufacturing in U.S., Germany, Scotland, Japan, and China
- Sales of approx $3 billion in fiscal 2010
- Ranked in the U.S. and Europe by Fortune Magazine as one of the top 100 company's to work for

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Gore's Four Divisions

- Electronic products
- Industrial products
- Medical products
- Fabrics

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e-PTFE membrane filtration

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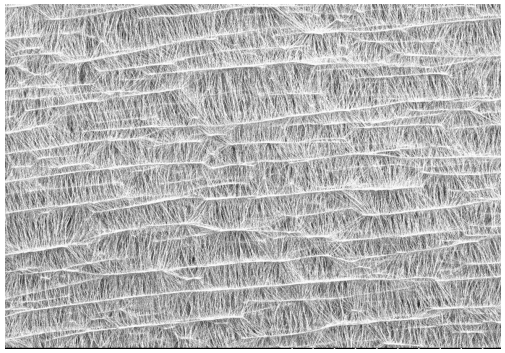
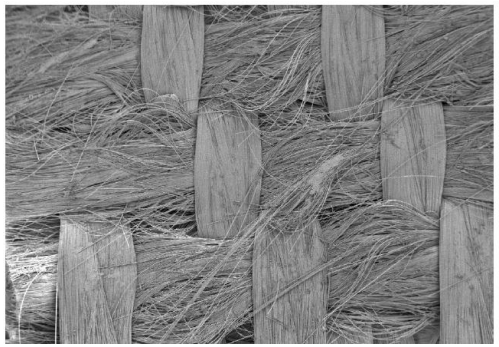
What is Membrane Filter Media?



ePTFE Membrane

Fabric (Fiberglass or felt)



Proprietary
Lamination Process

ePTFE Membrane
Laminate

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GORE® Filter Laminate

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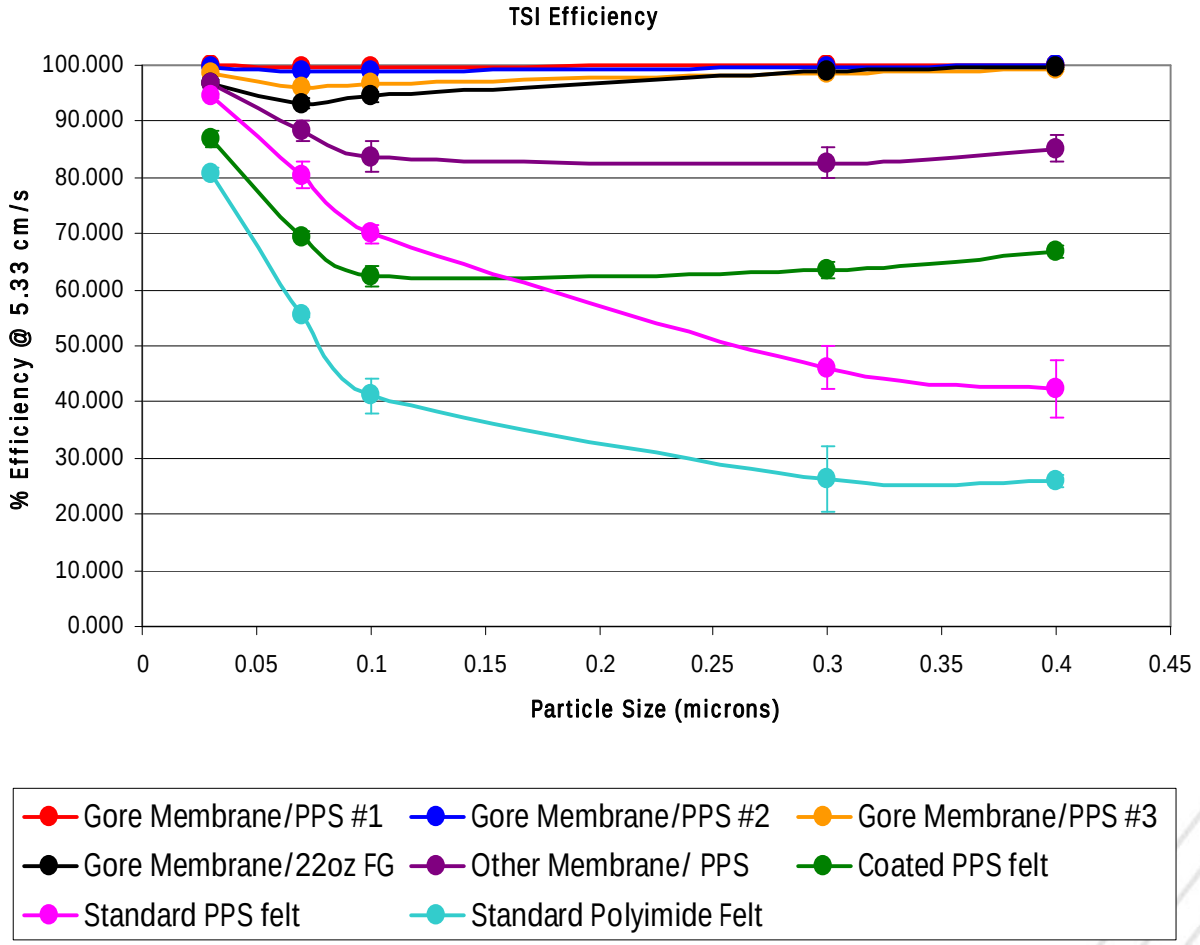
Gore In House Efficiency Testing on TSI Model 3160



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PM Emissions Potential (based on USEPA ETV Data)

- Inlet dust concentration = 8 gr/dscf (+/- 1.6 gr/dscf)
- Outlet particle concentration (Total) = 0.0000073 gr/dscf (detection limit)
- Outlet particle concentration ($PM_{2.5}$) = 0.0000073 gr/dscf (detection limit)
- Calculated Efficiency = 99.99991%
- Disclaimers
  - This is a flat sample of laminate, not a finished filter bag; bag fabrication and bag installation introduce potential sources for leakage
  - This is a controlled laboratory test done at ambient conditions with a test dust
  - Results in a field application may be substantially different

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GORE® Filter Bag with seam tape

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GORE® REMEDIA® Catalytic Filtration System

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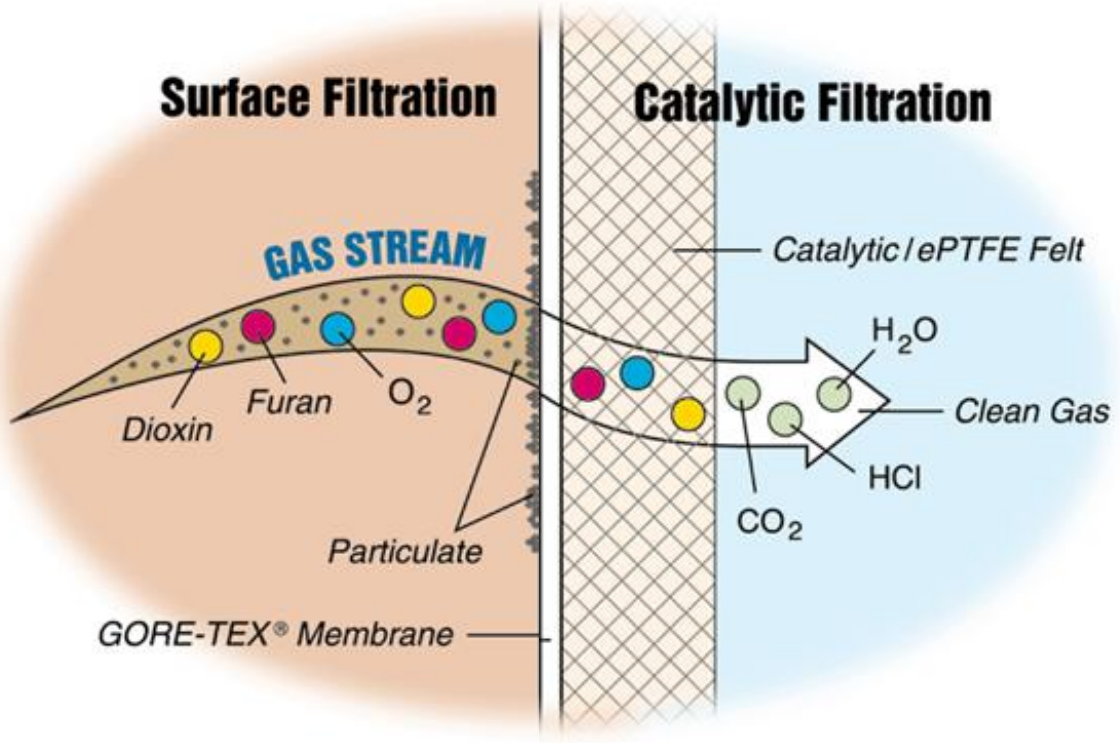
GORE® REMEDIA® Catalytic Filter System
The Combination of Two Proven Technologies:



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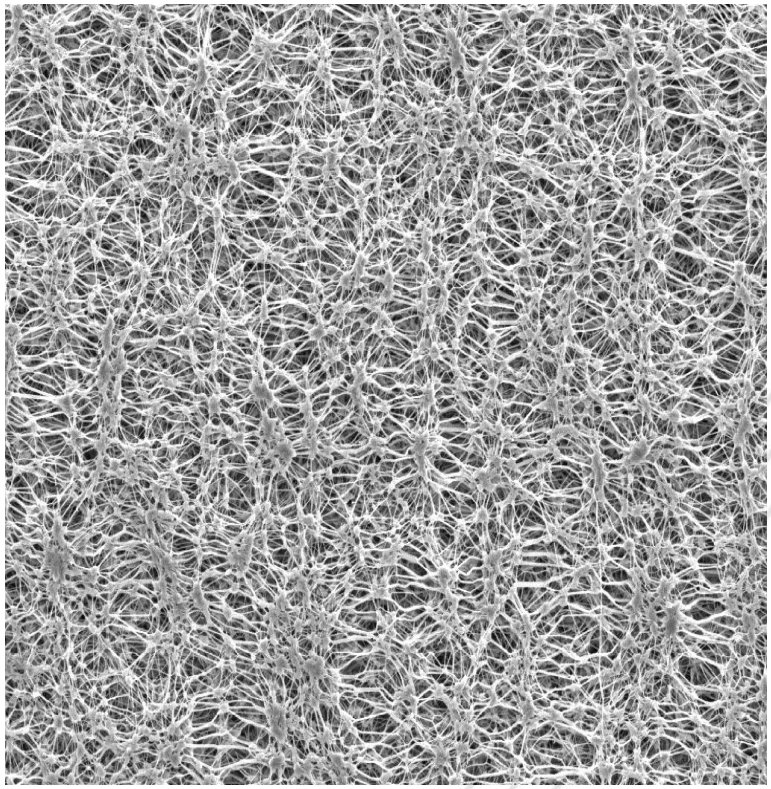
Surface Filtration

- Controls Fine Particulate
- Protects Catalyst
- Reduces Adsorbent Requirement
- Reduces Pressure Loss



SEM of ePTFE Membrane (x 3000)

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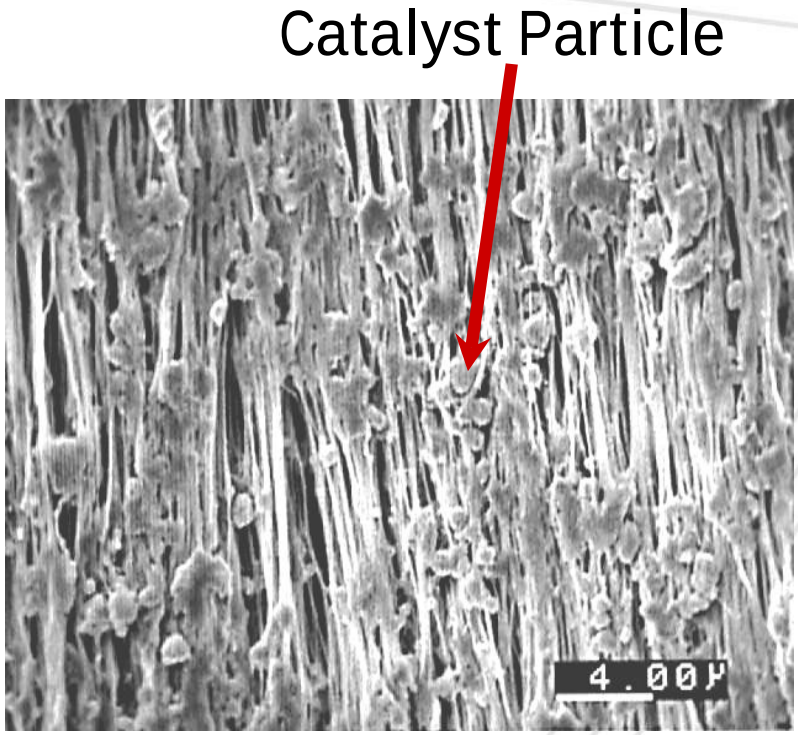
Catalytic Filtration: Dioxin/Furan Destruction

- Catalyst Integrated into PTFE Fiber
- Proven Destruction of Dioxin
- Easy to install and use



SEM of Catalyst/ePTFE Fiber

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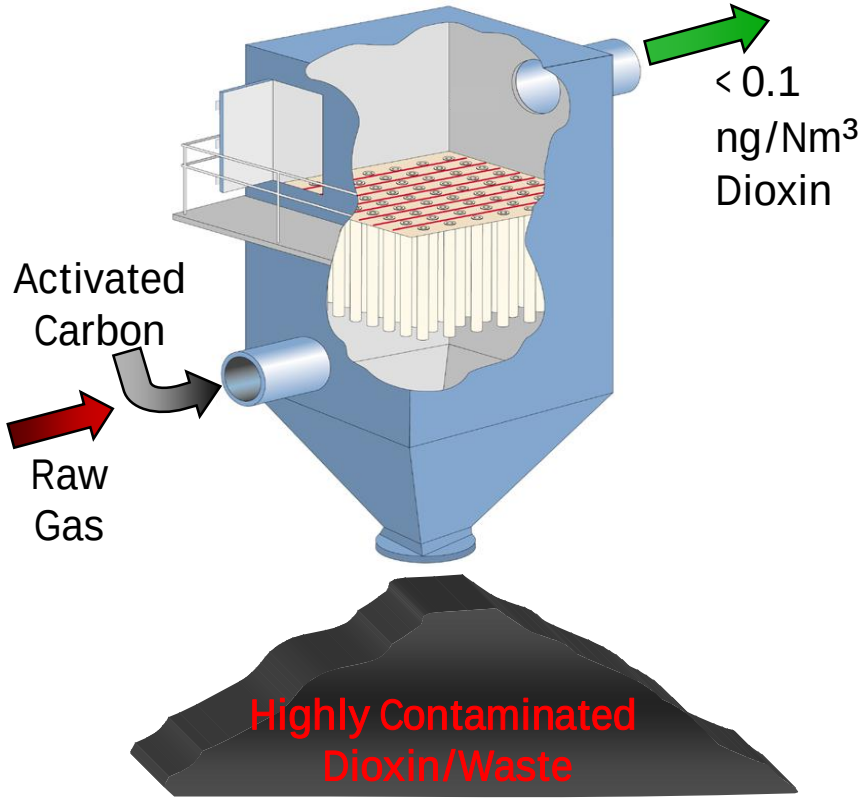
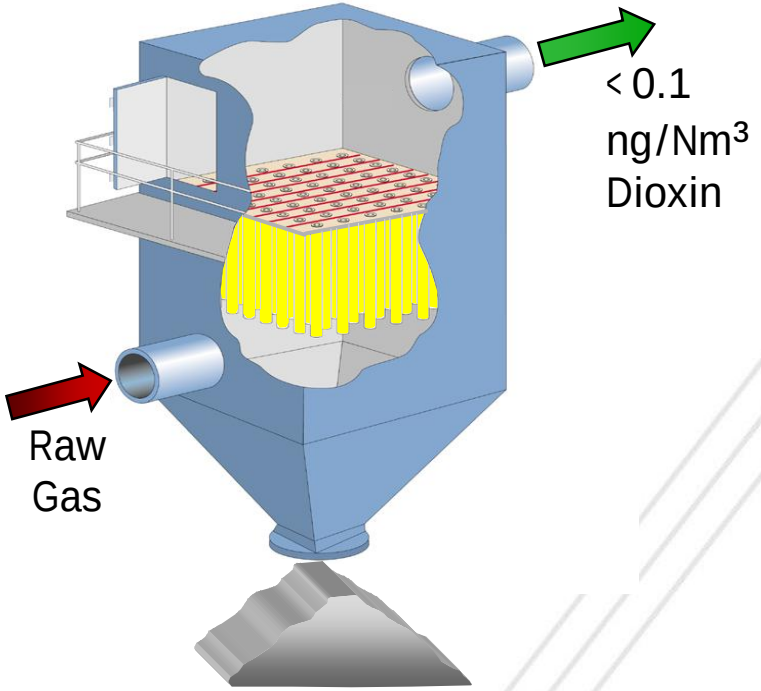
GORE® REMEDIA® Catalytic Filter vs. Adsorption

Adsorption Process



GORE® REMEDIA® Catalytic Filter System



Less Waste to Landfill
> 90% Dioxin Destroyed

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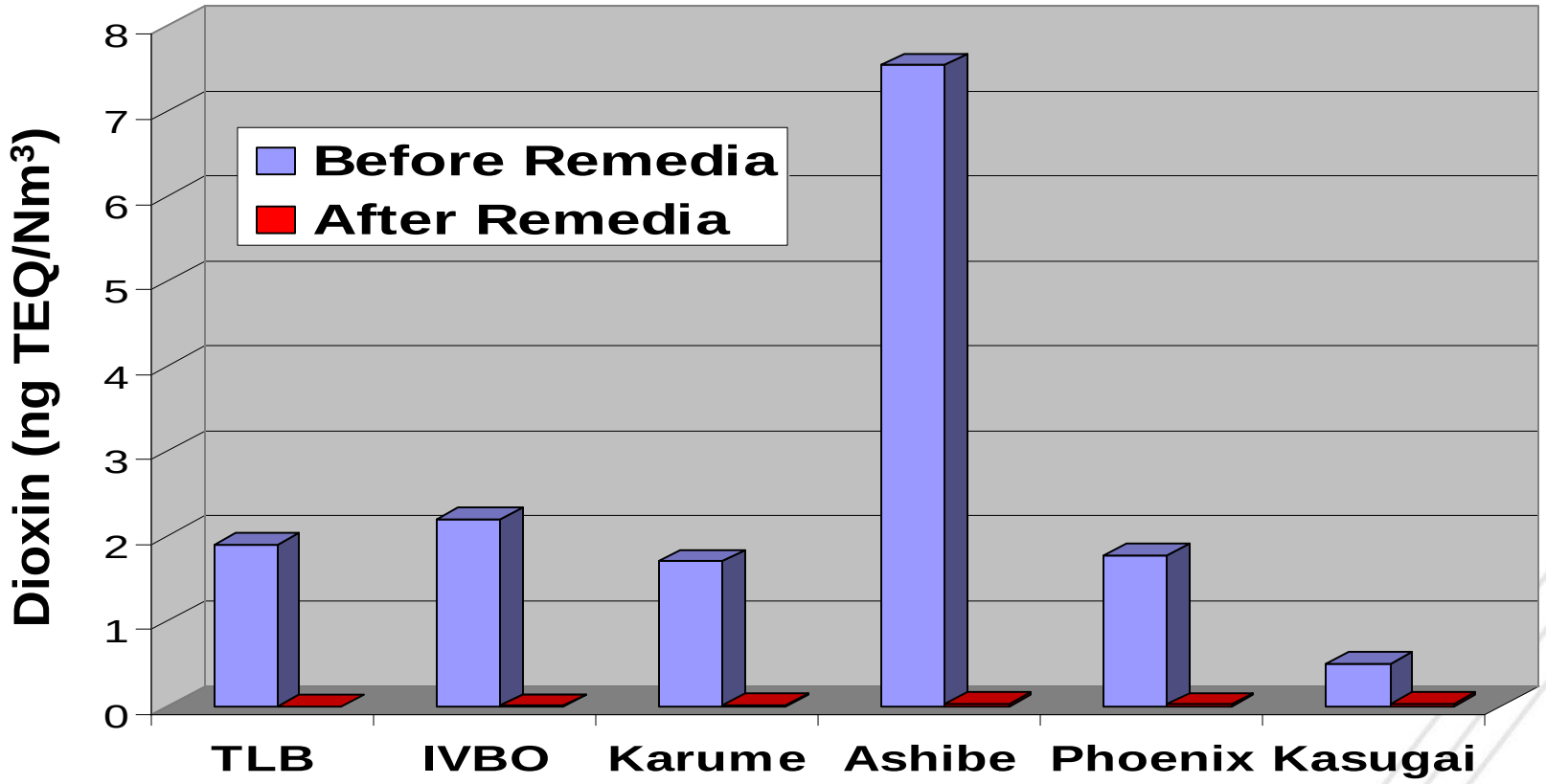
Worldwide Proven Performance



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D/F Emissions Reduction Potential with GORE® REMEDIA®

- Typical destruction efficiency for GORE® REMEDIA® is 90% to 99% based on inlet D/F concentrations of 1.0 to 10.0 ng/dscm
- For a low inlet concentration (less than 0.1 ng/dscm), the expected efficiency would be between 50% - 90%
- D/F emission limits of 0.004 ng/dscm for an existing source or 0.002 ng/dscm for a new source may be achievable with GORE® REMEDIA® depending on the inlet D/F concentrations

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Gore Carbon-Polymer Composite Material for Mercury Removal

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Gore's Mercury Removal Technology

- Gore's carbon-polymer composite (CPC) tape material:
  - Activated carbon (chemically treated) and fluoropolymer composite tapes
  - Applied in stationary bed configurations
  - Will ***not*** be saturated by SOx or other acid gases, therefore, no frequent bed regenerations are required

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Gore's Mercury Removal Technology (Cont'd)

- Gore's carbon-polymer composite (CPC) material (continued):
  - Flue gas conditions: low temperature (<100°C) and humid (>50%RH)
  - SOx and other acid gases are converted into aqueous acid solutions and expelled to the CPC tape's outer surfaces, then collected
  - Hg are fixed on the carbon surfaces with high capacity (>1.0 wt%), long-term operation before sorbent saturation by **mercury**
  - CPC tapes are made into modular forms with low pressure drop

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Small Scale Field Demonstration

- Plant Yates Demonstration (II) – Sorbent Module (Aug. - present)
  - The demonstrations were jointly carried out by Gore, EPRI, URS, and Southern Company
  - Tests were done at Southern Company's Plant Yates power station
  - Slip stream flue gas was taken after limestone wet scrubber (from stack)
    - Temperature: ~123F (51C)
    - Humidity: 100%
    - Flow Rate: 13.0 and 24.7acfm (5 and 9.5ft/second linear velocities)
    - Carbon tape: eight 6" deep, 3.8" diameter cylindrical modules
    - Testing date: July 31, Aug 30, Sept 16, Oct 26, Nov. 29

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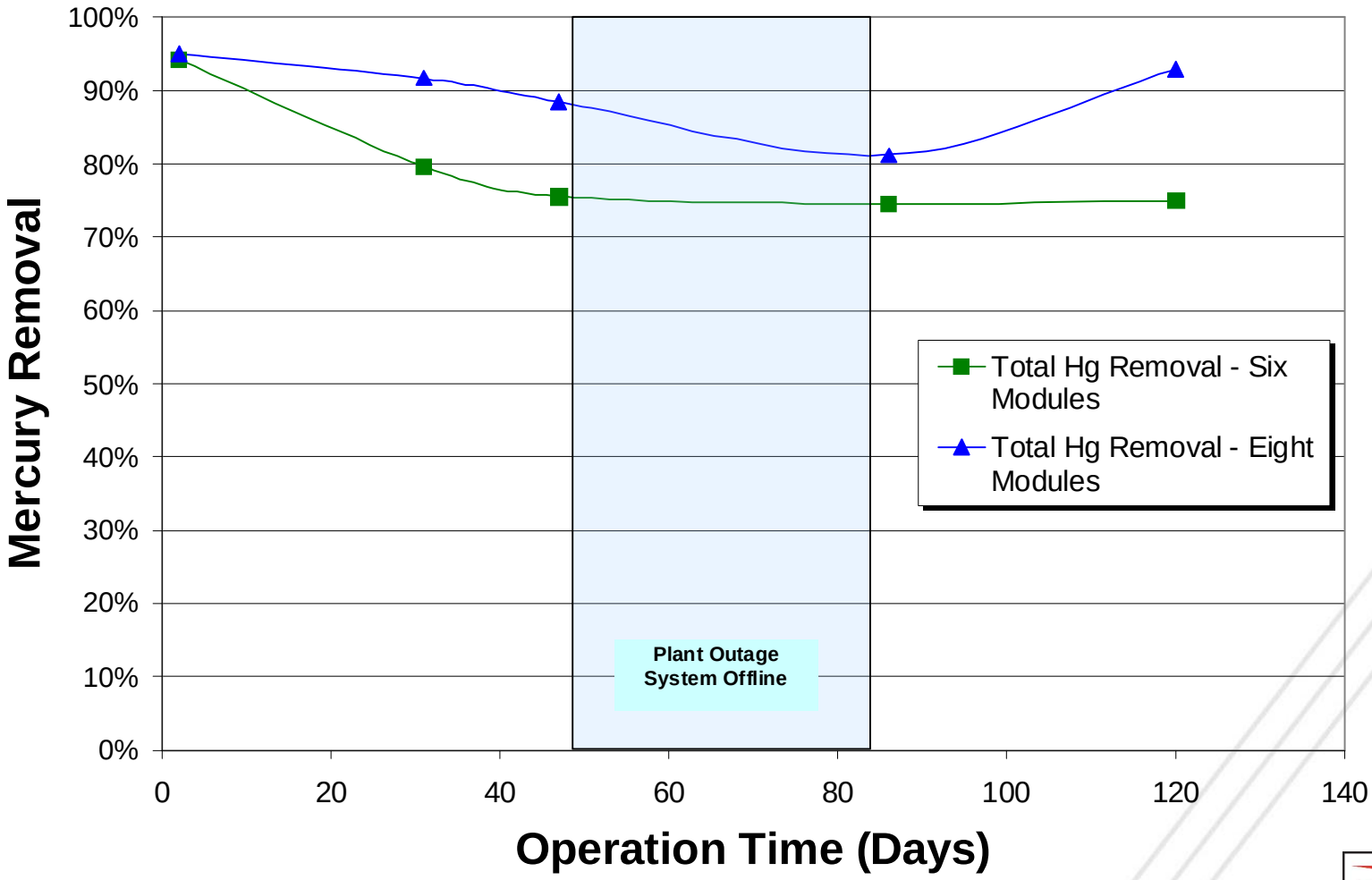
Small Scale Field Demonstrations (continued)



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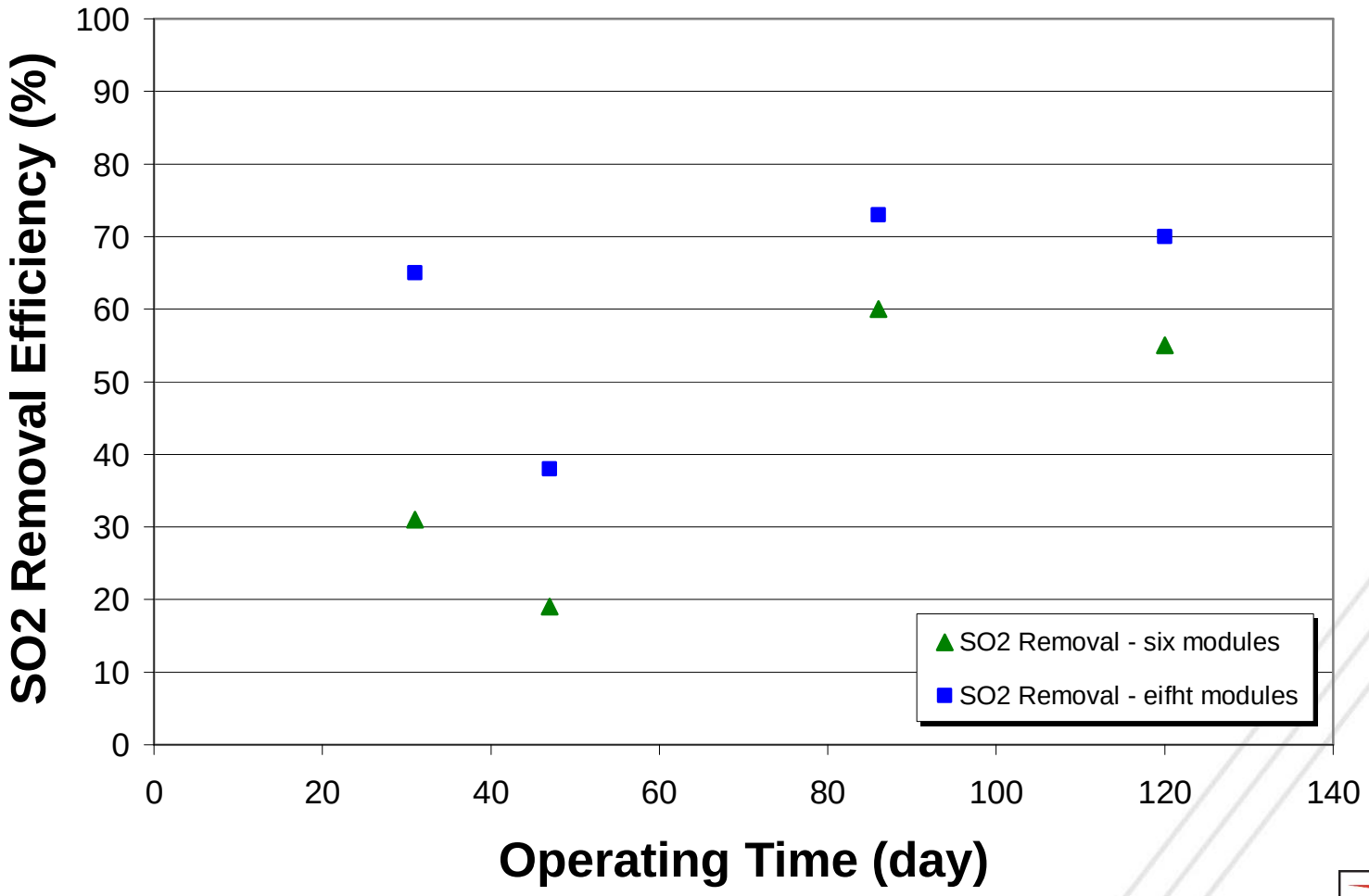
Small Scale Field Demonstrations (continued)



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Summary – Gore Mercury Removal

- A unique sorbent material, carbon polymer composite material (CPC), has been developed for flue gas mercury and other contaminates removal
- The CPC material is deployed in a stationary sorbent bed applications, and the sorbent bed does not require a frequent regeneration process
- Field demonstration tests have shown that the CPC bed is effective for Hg/SOx removal in coal-fired power plant for many months without requiring frequent regeneration or maintenance processes

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Conclusions

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Conclusions

- GORE® ePTFE membrane bags have been used to achieve near zero particulate emissions for over 30 years in many different applications
  - For existing sources, GORE® membrane bags can be installed in current baghouses to assure compliance with MACT PM requirements
  - For new sources, GORE® membrane bags can be incorporated in new baghouse system designs
- GORE® REMEDIA® catalytic filter bags have been used in various incineration applications for over 10 years
  - Destroys D/F through catalytic reaction; no contaminated, spent activated carbon handle and dispose of
  - Capable of meeting D/F emissions of 0.002 – 0.004 ng/dscm (TEQ) depending on inlet D/F concentration
- Gore Carbon-Polymer Composite material is a new product for control of mercury emissions
  - Lab testing a small scale field trial results look promising
  - Gore has additional field pilot tests in various stages
  - More information may be available under a non-disclosure agreement

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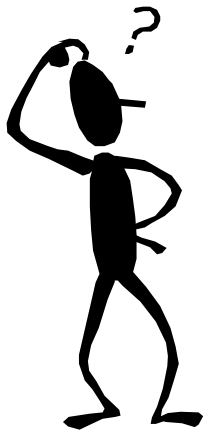
Questions?



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