

# Panel on SO<sub>3</sub> (H<sub>2</sub>SO<sub>4</sub>) Emissions

- Joe McCain                      Southern Research
- Scott Williams                 Duke
- Bryan Williams                 TVA
- Mike O'Connor                 Cinergy
- Brian Rupp                        AEP
- Mark Thomas                    Cinergy
- Nick Irvine                        Southern Company



# Overview of Problems Related to $\text{SO}_3$ Emissions

Joseph D. McCain  
Senior Research Scientist  
Environment & Energy Department  
Southern Research Institute



SOUTHERN RESEARCH  
INSTITUTE

Affiliated with The University of Alabama at Birmingham





Plume Opacity: Residual H<sub>2</sub>SO<sub>3</sub> Fume after Evaporation of Water Fog



SOUTHERN RESEARCH  
INSTITUTE

Affiliated with The University of Alabama at Birmingham



Sources:

Convection sections of boiler:

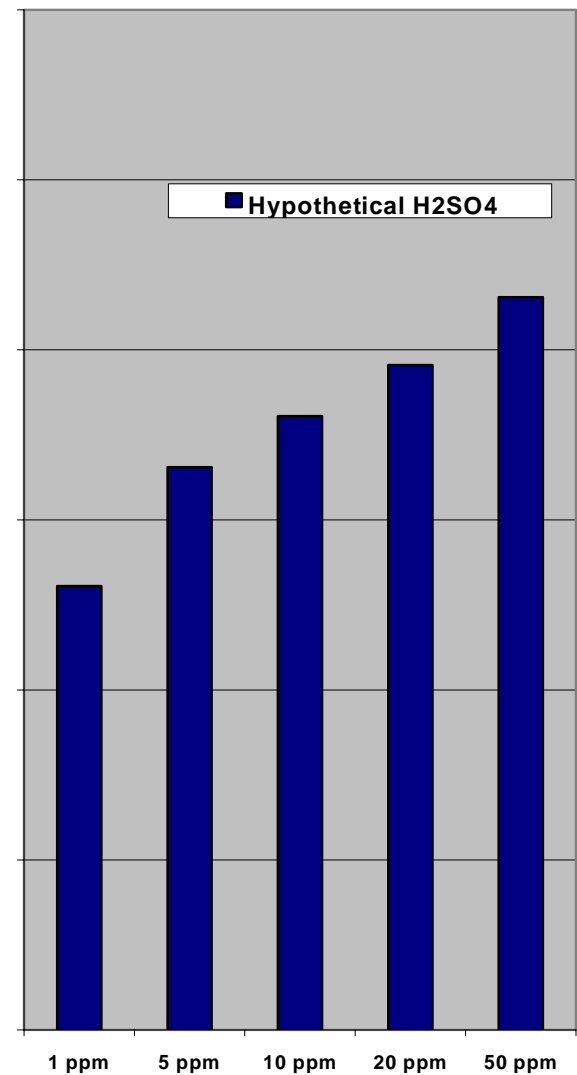
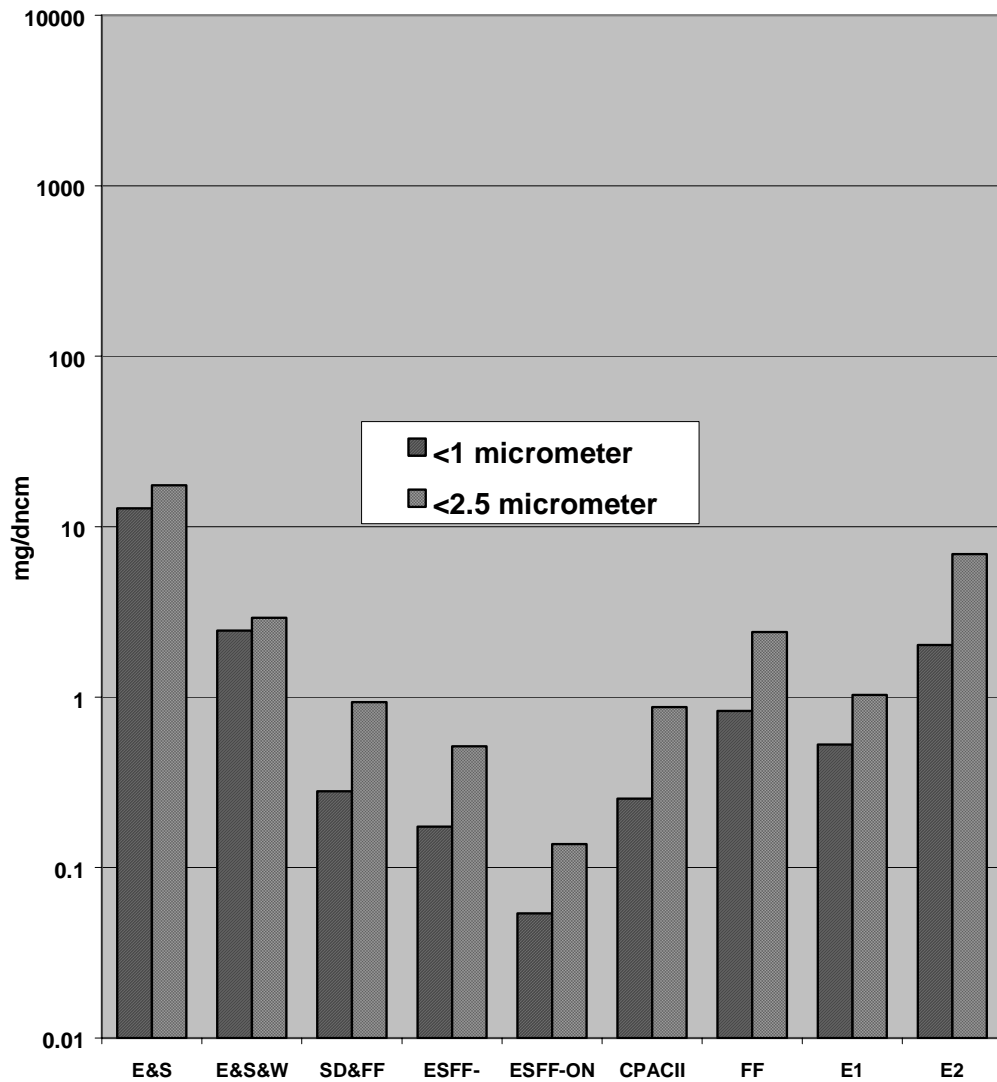
Typical eastern coals result in  $\text{SO}_3$  production  $\approx 1\%$  of  $\text{SO}_2$ .

PRB Coals result in very low  $\text{SO}_3$

SCR:

$\text{SO}_3/\text{SO}_2$  production ratio  $\approx 0.5$  to  $1\%$  for all sulfur levels (Note: the ratio will be about  $0.75\%$  for many boilers using high sulfur coals). Added catalyst beds will add to  $\text{SO}_3$  production. New catalysts are becoming available with conversion rates  $\approx 0.2\%$



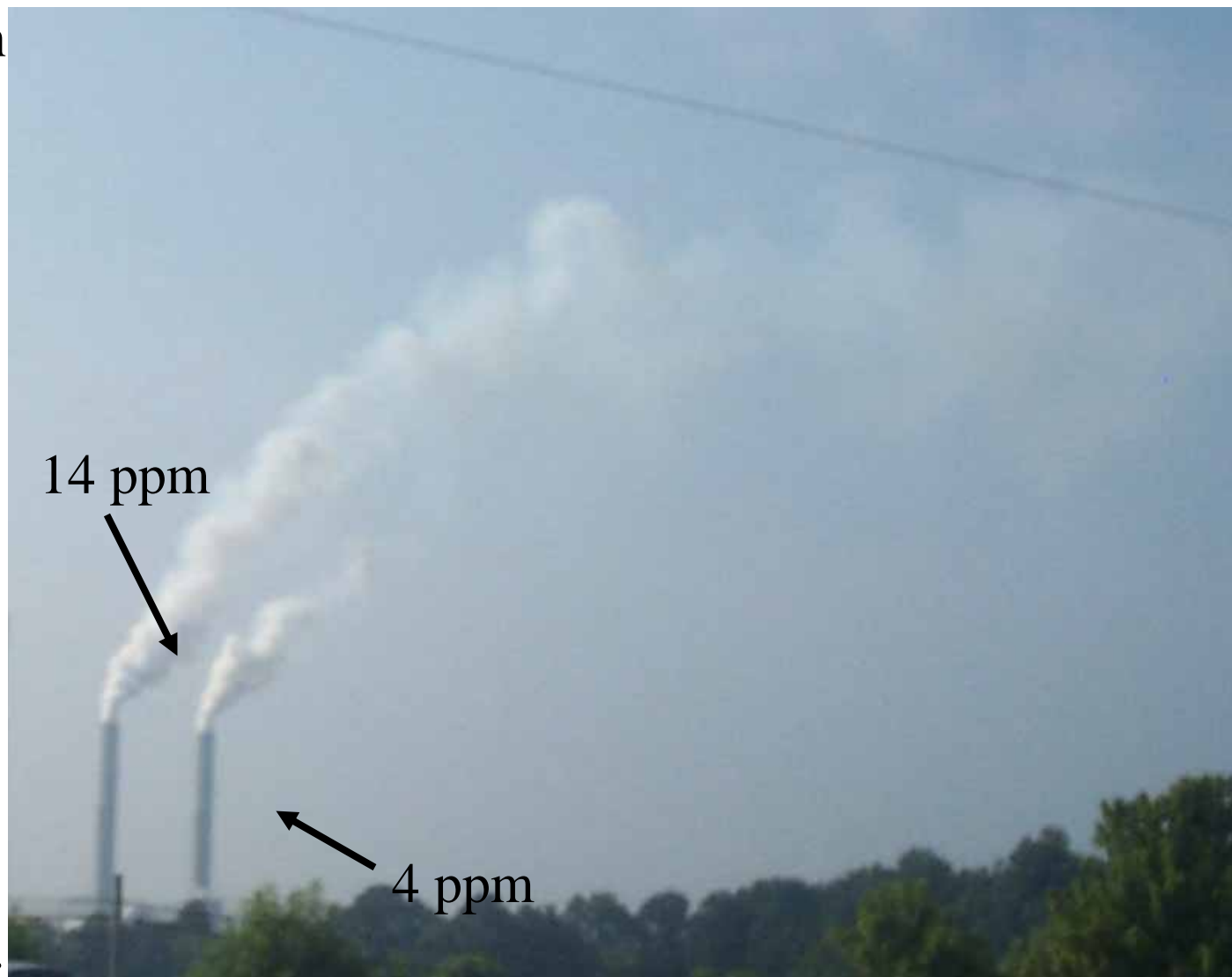


**Fine PM concentrations on a mass basis for several pollution control systems. The equivalent mass concentrations for hypothetical SO<sub>3</sub> emissions at 1, 5, 10, 20, and 50 ppmv are shown for comparison.**



Plumes from twin units, each with ESP followed by wet scrubber.  $H_2SO_4$  on one unit is controlled by lime injection and the other is not.

1 or 2 ppm of  $SO_3$  represents roughly 0.004 lbs/MMBtu of  $PM_{2.5}$  emissions.



SOUTHERN RESEARCH  
INSTITUTE

Affiliated with The University of Alabama at Birmingham

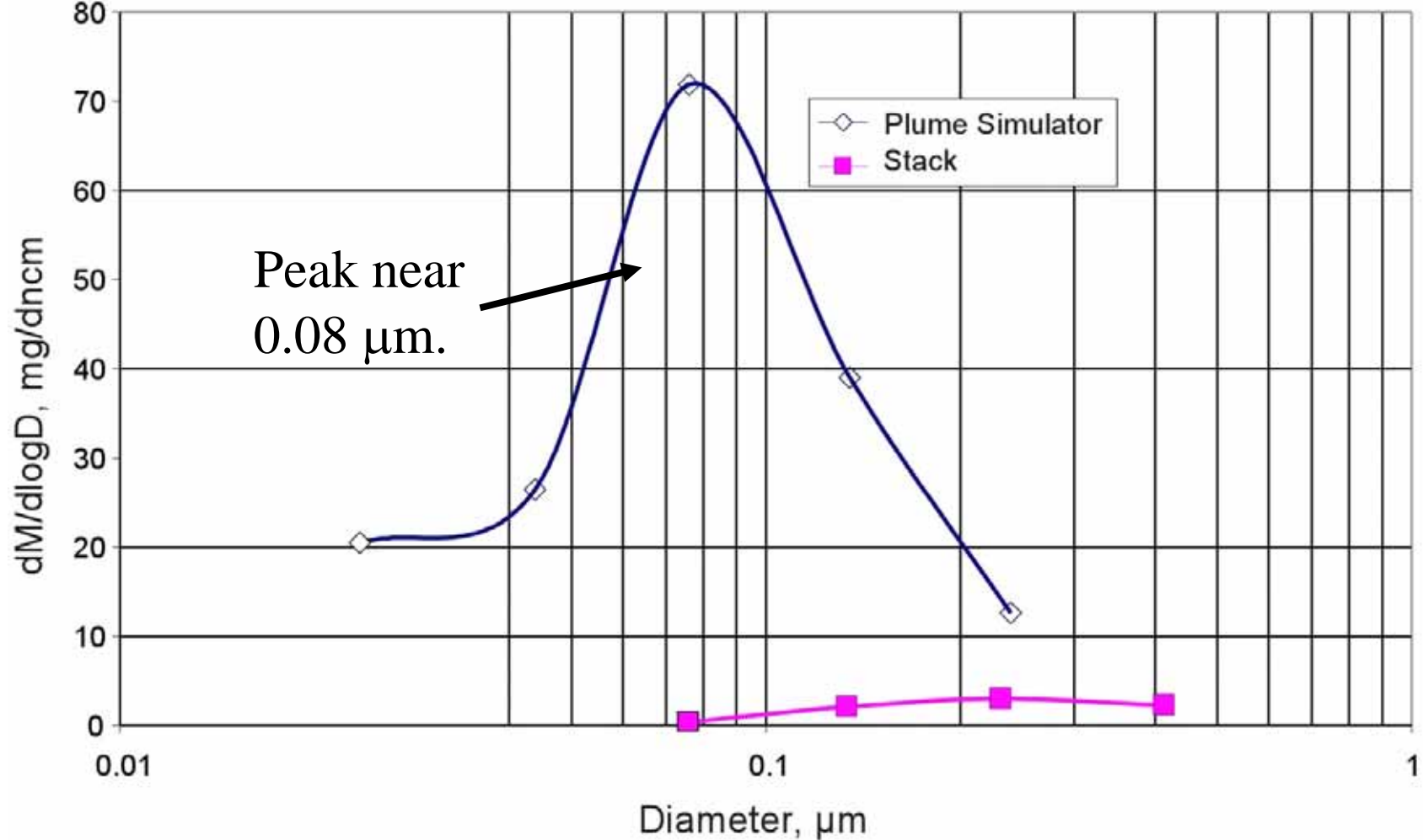


# Condensation Dynamics

Unscrubbed: Reduced Concentration  
Slow Quench

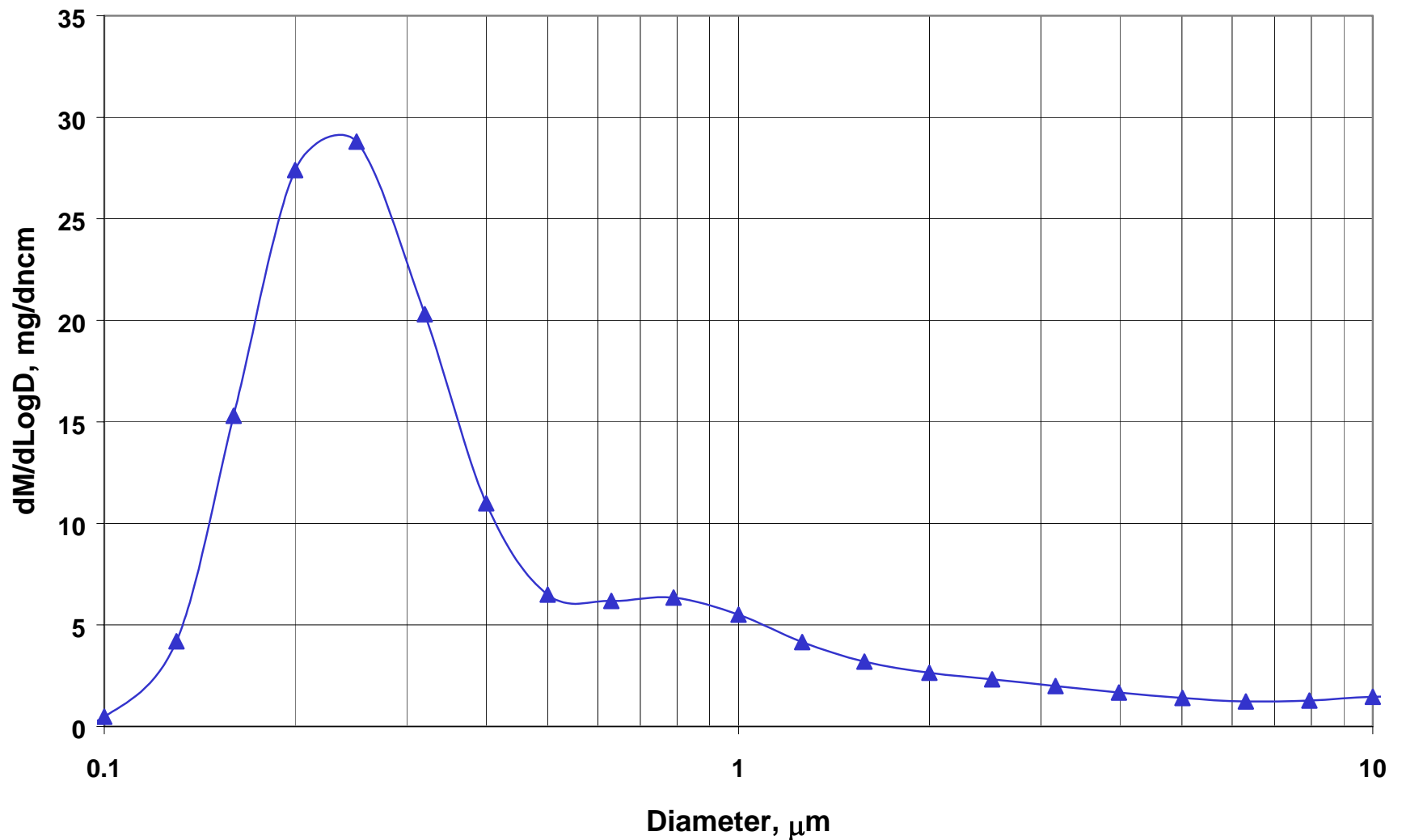
Scrubbed: Full Concentration  
Rapid Quench





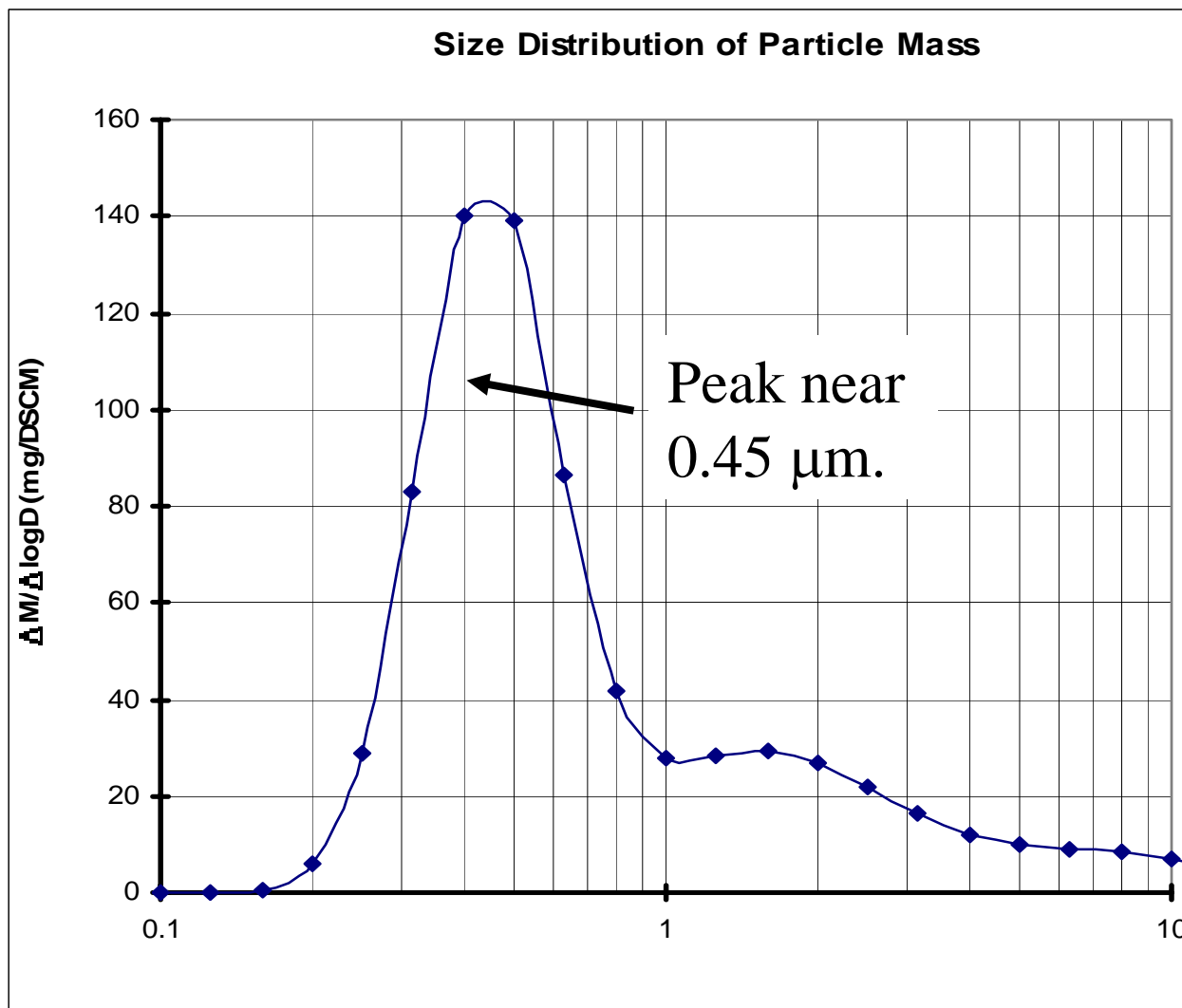
Size Distribution of  $H_2SO_4$  Particles by Mass from a Source with Approximately 6 ppm  $SO_3$  with ESP but No Scrubber.





Size Distribution of H<sub>2</sub>SO<sub>4</sub> Particles from a Source with Approximately 2.2 ppm SO<sub>3</sub> with Scrubber.





Size Distribution of  $H_2SO_4$  Particles from a Source with Approximately 14 ppm  $SO_3$  with ESP and Scrubber.



