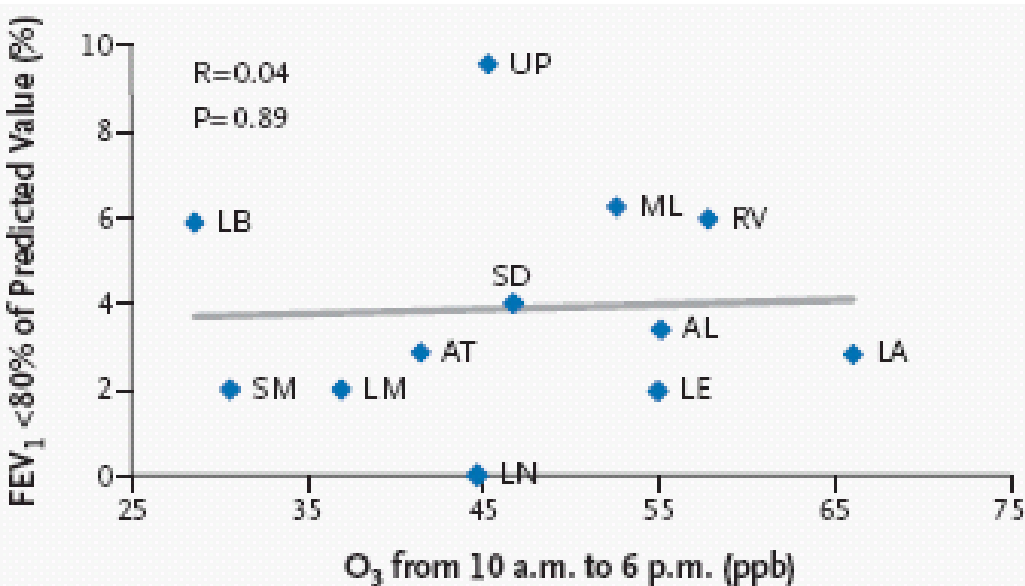
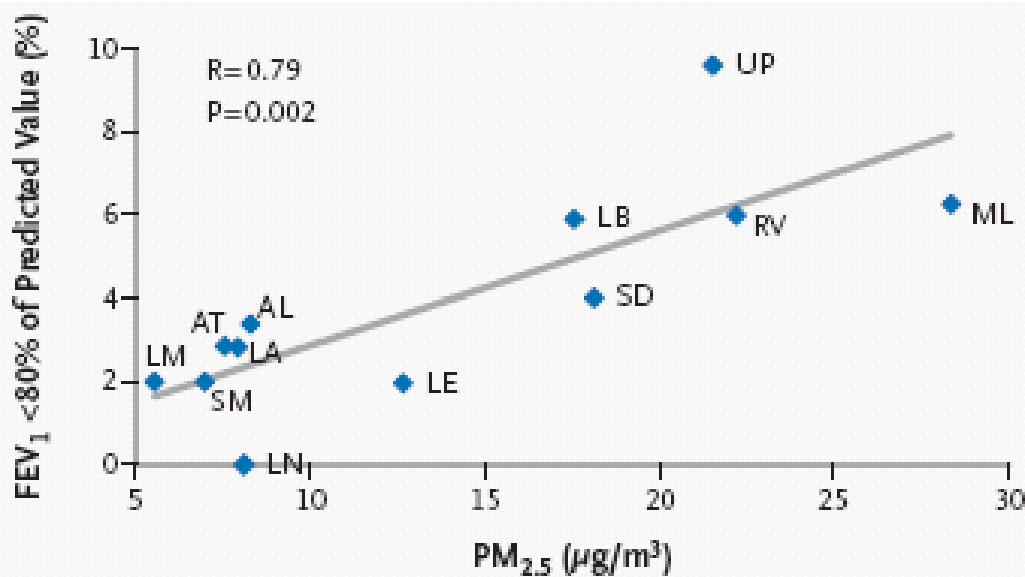


Health Effects of Air Pollution in the San Joaquin Valley



Sources and Impacts of Particulate Matter

Lung Function and Air Pollution

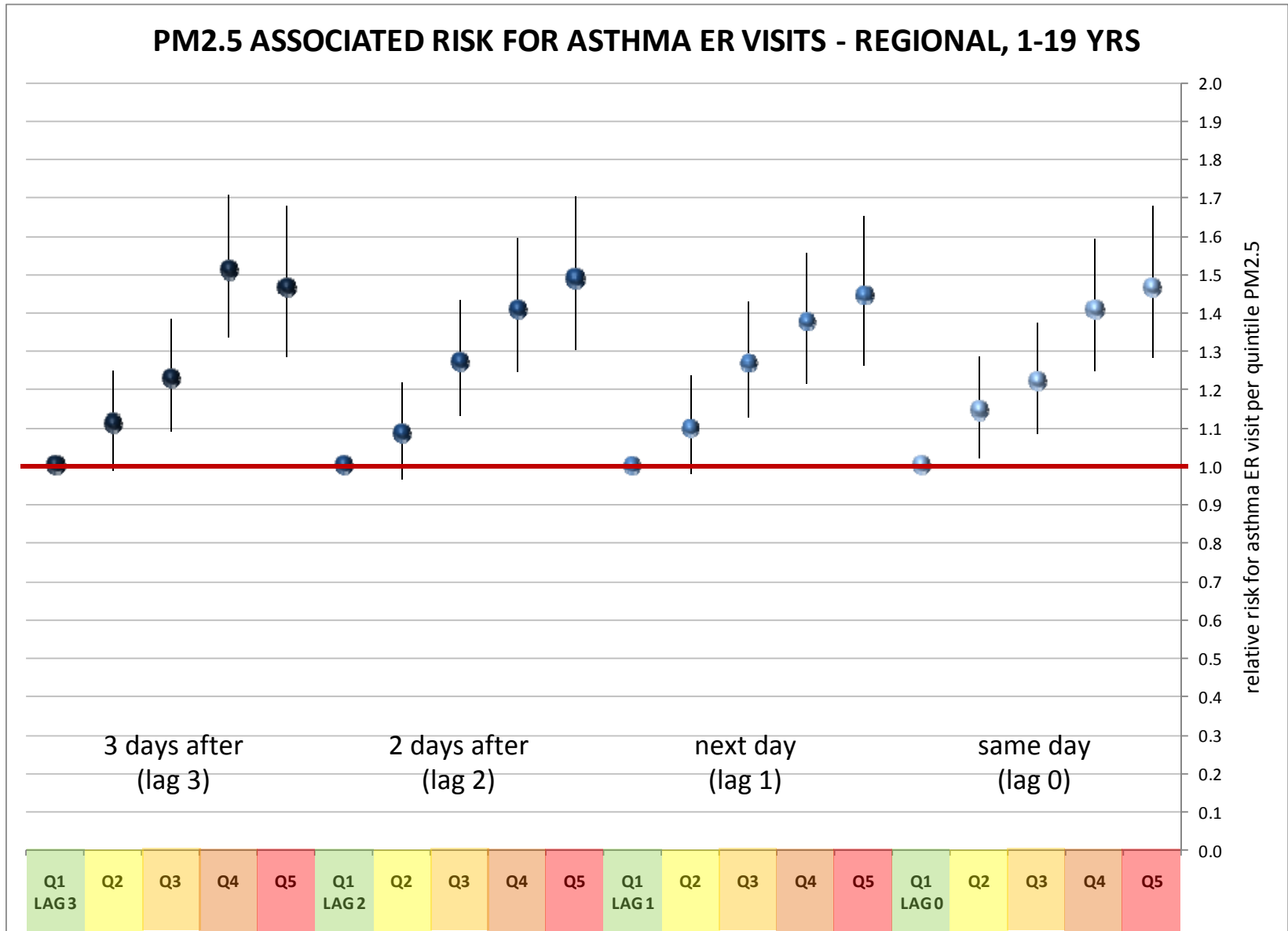


Higher particulate matter ($PM_{2.5}$) levels associated with worse lung function

Southern California Cities Study:

In 12 cities with varying levels of air pollution, FEV_1 (lung function) was measured in 18 year old males and found to correlate with $PM_{2.5}$ levels, but not ozone.

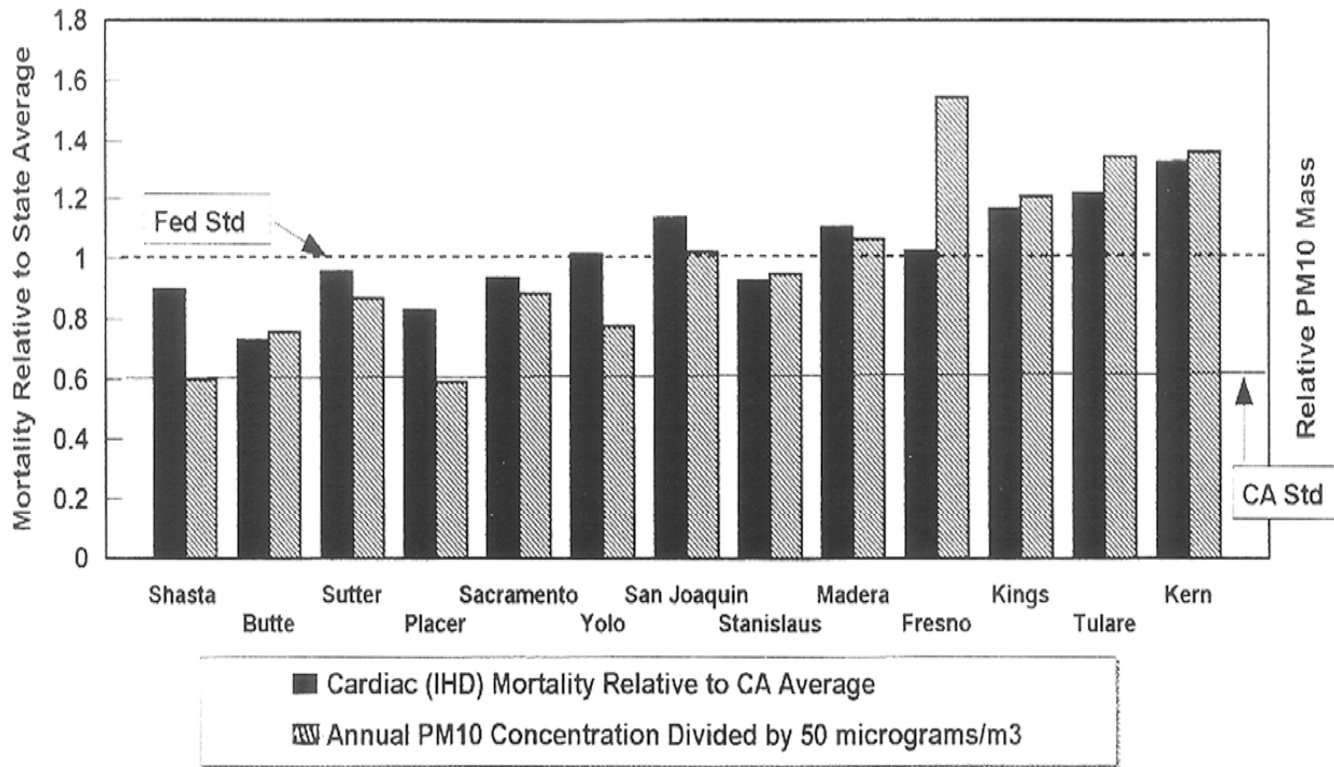
SJV Study: Elevated PM2.5 Increases Risk of Asthma ER Visit



Early Study on PM and Heart Disease

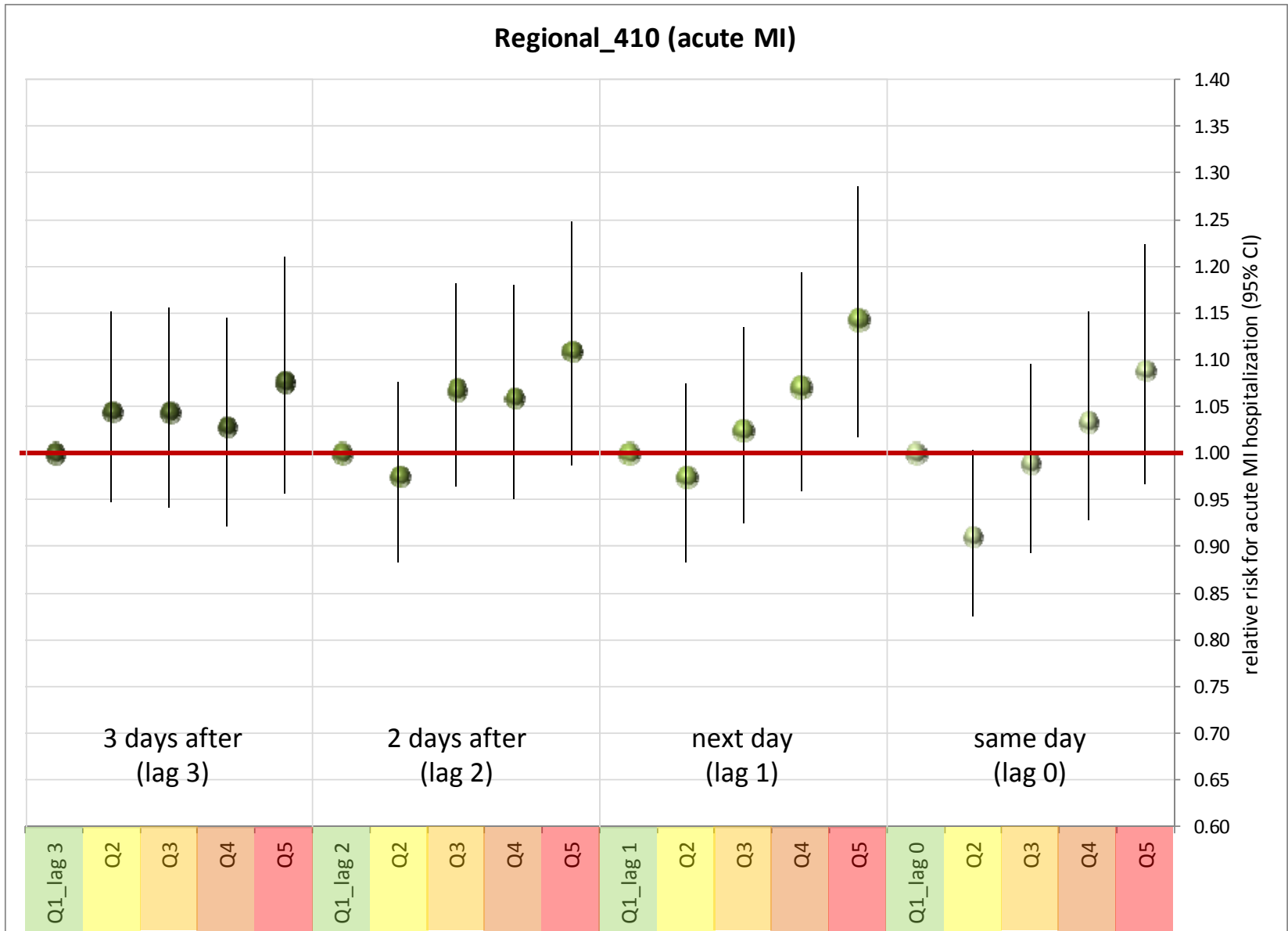
Compared Cardiac Mortality and PM10

Cardiac (IHD) Mortality vs PM10 Particle Concentrations
Central Valley, California (1989-1991)

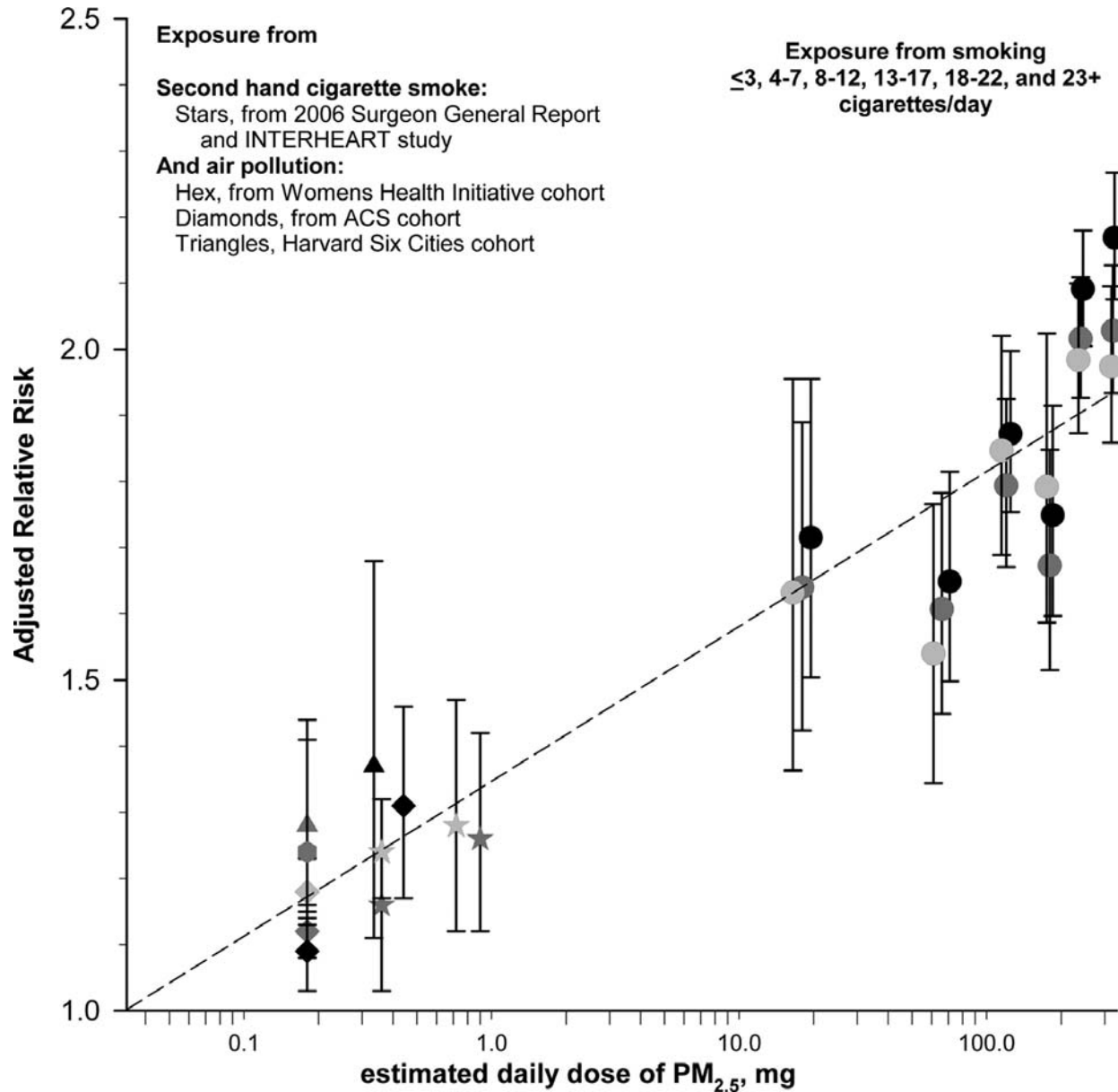


IHD - Ischemic Heart Disease

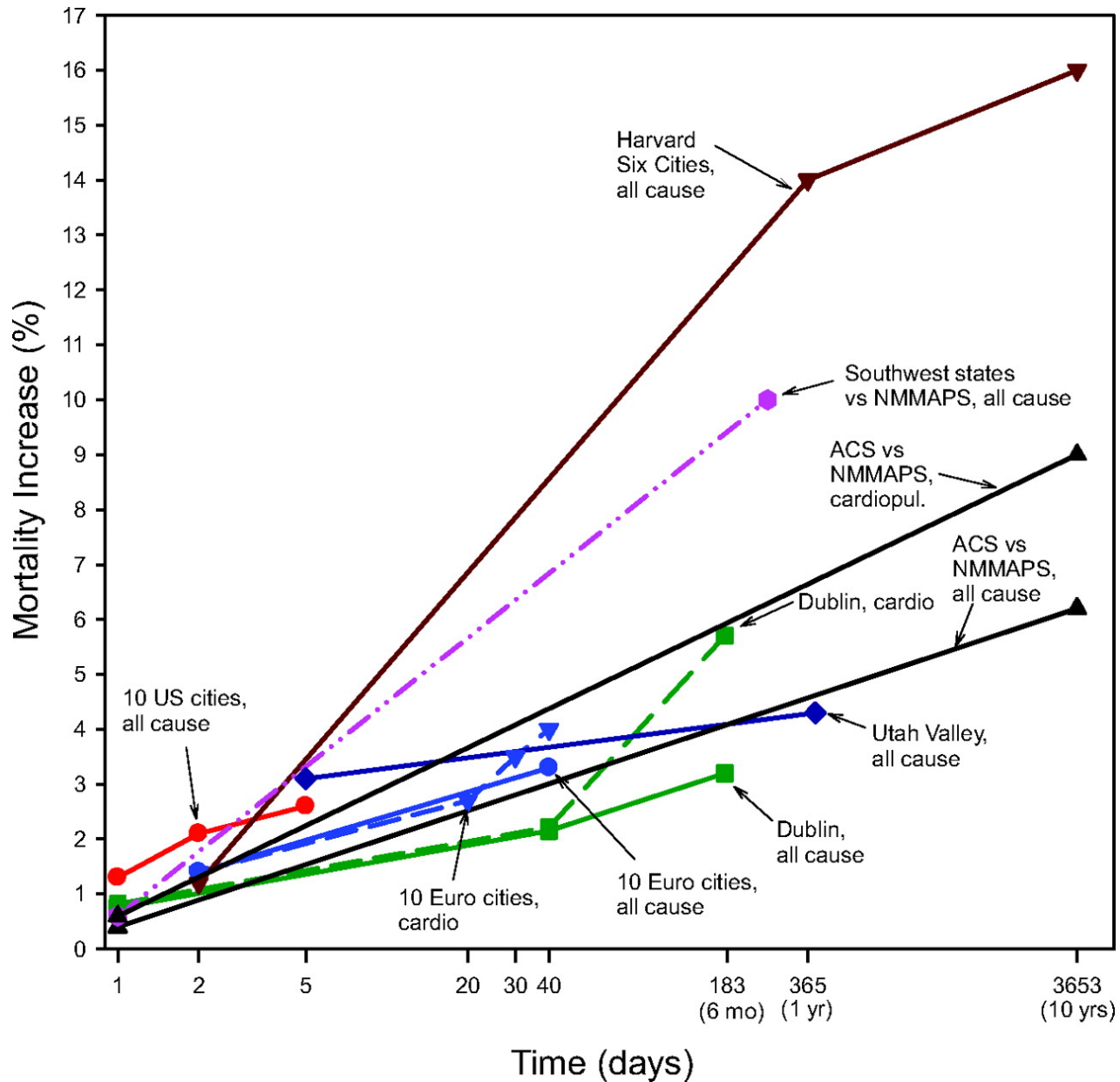
SJV Study: Elevated PM2.5 Increases Risk of Heart Attack



Increased Risk for Heart Disease: PM_{2.5} vs Cigarette Smoke

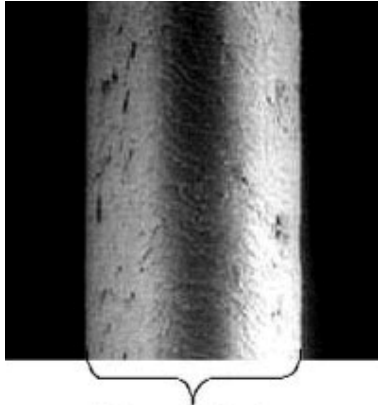


Increased Risk for Cardiac Mortality Associate with PM2.5

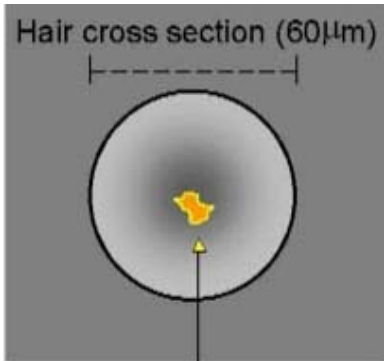


Particulate Matter (PM) Sizes

Coarse Particles (PM10)
 Fine Particles (PM2.5)
 Ultrafine Particles (UFP)



Human Hair
 (60 μm diameter)



Particulate matter
 such as a soot particle
 (10 μm)



Human Hair (dia)

— 150 Microns

_ Average Human Hair



— 25 Microns

_ Lint, Particles Visible to the Naked Eye



— 10 Microns

_ Heavy Dust, Lint, Fertilizer, Pollen



— 5 - 10 Microns

_ Average Dust, Plant Spores, Mold

PM10



— 1 - 5 Microns

_ Bacteria, Light Dust, Animal Dander

PM2.5



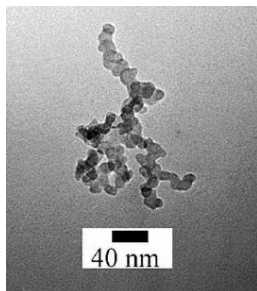
— 0.3 - 1 Microns

_ Bacteria, Tobacco and Cooking Smoke,

UFP

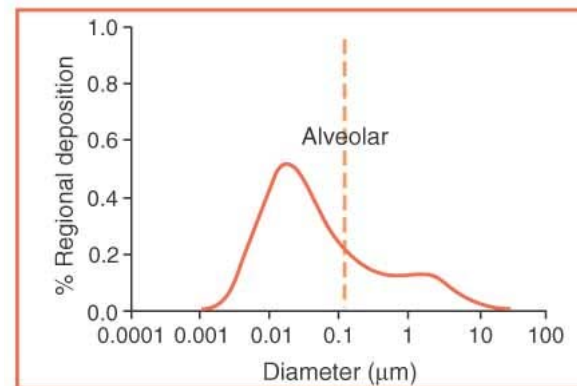
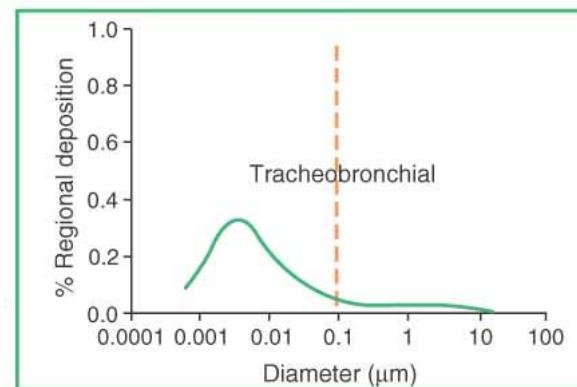
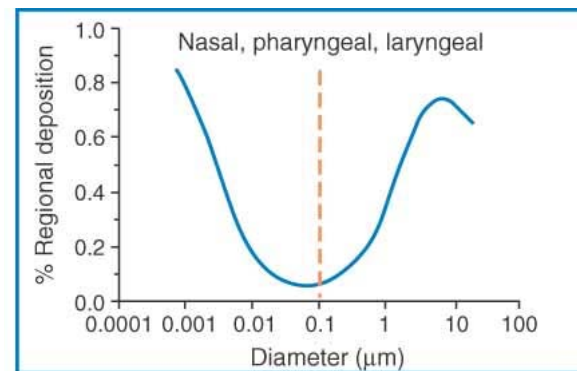
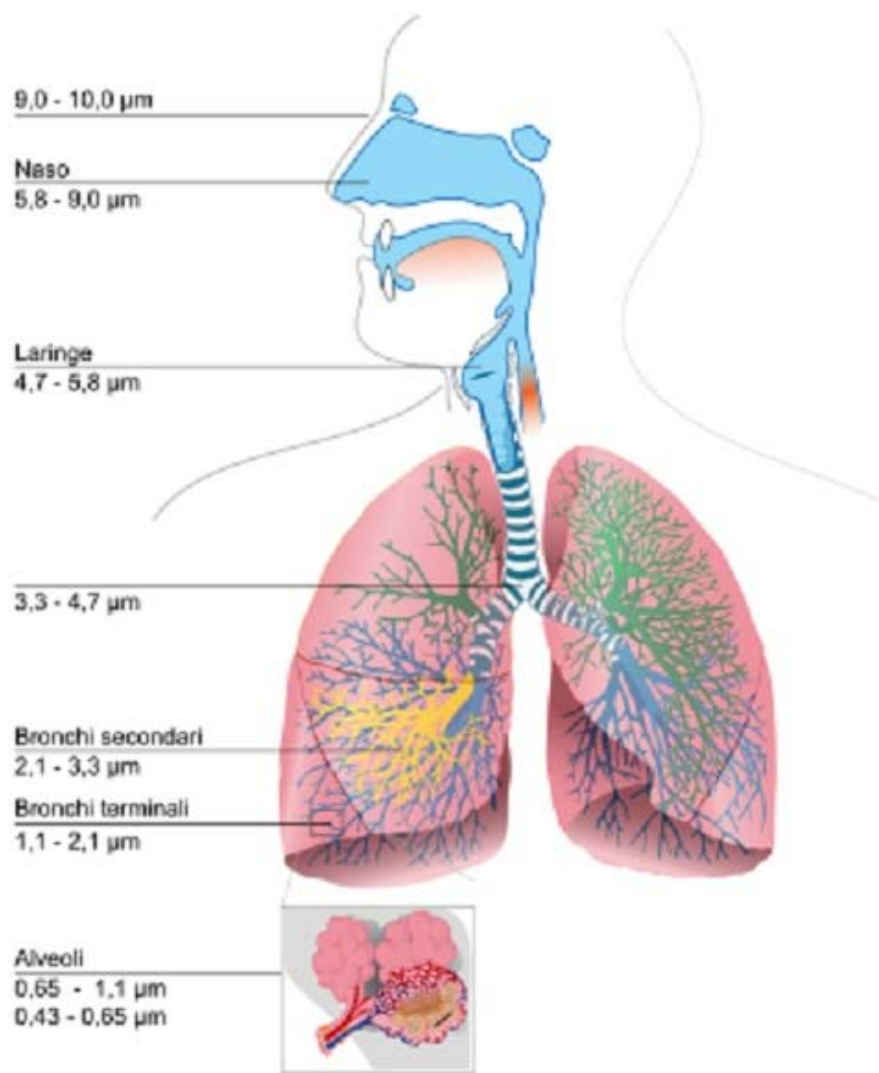
— 0.001-0.01 Microns

_ Viruses

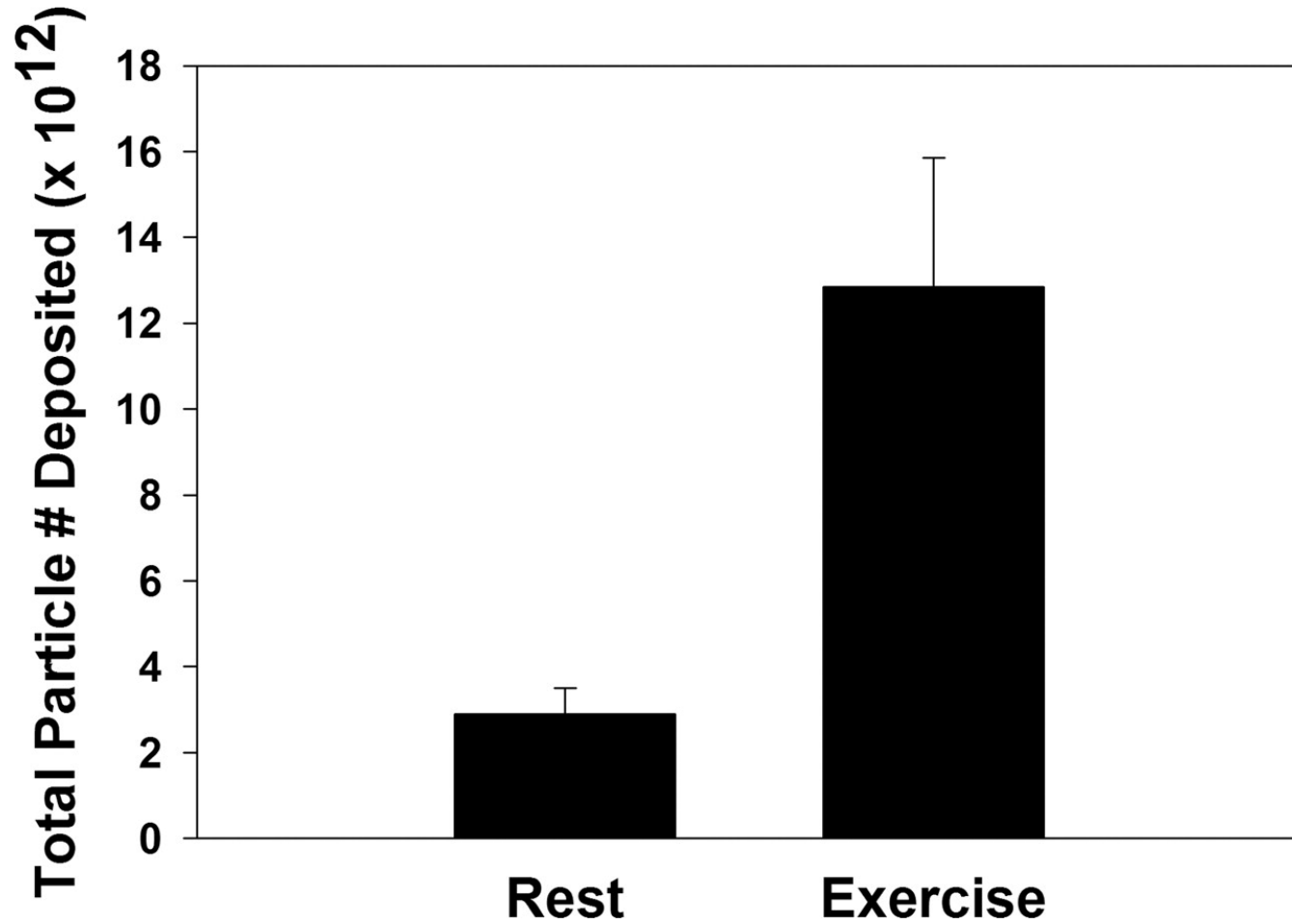


40 nm

Particle Size and Deposition in Lungs and Blood



UFP Deposition Rate Associated with Activity



Smaller Particles are More Bioactive

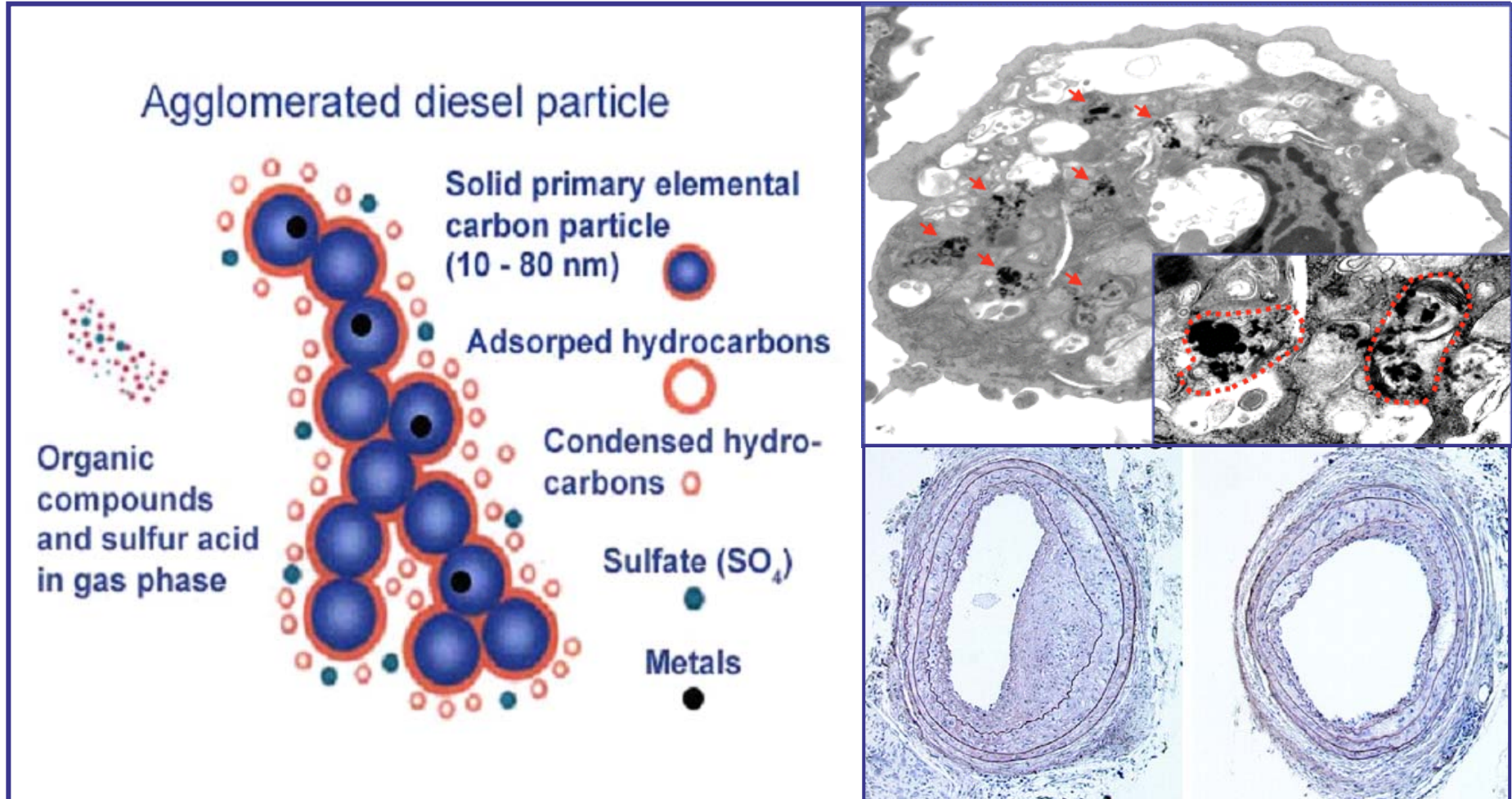
(bioactive = bad)

Parameters	Particle mode		
	Coarse (PM ₁₀)	Fine (PM _{2.5})	Ultrafine
Size	2.5–10 μm	2.5–0.15 μm	<0.15 μm
Organic carbon content	+	++	+++
Elemental carbon content	+	++	+++
Metals as % of total elements	+++	++	+
PAH content	+	+	+++
Redox activity (DTT assay)	+	++	+++
HO-1 induction	+	++	+++
GSH depletion	+	+++	+++
Mitochondrial damage	None	Some	Extensive

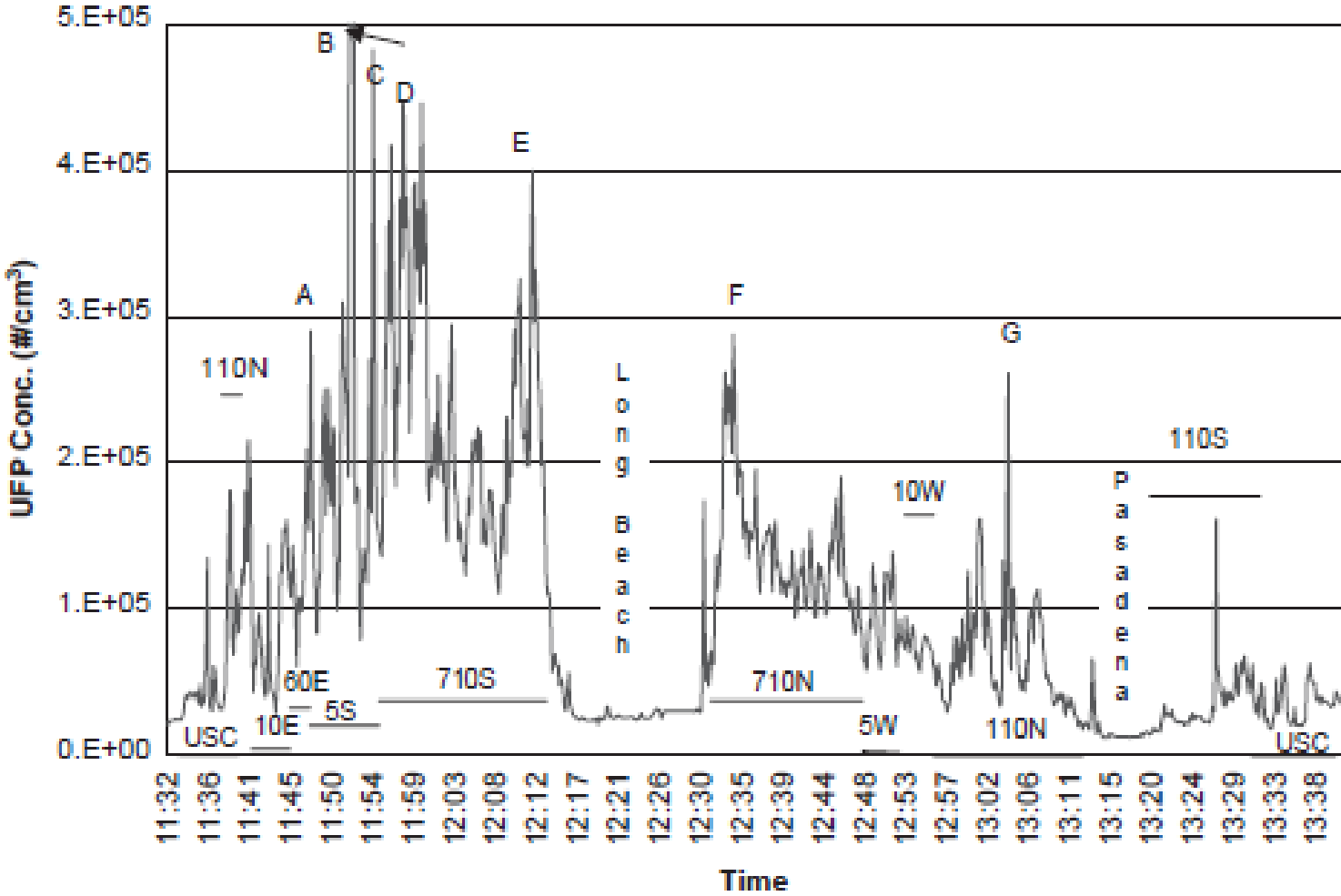
Ultrafine Particles Taken Up By Cells

Adsorbed Toxic Compounds Cause Oxidative Damage

Results in Inflammation and Increased Plaque Development in Arteries



Ultrafine Particle Concentrations on LA Freeways



Source-specific Concentrations of Ultrafine Particles in Fresno



Maximum Ultrafine Particle Levels (per 1 sec) in Fresno

