



# Health Impacts of Toxic Combustion By-Products

## *LSU Superfund Basic Research Program*

Maud Walsh and Barry Dellinger, Louisiana State University

Air & Waste Management Association, Louisiana Section Fall Conference  
October 28, 2009



# Superfund Research Program

## *National Institute of Environmental Health Sciences*

- A university-based program established in 1986 under SARA
- Supports research in the biomedical and non-biomedical fields through
- Facilitates training, community outreach, partnering, & technology transfer



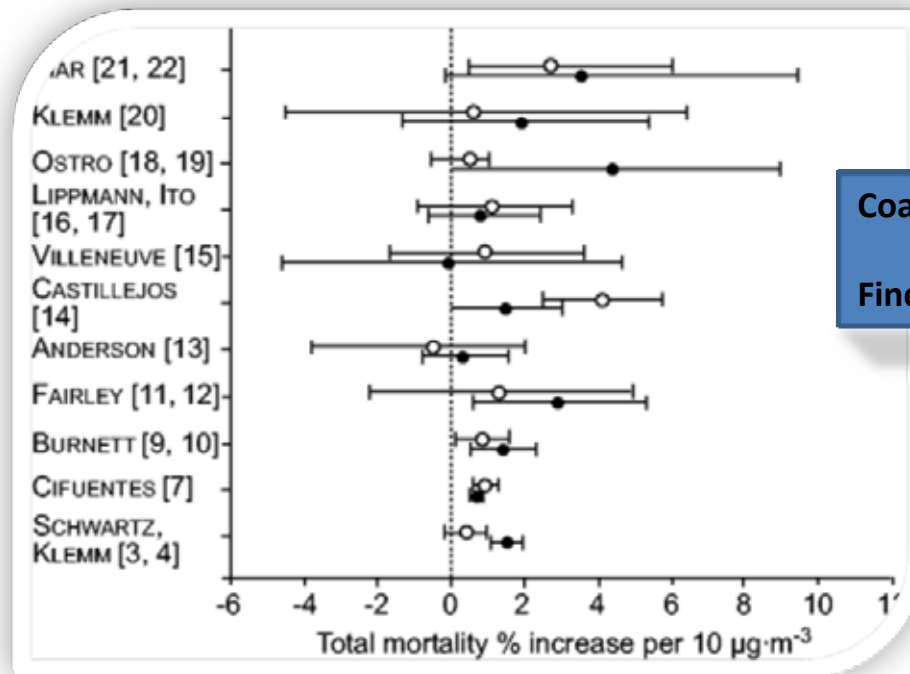
## Our research focus:

Origin and health impacts of four classes of pollutants:

- combustion-generated ultra-fine particles (UFPs) or nanoparticles
- environmentally persistent free radicals (EPFRs)
- chlorinated hydrocarbons (CHCs)
- brominated hydrocarbons (BHCs)

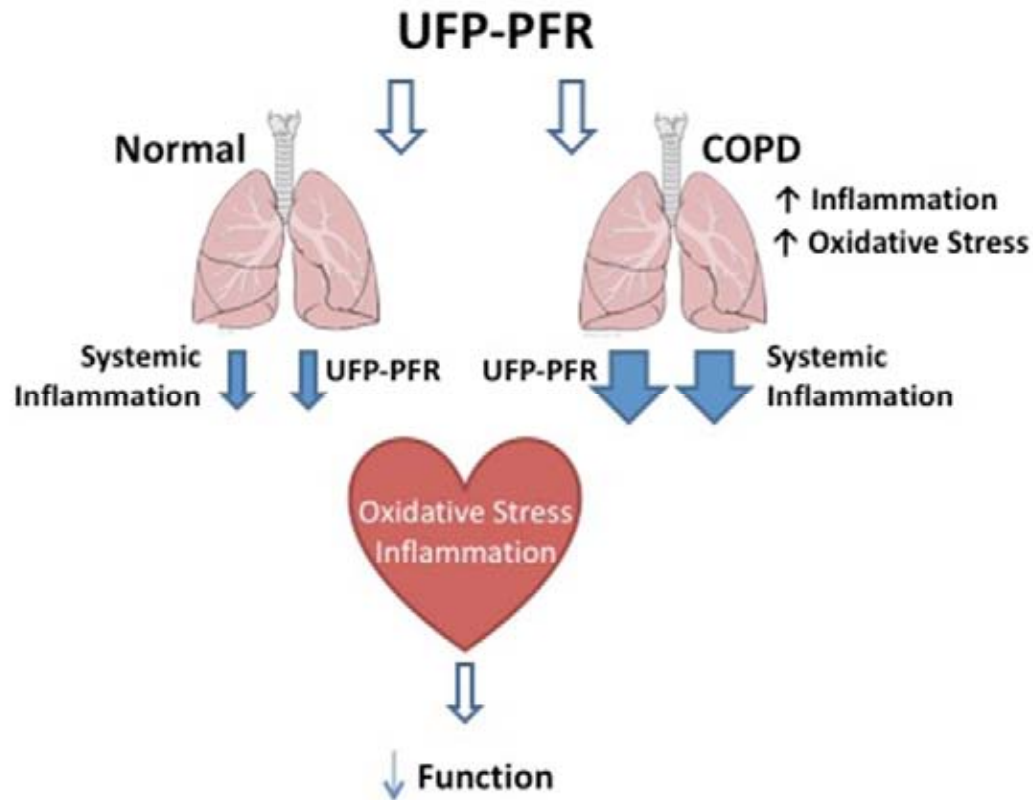


# PM: Respiratory Mortality



Coarse (PM10) ●  
Fine (PM2.5) ○

# Effect of Particulate Matter on the Cardiovascular System



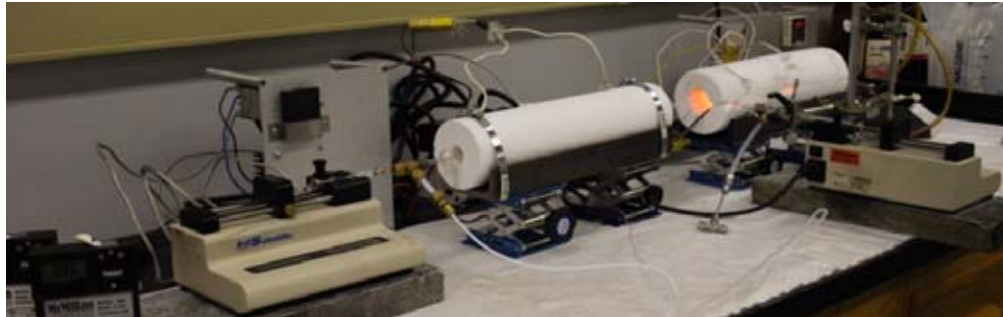
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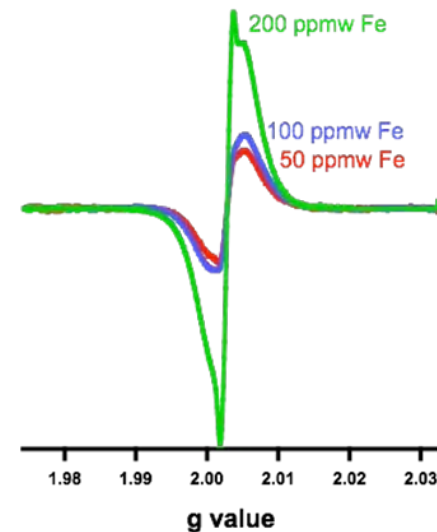
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# Combustion Research Support

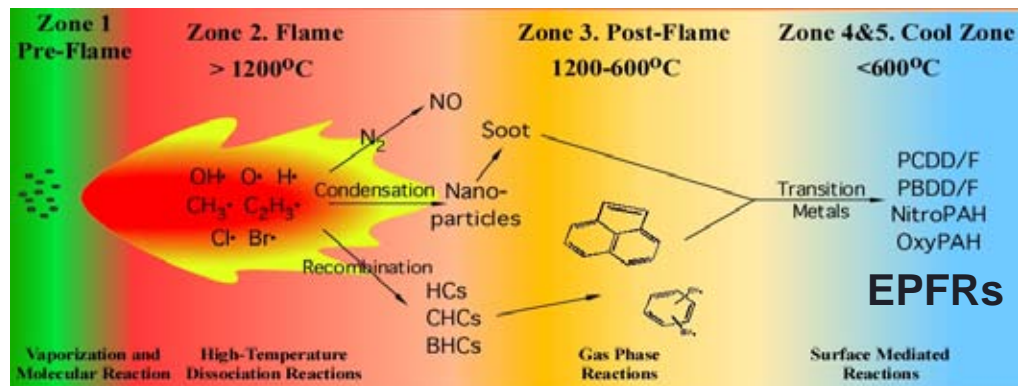


- Generate synthetic soot material in which the amount of metal oxide clusters and number of radicals can be controlled
- *Dr. Slawomir Lomnicki, LSU*



# Combustion-Generated Nanoparticles and Pollutant Formation

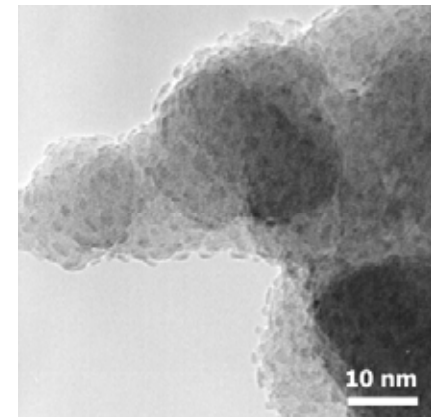
- Characterization of the metal-nanoparticle interfaces to determine how nanoparticles influence the formation of pollutants and associated radicals.
- *Dr. Erwin Poliakoff, Dr. Robin McCarley, Dr. Robert Cook, and Dr. Barry Dellinger, LSU*





# Role of Iron in the Formation of Dioxins and Persistent Free Radicals

- Effect of iron-containing fine and ultra-fine particles on the formation of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F) from chlorinated benzenes under post-flame combustion conditions.
- *Dr. Barry Dellinger and Lavrent Khachatryan, LSU*



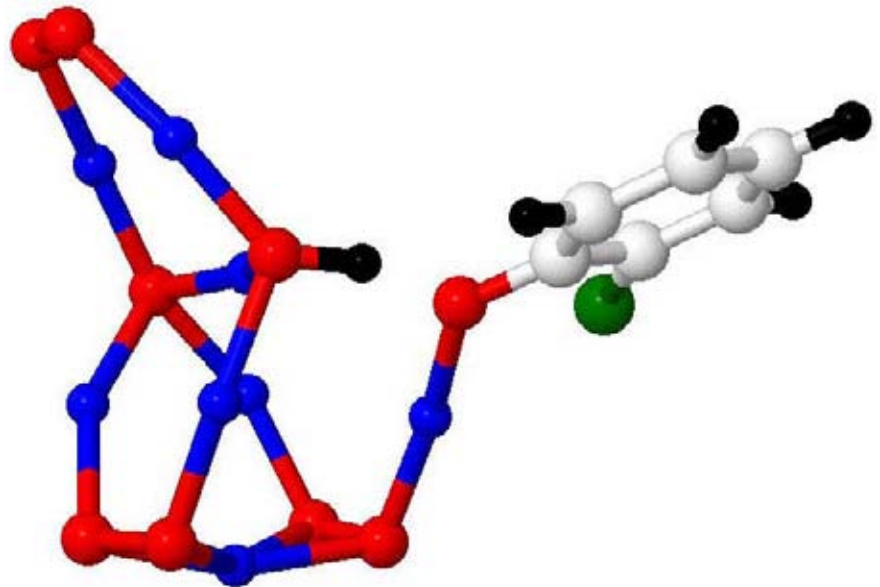
# Synthesis and Study of PXDD/Fs and Optically Active Pollutants

- Synthesis of mixed chloro/bromo PXDD/F standards and development of analytical separation methods for isolating chiral combustion byproducts.
- *Dr. Isiah Warner, LSU; Dr. Robert Strongin, Portland State University, and Dr. Barry Dellinger, LSU*



# Computational Research Support

- Model the properties and reactions of ultrafine particles, environmentally persistent free radicals, chlorinated hydrocarbons, and brominated hydrocarbons
- *Dr. Randy Hall, LSU*



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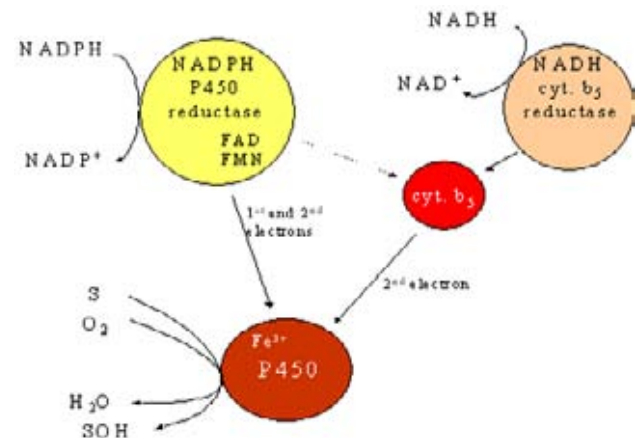
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# Pollutant-Particle Systems and Xenobiotic Bioactivation

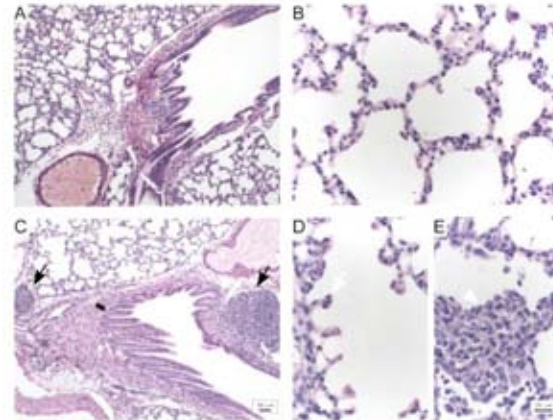
- Examination of the role of cytochrome P450 in the bioactivation of particulate matter and the effect of particle exposure on reactive oxygen species (ROS) production.
- *Dr. Wayne Backes, LSU Health Sciences Center, New Orleans*



# Ultrafine Pollutant Exposure Alters Pulmonary Immunologic Homeostasis

- Immunological and pathophysiological impact of ultrafine particle-persistent free radical systems on normal/diseased rat lungs
- *Dr. Stephania Cormier, LSU Health Science Center, New Orleans*

Air



DCB230

# Combustion-Generated UFPs: Cardiovascular and Cardiac Effects

- Effects of persistent free radical-ultrafine particle systems on oxidative stress in the heart and cardiac toxicity.
- *Dr. Kurt Varner and Dr. Pamela Lucchesi, LSU Health Sciences Center New Orleans*

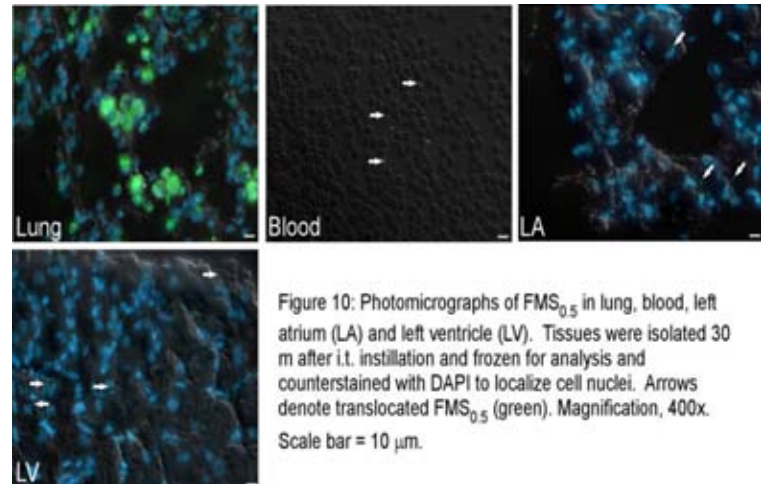
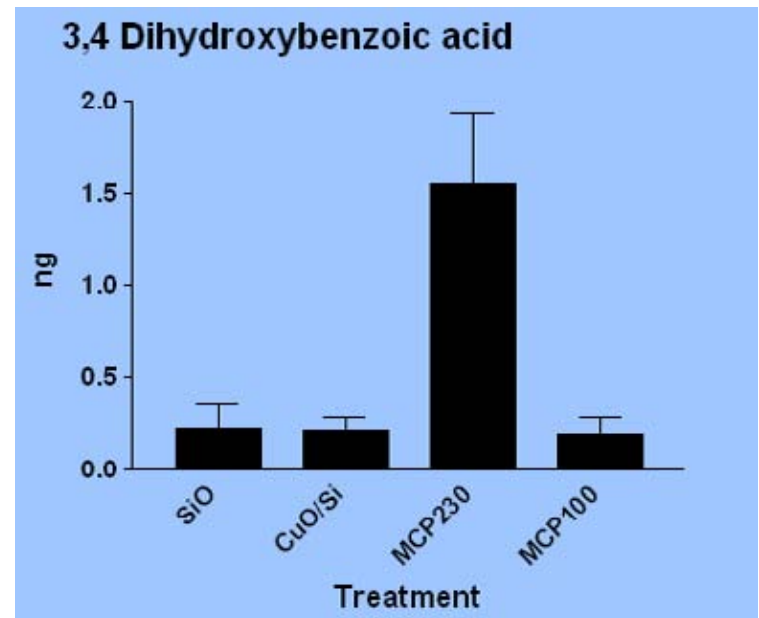


Figure 10: Photomicrographs of FMS<sub>0.5</sub> in lung, blood, left atrium (LA) and left ventricle (LV). Tissues were isolated 30 m after i.t. instillation and frozen for analysis and counterstained with DAPI to localize cell nuclei. Arrows denote translocated FMS<sub>0.5</sub> (green). Magnification, 400x. Scale bar = 10  $\mu$ m.

# Oxidative Stress Research Support

- Measures oxidant product, antioxidant levels, and oxidative stress markers in biological fluids and tissues.
- *Dr. Tammy Dugas, LSU Health Sciences Center, Shreveport*





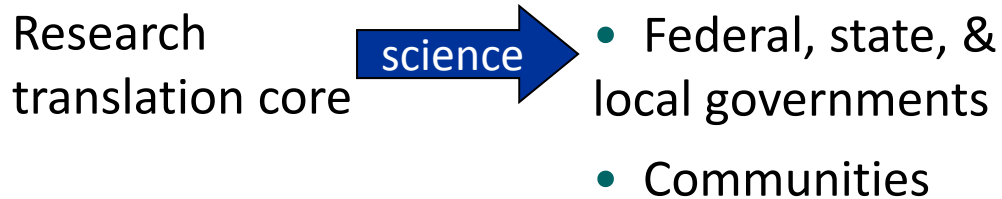
# Education

- Development of post-doctoral and graduate students in the highly interdisciplinary field of health effects engineering science.
- Dr. Robin McCarley, LSU



# Partnerships with Regulatory Agencies and Communities

## Research Translation Core



## Community Outreach Core



- Program initiated
- Aligned with the Program's science

- Partnership driven
- Draws from the expertise of program's investigators

# Outreach

- Identify key concerns of residents and create avenue of communication with Center
- Dr. Margaret Reams, LSU



Source: US Army Corps of Engineers, New Orleans District: Agriculture Street Landfill Superfund Site

<http://www.mvn.usace.army.mil/pd/iis/agriculture.htm>

# Research Translation

- Ensure that the program's research is communicated and appropriately applied to current environmental and health issues
- *Dr. Maud Walsh, LSU, and Dr. Dennis Wissing, LSU Health Sciences Center Shreveport*





**For more information:**

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