

Special Seminar & Networking Opportunities
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Human Health Implications of Environmentally Persistent Free Radicals

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Wednesday

July 20, 2011

Seminar: 10:00 – 11:30 am

Chamblee 106 1A/B

Informal Brainstorming Lunch

11:30 am – 1:00 pm

Chamblee 106 Cafeteria

Office Hours: 1:00 – 4:30 pm

By Appointment

Centers for Disease Control and Prevention

Chamblee Campus

4770 Buford Highway NE

Atlanta, GA 30341-3717

Semi-volatile pollutants have long been thought to be associated with particulate matter through adsorption to the surface or absorption in pores and cracks. However, semi-volatiles can also rapidly react and chemisorb on the surfaces of particles at moderately elevated temperatures in thermal and combustion systems. If a transition metal is present, the chemisorption results in reduction of the metal and formation of a surface-associated radical. This radical is resistant to oxidation in the atmosphere and can persist in the environment for days, weeks, or even longer. We refer to these surface-associated species as Environmentally Persistent Free Radicals (EPFRs).

At high concentrations in combustors, they can be intermediates in the formation of other pollutants, such as dioxins. However, at lower concentrations (ppm) they persist and are emitted into the atmosphere. When inhaled, the combination of the reduced metal and EPFR can stimulate the generation of reactive oxygen species (ROS), oxidative stress, and associated health effects. We have now shown that ROS are generated by a catalytic cycle in biological media in which the EPFR is not consumed.

An interesting ramification of the existence of EPFRs is that they may be mistaken for conventional molecular pollutants. Solvent extraction results in some of the EPFRs being released into the extract where they abstract hydrogens to form the molecular parent species or react with other EPFRs to form molecular species that may be erroneously assigned as molecular pollutants associated with the original particle.

Although temperatures are lower in soils contaminated with hazardous materials, the residence times can be years, instead of seconds, as they are in combustors. We have now shown that EPFRs are present in soils contaminated with pentachlorophenol at various Superfund sites. Furthermore, low temperature thermal treatment may actually increase the concentration of EPFRs as the concentration of the molecular pentachlorophenol is reduced by thermally activated chemisorption and conversion of the molecular species to the EPFR.

Dr. Dellinger's current research interests include toxic combustion by-products, particle-mediated pollutant formation, and the health impacts of environmentally-generated free radicals. At the University of Dayton, as Professor of Electro-Optics and Group Leader of Environmental Sciences and Engineering, he performed research that formed the basis for much of EPA's regulatory approach to hazardous waste incineration. *Environmental Science & Technology* selected Dellinger's paper, "[Potential for Misidentification of Environmentally Persistent Free Radicals as Molecular Pollutants in Particulate Matter](#)," for an Editor's Choice Award as one of the "Best Papers of 2010."

Learn more about his research & publications!

<http://www.ncbi.nlm.nih.gov/pubmed?term=Dellinger%2C%20Barry%5BFull%20Author%20Name%5D&cmd=DetailsSearch>
http://tools.niehs.nih.gov/srp/programs/Program_detail.cfm?Project_ID=P42ES13648
<http://www.srp.lsu.edu/>

Questions about these events? Contact Olivia Harris at 770-488-0597. Local partners outside CDC who wish to attend in person should contact OHarris@cdc.gov for security clearance (1 week notice for US citizens; 2 weeks for non-citizens). These events will not be ENVISIONED. Employees outside Atlanta and state/local partners may participate in the 10 am seminar via LiveMeeting on the internet. Please contact Sandra Gosnell (SGosnell@cdc.gov) for passcodes. Since the number of webports is limited, Chamblee campus employees should please attend in person.

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