13th International Congress on Combustion By-Products and Their Health Effects New Orleans, May 15-18 2013

Wednesday, May 15, 2013

6:00 pm to 8:00 pm	Registration and Reception

Thursday, May 16, 2013

7:30 am to 8:30 am	Breakfast
8:30 am to 8:35 am	**Orientation** – Stephania A. Cormier (LSUHSC-NO), PhD
8:30 am to 8:40 am	**Opening Address and Introduction of Dr. Birnbaum – Bill Suk** (NIEHS, director of the Superfund Hazardous Substances Basic Research and Training Program), PhD, MPH
8:40 am to 9:10 am	**Keynote Address: Linda Birnbaum** (Director, NIEHS & NTP), PhD, DABT, ATS
	Plenary Session I - Gulf Oil Spill: Emissions, Remediation, Combustion & Toxicity Moderators: **Barry Dellinger (LSU), PhD & Brian Gullett (EPA)** AB, MS, MEM, PhD
9:15 am to 9:30 am	**Plenary Talk: Maria L. Martinez**, PhD (US Environmental Protection Agency, Region 6, Dallas, TX). Ambient Air Monitoring in Response to the 2010 Gulf of Mexico Oil Spill
9:35 am to 9:50 am	Anthony Szema, MD. Emerging Respiratory Health Effects of Combustion Air Pollution in Iraq and Afghanistan: An Important Component of Iraq Afghanistan War Lung Injury (IAW-LI)
9:55 am to 10:10 am	Brian Gullett, PhD. Characterization of the Particulate Emissions from the BP Deepwater Horizon Spill Surface Oil Burns
10:15 am to 10:25 am	Slawo Lomnicki, PhD. Persistent Radicals in Tar Balls
10:30 am to 10:40 am	Arthur Penn, PhD. Direct Exposure to Deepwater Horizon Crude Oil Emulsions Elicits Morphology and Gene Expression Changes in Zebrafish embryos
10:45 am to 11:15am	Photo Session & Break
	Plenary Session II - Dosimetry and Environmental Fate of Pollutants from Combustion Sources Moderators: **Tobias Stöger (Helmholtz Zentrum München), PhD**
11:15 am to 11:45 am	**Plenary Talk: Philip Demokritou** (Harvard), PhD. Towards Accurate and Relevant Dosimetry for In Vitro Nanotoxicology
11:50 am to 12:05 am	Ian M Kennedy, PhD. Novel Lanthanide-labeled Metal Oxide Nanoparticles Improve the Measurement of In Vivo Clearance and Translocation
12:10 am to 12:20 am	Phillip M Potter, PhD. The Role of Aluminas and Aluminosilicates in PCDD/F Formation from Combustion Processes

12:25 pm to 1:30 pm	Lunch
1:30 pm to 1:45 pm	Lavrent Khachatryan, PhD. Demonstration of External vs. Internal Radicals
1:50 pm to 2:05 pm	JianHua Yan, PhD. Effect of Flocculating Agent on the Formation of Polychlorinated Dibenzodioxin and Dibenzofurans in Sewage Sludge Incineration
2:10 pm to 2:20 pm	Eric P. Vejerano, PhD. Emission of Polycyclic Aromatic Hydrocarbons, Polychlorinated Dibenzo-p-Dioxins, and Dibenzofurans from Incineration of Nanomaterials
2:25 pm to 2:55 pm	Break
	Plenary III - Environmental sampling: advances, challenges, and implications Moderators: Ian Kennedy (UC Davis), PhD & Vivian Aucoin (La DEQ), BA, BS
2:55 pm to 3:25 pm	**Plenary Talk: Richard Tropp** (DRI), PhD
3:30pm to 3:45 pm	JianHua Yan, PhD. Low Temperature Catalytic Decomposition of Gaseous 1,2-Dichlorobenzene Over CuOx/TiO2-carbon Nanotube Composite Catalysts: Experimental and Mechanism Study
3:50 pm to 4:05 pm	Rolf Zimmermann, PhD. On-line and Off-line Photo Ionization Mass Spectrometric Analysis of the Molecular Signature of PAH and Other Products of Incomplete Combustion in Gas- and Particle-phase of Combustion Aerosols
4:10 pm to 4:25 pm	Jeffrey S. Crosby, PhD. Detection of Aqueous Mercury Utilizing a Gold Nanoparticle Based Sensor
4:30 pm to 4:40 pm	Andrew Larkin, PhD. A Smartphone-centered Approach to Assessing, Predicting, and Preventing Atmospheric Eexposure to Products of Fossil Fuel Combustion
4:45 pm to 4:55 pm	M. Paul Herring, PhD. Paramagnetic Centers in Soot Formed from the Oxidative Pyrolysis of 1-Methylnaphthalene
5:00 pm to 6:30 pm	**Poster Session**
7:00 PM	Dinner (on your own)

Friday, May 17, 2013

7:30 am to 8:40 am	Breakfast
	Plenary IV - Combustion toxicology, epidemiology, and environmental studies Moderator: **Jim Diaz (LSUHSC-NO)**
8:40 am to 9:10 am	**Plenary Talk: Joe Mauderly** (LRRI), DVM. Disentangling the Causal Components of Combustion Emissions.
9:15 am to 9:30 am	Rebecca Klemm, PhD. The Impact of Air Pollution on Human Mortality in Southeastern U.S.
9:35 am to 9:50 am	**Sarofim Award**
9:55 am to 10:10 am	ShengYong Lu, PhD. Life Cycle Assessment of a Typical Medical Waste Incinerator in Eastern China
10:15 am to 10:25 am	Lucy W. Kiruri, PhD. Effect of Copper Oxide Concentration in CuO/Silica Particles on the Formation of Environmentally Persistent Free Radicals and ROS Generation

10:30 am to 10:40 am	Eric P. Vejerano, PhD. Oxidative Stress Potential of Particulate Matter from Nanowaste Incineration
10:45 am to 11:00 am	Break
	Plenary V - Pollutants from Combustion Sources: Mechanisms of Toxicity/Dysfunction (session I) Moderators: **Kurt Varner (LSUHSC-NO), PhD & Tammy Dugas (LSUHSC-S), PhD**
11:00 am to 11:30 am	**Plenary Talk: Timothy Nurkiewicz** (WVU), PhD
11:35 am to 11:50 am	James Reed, PhD. In Vitro Inhibition of Cytochrome P450-Specific Enzymatic Activities in Liver Microsomes by Ultrafine Nanoparticles Containing Environmentally Persistent Free Radicals
11:55 am to 12:05 am	Sarah Robertson, PhD. Vasoactive Circulating Factors are Induced by Diverse Inhaled Pollutants and Mediate Effects Through CD36
12:10 pm to 1:30 pm	Lunch
2:00 pm to 4:00 pm	Free Time / Plenary V/Swamp Tour
5:00 pm to 5:15 pm	XiaoDong Li, PhD. Effect of Oxygen on the Formation of Chlorobenzene and PCDD/Fs including the Potential Toxic Dioxins
5:20 pm to 5:35 pm	Mariana Ghosh, PhD. Investigation of Free Radicals Formed in the Oxidation of Acoustically Levitated a-Pinene Droplets by Electron Spin Resonance
6:00 PM	Dinner (on your own); International Executive Committee Dinner and Meeting Wolfe's in the Warehouse

Saturday, May 18, 2013

7:30 am to 9:00 am	Breakfast
	Plenary VI – Pollutants from Combustion Sources: Mechanisms of Toxicity/Dysfunction (session II) Moderators: **Stephania Cormier (LSUHSC-NO), PhD & Danielle Carlin (NIEHS), PhD**
9:00 am to 9:30 am	**Plenary Talk: Lyndsey Darrow** (Emory), PhD
9:35 am to 9:50 am	R. Zimmermann, PhD. Health Effects of Combustion-Derived Aerosols: First Results on Emission of a Ship Diesel Engine and Wood Combustion Aerosol
9:55 am to 10:10 am	Bijaya Kumar Padhi, PhD. Respiratory Health Effects of Household Solid Fuel Combustion in Rural India
10:15 am to 10:30 am	Gin Chuang, PhD. The Model Combustion-Derived Particulate DCB230 Induces Intrinsic Apoptotic Signaling and Cell Death in Cardiomyocytes
10:35 am to 10:45 am	Jordy Saravia, PhD. Immunosuppressive Effects of Early-life Exposure to Combustion-derived Particulate Matter: Implications for Modulation of Pulmonary Disease Development
10:50 am to 11:00 am	(available for late-breaking abstract)
11:05 am to 12:30 pm	**Box Lunch** **Closing Ceremony**

Poster Presentations

Thursday, May 16, 2013

5:00 pm to 6:30 pm	*Tamer Mohamed Ismail, PhD.* **CFD modeling of Chemical Looping Combustion for inherent CO2 separations** *Brendan R Burn.* **Environmentally persistent free radical inhalation aggravates ischemia-reperfusion induced left ventricular dysfunction** *Christopher J. Wingard, PhD.* **Mast Cells Contribute to the Differential Effects of Size Fractionated Ambient Particulate Matter on Aortic Vascular Reactivity and Cardiac Ischemia/Reperfusion Injury** *Cholena,L. Russo, PhD.* **Characterization of Extractable and Nonextractable Components in Fly Ash from a Municipal Waste Incinerator** *Mark D. Cohen, PhD.* **Modeling the Atmospheric Fate and Transport of Dioxin Emitted During in-situ Burning of Oil from the Deepwater Horizon Spill** *Tobias Stöger, PhD.* **Challenges of studying the pulmonary inflammatory response to carbon nanoparticles at the in vitro level** *Tobias Stöger, PhD.* **Differences in the stress response to different nanoparticles analyzed** *Tobias Stöger, PhD.* **In Vivo or In Vitro: A realistic cell exposure system for cigarette smoke: Performance characterization, real-time dose monitoring and dose-response curves** *Wonnam Lee, PhD.* **Soot Generation System for PM Study and Measurement Process Evaluation** *Guangrui Liu, PhD.* **The experiment study on the hydrocarbon synthesis by Kolbe reaction from saturated fatty acids**

Disentangling the Causal Components of Combustion Emissions

Presenting Author: Joe L. Mauderly[1]
Other Authors: Jacob D. McDonald[1] *Steven K. Seilkop*[2]
Affiliation: Lovelace Respiratory Research Institute[1]*, SKS Consulting Services*[2]

Abstract

Complex pollutant mixtures emitted from incomplete combustion vary among combustion sources and also within source categories due to variations in technologies, fuels, and operating conditions. Thus, identification, ranking, and mitigation of health hazards by source category have limited precision. Conversely, statistical associations between health outcomes and individual components of ambient pollutant mixtures have limited accuracy for attributing causality from exposure to mixtures. It is axiomatic that pollutants, rather than sources, impact health, that biological systems respond to mixtures of pollutants regardless of source, and that causation entirely by single components is likely rare. Regardless, source emissions remain a necessary focus of air quality management. We briefly review the different approaches to determining the causal components, and their combinations, that cause the cardiovascular and respiratory effects of complex pollutant mixtures, and then focus on results from application of an approach rarely employed in air pollution health research. The National Environmental Respiratory Center research program (www.nercenter.org) was created in 1998 as an experiment in addressing the multipollutant dimension of air quality health research. It adopted the strategy of constructing and analyzing a novel composition-concentration-response database created by identically-designed laboratory studies of animal response models exposed repeatedly to different source-based, complex pollutant atmospheres. Joint government-industry funding permitted populating the database with four mixtures: diesel and gasoline engine exhausts, hardwood smoke, and simulated downwind coal combustion emissions. Responses to the four mixtures are compared, and the results of regression tree analysis to rank putative causality among the many components are presented.

Emerging Respiratory Health Effects of Combustion Air Pollution in Iraq and Afghanistan: An Important Component of Iraq Afghanistan War Lung Injury (IAW-LI)

Presenting Author: Anthony Szema
Other Authors:
Affiliation: Stony Brook School of Medicine

Abstract

The U.S. Army Millennium Study noted that 14% of soldiers in Iraq had new-onset respiratory symptoms during the war. Our research team determined that 14% of military personnel from Long Island had respiratory symptoms to warrant spirometry and 6.6% were diagnosed with new-onset asthma. Only half of these asthmatics had reversible airway obstruction. We have since obtained four open lung biopsies from soldiers with dyspnea and found pathology as varied as titanium and other metals/minerals, granulomatous lung disease, and titanium with mycobacterium avium complex. Iraq dust instillation in animal models in our lab show polarizable crystals similar to open lung biopsies of soldiers studied by Dr. Robert Miller at Vanderbilt University. Suppression of immune protective regulatory T cells is seen with the mouse model, preventable with a novel class of drinkable anti-inflammatory drug called RUX. Plausible causes of Iraq Afghanistan War Lung Injury (IAW-LI) include dust storm inhalation, burn pit byproducts, improvised explosive device detonation, blast overpressure, mortar fired rounds, aeroallergens (indoor and outdoor), and ambient air pollution from burning oil well fires. As health concerns emerge, it is incumbent to review potential sources of particulate matter air pollution in order toprevent their etiology.

Oxidative Stress Potential of Particulate Matter from Nanowaste Incineration

Presenting Author: Eric P. Vejerano
Other Authors: Amara L. Holder, Linsey C. Marr
Affiliation: Virginia Tech

Abstract

Disposal of some nanomaterial-containing waste through incineration and the subsequent formation of particulate matter (PM) along with hazardous combustion by-products are inevitable. However, the toxicity of the generated PM is not known. We report the first study, to our knowledge, on the oxidative potential of PM from the incineration of paper and plastic wastes containing various nanomaterials in a laboratory-scale furnace. Reactive oxygen species (ROS) formation was measured with the dichlorofluorescein assay supplemented with the measurement of the consumption of ascorbic acid, dithiothreitol, glutathione, and uric acid antioxidants. For most samples, the oxidative potential of PM from waste containing nanomaterials was not significantly different compared with PM from unspiked control waste.

Also, PM from waste containing similar nanomaterial but with different concentrations was not significantly different. PM derived from waste containing silver and titania had elevated ROS response for some assays compared with other nanomaterials. Different antioxidants have varying sensitivity towards ROS, with ascorbic acid, glutathione, and dithiothreitol being the most sensitive, and uric acid, the least sensitive. The oxidative potential of PM was not significantly different compared with PM extracted with organic solvents, suggesting a more dominant role of ROS-active metals for particle toxicity in vitro.

Emission of Polycyclic Aromatic Hydrocarbons, Polychlorinated Dibenzo-p-Dioxins, and Dibenzofurans from Incineration of Nanomaterials

Presenting Author: Eric P. Vejerano
Other Authors: Amara L. Holder, Linsey C. Marr
Affiliation: Virginia Tech

Abstract

Given the growth in nanotechnology, disposal of some nanomaterial-laden waste through incineration is inevitable. However, nanomaterials influence on hazardous pollutant formation under high-temperature, oxidative conditions is not well understood. This paper reports the formation of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated-dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) from incineration of paper and plastic wastes containing various nanomaterials in a laboratory-scale furnace. The presence of nanomaterials in the waste stream resulted in higher emissions of some PAH species and lower emissions of others, depending on the type of waste. Emissions were sensitive to the concentration of nanomaterials in the waste, and the major PAH species formed were phenanthrene and anthracene. Generally, there were no significant differences in emission factors for the larger PAH species when nanomaterials were added to the waste.

The total PAH emission factors were on average ~6 times higher for waste spiked with nanomaterials v. their bulk counterparts. Emissions of chlorinated dioxins from poly(vinyl chloride) (PVC) waste were not detected; however, chlorinated furans were formed at high concentrations compared to the control with wastes containing silver and titania nanomaterials, and toxicity was attributable mainly to 2,3,4,7,8-pentachlorodibenzofuran. The combination of high specific surface area and (electro) catalytic properties of the nanomaterials might be responsible for affecting the formation of toxic compounds during incineration.

CFD modeling of Chemical Looping Combustion for inherent CO2 separations

Presenting Author: Tamer Mohamed Ismail[1]
Other Authors: Mohamed Abd El-Salam Al [2] Mahmoud Abd Elfattah El-Kaddy[1] Saed Ibrahim
Affiliation: Suez Canal University[1]
Other Affiliation: Cairo University[1], Al-Azhar University[2]

Abstract

A new type of coal gas fueled chemical-looping combustion (CLC) is experimentally and numerically investigated. Chemical-looping combustion may be carried out in two successive reactions between two reactors, a reduction reactor (coal gas with metal oxides) and an oxidation reactor (reduced metal with oxygen in the air), which may lead to a breakthrough in clean coal technology by simultaneously allowing efficient use of energy and greenhouse gas control. In CLC, the solid oxygen carrier supplies the stoichiometric oxygen needed for CO2 and water formation, and this leads to a free nitrogen mixture. As a result, the requirement of CO2 separation from flue gases, a major cost for CO2 capture, is circumvented. Furthermore, formation of NOx is also reduced. A good oxygen carrier for CLC shall readily react with the flue gas and shall be re-oxidized upon being contacted with oxygen. An oxygen carrier is typically formed by a metal oxide and an inert binder, which provide, respectively, oxygen storage, fluidizability, and mechanical strength.

Simulations were carried out to test the capability of the CFD model to capture changes in outlet gas concentrations with changes in number of parameters such as superficial velocity, metal oxide concentration, reactor temperature, etc. For the experiment, detailed time varying outlet concentration values were compared, and it was found that CFD simulations provided a reasonable match with this data.

Immunosuppressive effects of early-life exposure to combustion-derived particulate matter: implications for modulation of pulmonary disease development

Presenting Author: Jordy Saravia
Other Authors: Dahui You, Greg I. Lee, Bishwas Shrestha, Stephania A. Cormier
Affiliation: Louisiana State University, Health Sciences Center, New Orleans

Abstract

The association of elevated levels of ambient particulate matter with increased morbidity and mortality due to respiratory tract infections has been well documented. Interestingly, infants and young children appear to be the most vulnerable to these adversities. Using mice to model early-life exposure to combustion-derived particulate matter (CDPM), we demonstrate the development of an immunosuppressive environment in the lung as evidenced by increases in tolerogenic dendritic cells, regulatory T cells (Tregs), and IL-10 production and impairment of T effector proliferation in response to antigen. Specifically, infant mice co-exposed to CDPM and house dust mite allergen failed to develop certain hallmarks of asthma (e.g. airway hyperresponsiveness, eosinophilia, Th2 inflammation) while maintaining others (e.g. increased mucus production, elevated serum IgE). Our data suggest a mechanism of exposure-mediated modulation of pulmonary disease in infants.

Detection of Aqueous Mercury Utilizing a Gold Nanoparticle Based Sensor

Presenting Author: Jeffrey S. Crosby
Other Authors: Donald Lucas, Catherine P. Koshland
Affiliation: University of California, Berkeley

Abstract

We have developed a low cost, portable, and easy to operate aqueous mercury sensor utilizing gold nanoparticles. Gold nanoparticles have a well-studied absorbance peak due to the localized surface plasmon resonance (LSPR). The location and intensity of this peak is sensitive to the composition, size, shape and surrounding medium of the particle. The adsorption of mercury onto the gold nanoparticles changes the dielectric function of the particle, causing a shift in the LSPR peak towards higher energies. Since our sensor detects elemental mercury, to detect the total mercury in a water sample we modified an established oxidation and reduction scheme to work with our system. Briefly, all forms of mercury are oxidized to ionic mercury with bromine monochloride. The ionic mercury is subsequently reduced to elemental mercury with stannous chloride. Air bubbling through the disposable sampling container separates the elemental mercury, which then interacts with the nanoparticles, adsorbing onto the surface and causing a shift in the LSPR.

The rate of the LSPR peak shift is linearly proportional to the concentration of mercury in the solution, with concentrations as low as 0.5 μg/L in a 400mL sample being directly measured within 150 seconds. The active sensing element is 1 sq.cm. and the entire apparatus could be easily modified to be field deployable. Further sensitivity gains may be realized by increasing the volume of the sample and optimizing the mercury mass transfer to the sensor. Additionally, the method has been applied towards specimens collected from the field with promising results.

Novel lanthanide-labeled metal oxide nanoparticles improve the measurement of in vivo clearance and translocation

Presenting Author: Ian M. Kennedy
Other Authors: Aamir Abid, Donald Anderson, Gautom Das
Affiliation: University of California, Davis

Abstract

The deposition, clearance, and translocation of europium-doped gadolinium oxide nanoparticles in a mouse lung were investigated experimentally. Nanoparticles were synthesized by spray flame pyrolysis. The particle size, crystallinity, and surface properties were characterized. Following instillation, the concentrations of particles in organs were determined with inductively coupled plasma mass spectrometry. The protein corona coating the nanoparticles was found to be similar to the coating on more environmentally relevant nanoparticles such as iron oxide. Measurements of the solubility of the nanoparticles in surrogates of biological fluids indicated very little propensity for dissolution, and the elemental ratio of particle constituents did not change, adding further support to the contention that intact nanoparticles were measured.

The particles were intratracheally instilled into the mouse lung. After 24 hours, the target organs were harvested, acid-digested, and the nanoparticle mass in each organ was measured by inductively coupled plasma mass spectrometry (ICP-MS). The nanoparticles were detected in all the studied organs at low ppb levels; 59% of the particles remained in the lung. A significant amount of particles was also detected in the feces, suggesting fast clearance mechanisms. The nanoparticle system used in this work is highly suitable for quantitatively determining deposition, transport, and clearance of nanoparticles from the lung, providing a quantified measure of delivered dose.

Life Cycle Assessment of a Typical Medical Waste Incinerator in Eastern China

Presenting Author: ShengYong Lu
Other Authors: WenJuan Li, XiaoDong Li, JianHua Yan
Affiliation: Zhejiang University, Hangzhou

Abstract

In China, medical waste (MW) is the waste first listed in the National Hazardous Waste Catalog. Since the increasing generation of MW has a bad effect on humans and the environment, the environmentally sound disposal of MW must be carried out. Incineration is a more appropriate method which is encouraged by the Chinese government compared with landfills and gasification/pyrolysis. This study utilized life cycle assessment to analyze environmental impact of MW incineration. A rotary kiln incineration model was built and data inventory was established based on the running plant in Zhejiang province, China. Environmental impact was quantified in order to facilitate the evaluation.

Through analyzing environmental impact, MW rotary kiln incineration had an obvious contribution to global warming, acidification, nutrient enrichment, and human toxicity. NOX, CO2, and heavy metals among pollutants emitting from incineration increased environmental burdens. Since MW incineration plant was equipped with bag filter and activated carbon adsorption, PCDD/Fs seemed to cause little harm to the environment. This shows that the running incineration plants can control PCDD/F emission well. According to the results, the study also proposed the improvement directions on the basis of the present pollutant removal effects: strengthening CO2 monitor and NOX control and strictly disposing of fly ash and bottom slag.

Low Temperature Catalytic Decomposition of Gaseous 1,2-Dichlorobenzene over CuOx/TiO2-carbon Nanotube Composite Catalysts: Experimental and Mechanism Study

Presenting Author: JianHua Yan
Other Authors: QiuLing Wang, ShengYong Lu, XiaoDong Li, Tong Chen
Affiliation: Chinese Academy of Sciences, Beijing

Abstract

Gaseous 1, 2-dichlorobenzene (1, 2-DCBz) were catalytically decomposed in a fixed-bed catalytic reactor with copper oxide supported on titanium oxide-based (CuOx/TiO2) catalysts at low temperature (<200 ^{0}C). Carbon nanotubes (CNTs) which have been proved as great adsorbents for organic pollutants were introduced to prepare novelty CuOx/TiO2-CNTs catalysts by sol-gel method in this paper. The addition of CNTs can evidently promote the catalytic activity, especially at low temperatures: catalytic removal efficiency of 1, 2-DCBz was only 55% at 150 ^{0}C; without CNTs, however, it was increased to around 80% after 10 w% CNTs being added.

The influences of reaction temperature, catalyst composition (i.e. CuOx and CNTs contents) and reaction atmosphere on composite catalyst activity were investigated. Scanning electron microscope (SEM) and transmission electron microscope (TEM) were conducted to reveal the catalyst micro surface morphology. Additionally, these home-made catalysts were further characterized by means of X-ray diffraction (XRD), temperature-programmed reduction (TPR), energy dispersive X-ray (EDX) Spectroscopy analysis and N2-adsorption. Furthermore, catalytic reaction mechanism was also analyzed based on the reaction intermediate product detection and catalyst characterization before and after catalytic reaction.

Effect of Oxygen on the Formation of Chlorobenzene and PCDD/Fs Including the Potential Toxic Dioxins

Presenting Author: XiaoDong Li
Other Authors: Jie Yang, Tong Chen, ShengYong Lu, JianHua Yan, Kees Oile
Affiliation: Zhejiang University, Hangzhou

Abstract

Since Kees Olie et.al found PCDD/Fs in fly ash from MSWI in 1970s, significant research has been done on the formation mechanism of PCDD/Fs. They found that precursor, chlorine in feed, temperature, residence time, and oxygen availability etc. were the key parameters affecting PCDD/Fs emission during thermal process. It could be useful to control and optimize incinerator operating conditions. In this study, a model fly ash was added with CuO to further study the effect of oxygen (oxygen content 0%, 6, 10, 21%) on CBz and PCDD/Fs formation including 136 isomers.

The results showed that the ratio of PCDD/PCDF increased with the oxygen increment (0.78-3.74). It means that the increase of oxygen concentration contributes to the generation of PCDD. At the same time, we presented a concept of the potential toxic dioxin: chlorine substituted on arbitrary three positions of 2,3,7,8 on non-toxic dioxins. It contains 45 isomers and the concentration of the potential toxic dioxin has a good correlation with toxic dioxins (R2 =0.997). Besides, the concentration of CBz and PCDD/Fs are almost perfectly correlated with oxygen content (R2=0.968 and 0.991 respectively).CBz and PCDDFs also has a good correlation (R2 =0.968).

Effect of Flocculating Agent on the Formation of Polychlorinated Dibenzodioxin and Dibenzofurans in Sewage Sludge Incineration

Presenting Author: JianHua Yan
Other Authors: XiaoQing Lin, ShengYong Lu, Fei Wang, XiaoDong Li, HuiPing Xiao, Ke Yuan
Affiliation: Chinese Academy of the Sciences, Beijing

Abstract

As we known, flocculating agent is widely used to improve the property of sludge dewatering in industrial wastewater treatment. However, there is seldom study on effect of flocculating agent on the formation of polychlorinated dibenzodioxins and dibenzofurans (PCDD/Fs) in sewage sludge incineration process. The paper did experiments to study on it found that polyacrylamide (PAM) flocculant, which is an organic flocculant, inhibited the formation of PCDD/Fs in sewage sludge incineration process, while inorganic flocculant, such as polymerization ferric chloride (PFC) and poly aluminum chloride (PAC), promoted the formation. Since PAM flocculant contains amino, which can inhibit the formation of PCDD/Fs to some extent as the previous study confirmed, it reduces the formation of dioxins.

There exists chlorine content in PFC and PAC flocculants that could provide chloride source for the formation of PCDD/Fs in the incineration process, and then it can promote the formation of dioxins. Moreover, PFC and PAC flocculants can provide metal catalyst, such as $FeCl_3$ and $AlCl_3$, for the formation. Therefore, we should strictly regulate the use of inorganic flocculants in industrial wastewater treatment, and we can give priority to the use of organic flocculants.

Direct Exposure to Deepwater Horizon Crude Oil Emulsions Elicits Morphology and Gene Expession Changes in Zebrafish embryos

Presenting Author: Arthur Penn
Other Authors: Frances Xin[1, 2, 3], Rui Xiao [1], Allen Bui[1, 4], Zakia Perveen[1], Louis Thibodeaux[5], Scott Miles[6], Kevin Kleinow[1]
Affiliation: LSU Veterinary Medicine[1], University of Pennsylania[2], St. Olaf College[3], LSU School of Medicine[4], LSU Chemical Engineering[5], LSU School of the Coast and Environment[6]

Abstract

Rationale: The 2010 Deepwater Horizon (DH) blowout damaged marine habitats and halted commercial fishing in much of the Gulf of Mexico. As the spill continued, polynuclear aromatic hydrocarbon-rich emulsions washed up along the Gulf shoreline. Zebrafish embryos (ZFE), a well-established model for vertebrate development, are very sensitive to a variety of environmental pollutants.

Methods: We assessed short-term developmental responses of ZFE that were exposed directly (from 0-48; 24-72; or, 48-96 hours post-fertilization) to DH-derived emulsions collected from 4 sites along the Gulf (in MS, AL, and FL). ZFE were examined for morphological and behavioral changes; Affymetrix ZF arrays were used to assess gene expression changes in emulsion-exposed ZFEs from each site at each time point; and qRT-PCR was used to confirm fold-change values of selected genes. Alkane/PAH levels were determined.

Results: Similar morphological changes (axial malformations, pericardial and yolk sac edema), altered swimming patterns and enhanced levels of gene expression were observed in samples from all the sites. Phase I biotransformation-related genes (cyps1a, 1b1, 1c1, 3a65; plus ahrr and sult6b1) displayed greater levels of up-regulation compared to oxidative stress genes (nqo1, prdx1, hmox1) at earlier stages of ZFE development. Phase I gene expression levels dropped rapidly after ZFE were removed from the emulsions. Up-regulation of oxidative stress genes persisted even after ZFE were washed and placed in emulsion-free media. The collection site of the emulsions did not appreciably affect gene expression response patterns.

Conclusions: DH spill products from a 200-mile stretch across the Gulf were persistently embryotoxic.

A smartphone-centered approach to assessing, predicting, and preventing atmospheric exposure to products of fossil fuel combustion

Presenting Author: Andrew J Larkin[1, 2, 3]
Other Authors: William M. Baird[1, 3], David E. Williams[1, 3, 4]
Affiliation: Environmental and Molecular Toxicology, Oregon State University[1], Statistics, Oregon State University[2], Superfund Research Center, Oregon State University[3], Linus Pauling Institute, Oregon State University[4]

Abstract

Environmental pollutant monitoring and modeling are well-established fields that have vast potential for assessing and preventing exposure to atmospheric byproducts of fossil fuel combustion. This potential however, has remained largely unrealized. We developed a software package centered on smartphone technology to integrate environmental modeling, risk prevention, community outreach, and personal healthcare using free open-source technology. Environmental models of hourly PM2.5, PM10, and ozone concentrations for the state of Oregon were created using MODIS satellite imagery and Oregon Department of Environmental Quality (DEQ) hourly atmospheric measurements. Smartphone locations were sent at 30 minute intervals to a database storing the environmental models, and predicted exposure levels at the given locations were returned to the corresponding smartphone within 60 seconds. Predicted exposures were presented to users as interactive Google maps and graphs color-coded to coincide with the EPA air quality index (AQI) categories.

Exposure warning levels were set by users via interactive color-coded bars, and users were notified if predicted concentrations within a minimum of 10km exceeded warning levels. Exposure maps for the entire sampling population were automatically generated on an hourly basis, as well as for selected time points of interest. Personal predicted exposure histories were uploaded via Bluetooth to approved computers and viewed as Google maps and graphs for consulting with a physician or identifying exposure sites for emergency medical treatment related to chemical exposures. We conclude that smartphone applications coupled with environmental models have the potential to provide a low-cost technology for improving human health.

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Respiratory Health Effects of Household Solid Fuel Combustion in Rural India

Presenting Author: Bijaya Kumar Padhi[1]
Other Authors: Pratap Kumar Padhy[2], VK Jain[3], Pinaki Panigrahi[4]
Affiliation: Centre for Environmental and Occupational Health, Asian Institute of Public Health, Bhubaneswar, India[1], Centre for Environmental Studies, Visva-Bharati University, India[2], School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India[3], Center for Global Health and Development, College of Public Health, University of Nebraska Medical Center, USA[4]

Abstract

The recently released "Global Burden of Disease 2010," a new systematic analysis of all major global health risks, has concluded that household air pollution (HAP) from cooking with solid fuels kills 4 million people annually worldwide. The disease burden from the HAP is a consequence of exposure to the toxic pollutants produced by solid fuels burned in open fires or stoves in the home for cooking or heating. The study reports the results of a cross sectional survey of household fuel combustion, indoor air pollution and respiratory health effects among women (primary cook) in rural Odisha, India. The incidence of respiratory illness were determined using a standard questionnaire survey of 1372 adult women aged 22 to 50 years. A peak flow meter was used to study the lung function test. Indoor PM10 and PM2.5 concentrations were measured using portable air samplers.

The association between household solid fuel combustion and respiratory health effects were evaluated with logistic regression analyses. Most of the study subjects (76.52%) had experienced symptoms of respiratory illness in the 30 days preceding the survey. The study finds a high correlation between indoor PM2.5 levels and peak expiratory flow (PEF). The study demonstrated that exposure to solid fuel combustion is associated with indoor air pollution and respiratory health effects.

Characterization of the Particulate Emissions from the BP Deepwell Horizon Spill Surface Oil Burns

Presenting Author: Brian Gullett
Other Authors: Dennis Tabor, Michael Hays
Affiliation: U.S. EPA, Office of Research and Development

Abstract

A particle sample gathered from the plume of the purposely-burned surface oil during the BP Deepwater Horizon disaster in the Gulf of Mexico was analyzed for polycyclic aromatic hydrocarbons (PAHs), organic acids, organic carbon (OC), elemental carbon (EC), metals, and chloro-organics, including polychlorinated dibenzodioxins/dibenzofurans (PCDDs/PCDFs). Emission factors were estimated based on carbon capture from background-adjusted CO2 and PM-bound C. The Total PM emission factor was 75 g/kg oil burned. The mean of five thermal-optical analyses indicated that the burned crude oil particulate matter was 95% carbon (w/w) with the predominance being refractory elemental carbon (82% w/w). PAHs accounted for roughly 60 µg/g of the PM mass or 4.5 mg/kg oil burned. The PCDD/PCDF concentration of the PM was 1.5 to 3.3 ng TEQ/kg oil burned, consistent with earlier analysis of a dedicated gas/solid sample.

Environmentally persistent free radical inhalation aggravates ischemia-reperfusion induced left ventricular dysfunction

Presenting Author: Brendan R Burn
Other Authors: Sarah E Mahne, Venkat N Subramaniam, Kurt J Varner
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Abstract

Environmentally persistent free radicals (EPFRs) have been identified in the particulate matter (PM) milieu at Superfund sites. These EPFRs, capable of redox cycling and the continual generation of radical species, form during combustion processes as halogenated hydrocarbons chemisorb to transition metal-oxide-containing particles. We showed short-term inhalation of EPFRs decreased stroke volume (SV) and cardiac output (CO) in rats secondary to increased pulmonary resistance and decreased ventricular filling. EPFRs also increased markers of oxidative stress and inflammation both systemically and in the left ventricle.

Epidemiological studies link PM exposure to increased cardiac morbidity and mortality from ischemic events. Therefore, the current study sought to determine if prior exposure to EPFRs would increase cardiac vulnerability to ischemia-reperfusion (I-R) injury. The EPFRs tested were surrogates consisting of 1, 2-dichlorobenzene chemisorbed to a silica/CuO particle at 230C (DCB230). Rats were exposed via nose-only inhalation to DCB230 (171 µg), silica particles or vehicle for 20 min/day for 7 days. Ventricular function was measured in vivo via pressure-volume catheterization. I-R injury was induced by 20 min ligation of the left anterior descending coronary artery followed by 60 min of reperfusion. Compared to controls, baseline CO, stroke work and SV were significantly reduced by exposure to DCB230 and further reduced by ischemia. These data show that EPFRs reduce baseline ventricular function and exacerbate the decrease elicited during I-R injury.

The Model Combustion-derived Particulate DCB230 Induces Intrinsic Apoptotic Signaling and Cell Death in Cardiomyocytes

Presenting Author: Gin C. Chuang[1]
Other Authors: Barry Dellinger[2], Slawo Lomnicki[2], Kurt J. Varner[1]
Affiliation: Department of Pharmacology, Louisiana State University Health Sciences Center, New Orleans, Louisiana[1], Department of Chemistry, Louisiana State University and A&M College, Baton Rouge, Louisiana[2]

Abstract

Epidemiology studies have linked combustion-derived particulate exposure to increased incidence of heart-related diseases and death. To model particulates generated in the post-flame cool zone, the environmentally persistent free radical (EPFR) DCB230 was synthesized by chemisorption of 1,2-dichlorobenzene to 0.2 m silica particles containing 5% Cu(II)O at 230C. Electron paramagnetic resonance showed that the radical signal of DCB230 is comparable to those of environmentally-sampled EPFRs. Previously, we demonstrated that DCB230 induced inflammation and oxidative stress in both lung and heart of exposed rats. Using HL-1 cardiomyocytes, we tested the hypothesis that DCB230 exposure induces apoptosis, a signaling mechanism activated by inflammation and oxidative stress, and causes cell death.

Lactate dehydrogenase (LDH) release, a marker of late cell death, was observed after 8 hours of DCB230 treatment (0-200 g/mL, n=3). Caspase 3, caspase 9, and poly (ADP-ribose) polymerase 1 cleavage also increased dose-dependently with DCB230 concentration after 8 hours of treatment, indicating apoptotic signaling activation. In contrast, caspase 9 cleavage was detected in absence of cell death after 2 hours of DCB230 treatment (0-200 g/mL, n=3), indicating an initiation of early intrinsic apoptotic signaling and suggests of mitochondrial involvement. Confocal microscopy showed that 2 hours of DCB230 treatment (100 g/mL, n=3) decreased mitochondrial membrane potential, a marker of mitochondrial dysfunction. Taken together, DCB230 exposure depolarized mitochondria in cardiomyocytes, leading to the activation of canonical intrinsic apoptotic signaling and resulting in cell death. Future studies will assess mitochondrial permeability transition and autophagy as contributing mechanisms.

Mast Cells Contribute to the Differential Effects of Size Fractionated Ambient Particulate Matter on Aortic Vascular Reactivity and Cardiac Ischemia/Reperfusion Injury

Presenting Author: Christopher J. Wingard[1]
Other Authors: Jared M. Brown[2], Robert M. Lust[1]
Affiliation: Department of Physiology, East Carolina Univeristy[1], Department of Pharmacology & Toxicology, East Carolina University[2]

Abstract

Background: Epidemiological studies have demonstrated that ambient air pollution particulate matter (PM) concentrations increased risk for adverse cardiovascular events. Degranulated tissue mast cells have been observed in cardiovascular tissue following PM exposure. However, little data exists on the contribution of mast cells to the adverse health effects of PM despite their recognized role in allergic inflammation and asthma and cardiovascular disease.

Objectives: The aim was to examine the contribution of mast cells to the pulmonary and cardiovascular responses following instillation of coarse (PM10), fine (PM2.5) and ultrafine (PM0.1) particulate matter in C57BL/6 and B6.Cg-KitW-sh mast cell deficient mice.

Methods: We assessed the role of mast cells by comparing pulmonary inflammation, aortic vascular reactivity and myocardial ischemia/reperfusion injury between C57BL/6 and B6.Cg-KitW-sh mice, as well as activation of bone marrow-derived mast cells (BMMCs) in vitro.

Results: C57BL/6 mice instilled with PM exhibited increased pulmonary inflammation, altered aortic vascular reactivity and myocardial ischemia/reperfusion injury. These endpoints were attenuated or absent in B6.Cg-KitW-sh mice. PM0.1 produced the largest expansion of infarct size. While PM10 had the greatest effect on BMMC activation as measured by degranulation and TNF-alpha production which was dependent on scavenger receptor class B (SR-BI/II).

Conclusions: These findings demonstrate that mast cells are critical mediators of the cardiovascular effects that are observed following PM exposure and in particular the response to ultrafine PM.

Characterization of Extractable and Nonextractable Components in Fly Ash from a Municipal Waste Incinerator

Presenting Author: Cholena,L. Russo
Other Authors: Barry,Dellinger, Slawo Lomnicki, Phillip M. Potter
Affiliation: Louisiana State University

Abstract

Studies performed on fly ash demonstrate exposure induces adverse health effects. Fly ash is known to generate reactive oxygen species (ROS) in physiological conditions resulting in oxidative stress. Recently discovered environmentally persistent free radicals (EPFRs) are known to be present in fly ash. A key issue is whether the toxicity is caused by the nonextractable components or the extractable components. Micro soxhlet extractions were implemented for removal of the extractable components. A comparison was made between data obtained from thermal desorption studies and micro soxhlet extraction studies.

Modeling the Atmospheric Fate and Transport of Dioxin Emitted During in-situ Burning of Oil from the Deepwater Horizon Spill

Presenting Author: Mark D. Cohen
Other Authors: Roland Draxler, Richard Artz, Steven Fine, Hyun Cheol Kim, Daewon Byun
Affiliation: NOAA Air Resources Laboratory

Abstract

The regional atmospheric fate and transport of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) emitted from the ocean-surface burning of oil from the Deepwater Horizon (DWH) spill was modeled. The simulations were carried out on a congener-specific and burn-by-burn basis, using a special version of the NOAA HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) model designed to simulate semi-volatile pollutants such as PCDD/Fs (HYSPLIT-SV). Burn-by-burn emissions estimates were made by combining the estimated amounts of oil burned with PCDD/F emissions factors measured by Aurell and Gullet (Environ. Sci. Technol. 2010, 44, 9431). Time-dependent atmospheric deposition fluxes and ground-level concentrations of PCDD/Fs were estimated throughout a 5 x 5 degree domain (centered on DWH site) with a resolution of 0.1 degrees (~10 km).

Due to the varying nature of burn activity and meteorology, the modeled air concentrations and deposition of PCDD/Fs downwind of the DWH site was highly episodic. Illustrative examples of mass balances, ambient concentration time series at selected locations, and maps of deposition and concentration will be shown. To summarize the results, the individual congener simulations were added together using the congener-specific toxic-equivalent (TEQ) factor, in the usual manner, to create results expressed as TEQ. The overall results of this modeling were utilized by the USEPA in their screening level assessment of risks due to dioxin emissions from burning oil from the DWH spill (Schaum et al., Environ. Sci. Technol. 2010, 44, 9383).

Ambient Air Monitoring in Response to the 2010 Gulf of Mexico Oil Spill

Presenting Author: Maria L. Martinez
Affiliation: US Environmental Protection Agency, Region 6, Dallas, TX

Abstract

The 2010 BP oil drilling rig explosion in the Gulf of Mexico resulted in an oil spill unprecedented in the Gulf. It raised many issues, including concerns about human health, food safety, wildlife, waste disposal and water and air quality. The U.S. Environmental Protection Agency (EPA) is one of many agencies that provided support to the U.S. Coast Guard-led federal response to the spill. As part of the spill response, the Agency monitored the ambient air quality in the Gulf region from New Orleans, Louisiana to Panama City, Florida for air pollutants associated with the spill that could adversely affect public health. The EPA monitored more than 170 pollutants including particle pollution (PM), ozone (O3), numerous volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and hydrogen sulfide (H2S).

The Agency focused on pollutants with the potential to pose risks to public health that could be emitted from burning oil at sea (controlled, in-situ burns), evaporate from "fresh" oil at sea, or evaporate from "weathered" oil near the shore or on the shore. In addition, the Agency and states monitored the air in response to odor complaints. The presentation will include a summary of the air quality data EPA collected on shore in the Gulf region during the spill. It will also include an evaluation of the spills impact on air quality based on information gathered from the monitors and the potential for health effects from exposure to the measured pollutants.

Paramagnetic Centers in Soot Formed from the Oxidative Pyrolysis of 1-Methylnaphthalene

Presenting Author: M. Paul Herring
Other Authors: Lavrent Khachatryan, Slawomir Lomnicki, and Barry Dellinger
Affiliation: Louisiana State University

Abstract

The identity of radical species associated with particulate formed from the oxidative pyrolysis of 1-methylnaphthalene (1-MN) was investigated using Low Temperature Matrix Isolation EPR Spectroscopy (LTMI-EPR), a specialized technique that provided a method of sampling and analysis of the gas-phase radical components. A superimposed EPR signal was identified through the manipulation of the sample matrix. The distinguishable radical species were identified as delocalized electrons in a carbon matrix (soot radicals), organic radicals consisting of carbon centered radicals σ-and π-type), as well as some trace amounts of oxygen centered radicals. Formation of these radical species was promoted by the addition of Fe(III)2O3 nanoparticles. Enhanced radical formation from the addition of Fe(III)2O3 nanoparticles can account for the observed increased sooting tendency associated with Fe(III)2O3 nanoparticle addition.

Abstract Withdrawn

In Vitro Inhibition of Cytochrome P450-Specific Enzymatic Activities in Liver Microsomes by Ultrafine Nanoparticles Containing Environmentally Persistent Free Radicals

Presenting Author: James R. Reed
Other Authors: Wayne L. Backes
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Abstract

Combustion of Superfund pollutants is known to lead to the production of nanoparticles that contain environmentally persistent free radicals (EPFRs). In order to distinguish the effects of nanoparticles from EPFR-containing nanoparticles, we used a chemically-defined model system where ultrafine-silica nanoparticles (UFP) and copper are heated with dichlorobenzene (DCB) or monochlorophenol (MCP) to generate specific UFP with EPFRs (DCB-CuO-Si and MCP-CuO-Si). Cytochromes P450 (P450 or CYP) represent a superfamily of enzymes that catalyze the majority of oxidative reactions needed for the elimination of foreign compounds and pollutants.

The purpose of this study was to determine whether in vitro addition of DCB-CuO-Si and MCP-CuO-Si inhibited specific P450 enzyme activities. By using P450-specific substrates and liver microsomes from animals chemically induced to over-express the various P450 forms, we assessed the effect of DCB-CuO-Si and MCP-CuO-Si on metabolism catalyzed by CYP1A1, CYP1A2, CYP2E1, CYP2C, CYP2B, and CYP3A enzymes from rabbit liver microsomes. MCP-CuO-Si (0.2 mg/ml) had little effect on metabolism by CYP1A1 but inhibited CYP1A2, CYP2E1, CYP2C, and CYP3A activities by 30 to 50%. Surprisingly, metabolism by CYP2B was actually stimulated (~ 20%) by MCP-CuO-Si. Interestingly, DCB-CuO-Si (at 0.2 mg/mL) inhibited all P450 activities by greater than 50%. Furthermore, CYP2C- and CYP3A-dependent activities were completely inhibited by this concentration of DCB-CuO-Si. UFPs that did not contain EPFRs (0.2 mg/ml) did not dramatically inhibit metabolism by any of the P450-dependent activities except for P450 2E1 (~ 20%), showing that in general, inhibition of P450 was due to the EPFR.

Challenges of studying the pulmonary inflammatory response to carbon nanoparticles at the in vitro level

Presenting Author: Tobias Stoeger
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Abstract

We have shown that carbon nanoparticle (CNP) inhalation can trigger inflammatory cell recruitment to the lungs of mice, associated with pro-inflammatory gene expression as lipocalin-2 (Lcn2) in alveolar epithelial type II like cells (AEC) and osteopontin (Opn) in alveolar macrophages (AM). In vitro studies using murine AM or AEC however failed to reproduce these responses. We hypothesize that macrophage-epithelial cell interaction is required to promote the inflammatory responses detected in vivo. Murine cell lines representing AM (MHS), AEC (LA4), or cocultures of both cell types were incubated with CNPs or zinc oxide (ZnO) NP (positive control). LA4 cells were plated on cell culture inserts and upon their confluency, MHS cells were seeded on top. After 24h the apical medium was removed to create air-liquid interface conditions. After further 24h, suspensions of CNP (Printex90, 50 µg) or ZnO (10 µg) were added. Gene expression of inflammatory mediators (Opn, Lcn2, Il6, Cxcl1) and oxidative stress markers (Hmox1, Mt2) was measured by qPCR after 6h incubation. Regardless of condition, Lnc2 and Opn transcript levels were unchanged. CNP exposure caused 8 fold increased Il6 mRNA levels only in MHS monocultures, no changes could be detected in LA4 co- or monocultures. Il6 mRNA levels were, however over 30 fold higher in LA4 monocultures compared to MHS. ZnO exposure induced about 20 fold increased transcript levels of Hmox1and Mt2 in MHS/LA4 cocultures or LA4 and MHS monocultures, respectively.

In summary, in vitro and at the gene expression level CNP did not cause an oxidative stress response and unlike in vivo was not effective to trigger Opn and Lcn2 expression under any tested culture condition. Our results do not support the promotion of particle exposure triggered pro-inflammatory pathways by epithelial cell interaction. We suggest that more complex and realistic culture conditions are necessary to reproduce pro-inflammatory responses at the in vitro level and therefore point out that in vitro based toxicity screening of poorly soluble nanoparticles is likely to produce false negative results.

Differences in the stress response to different nanoparticles analyzed In Vivo or In Vitro

Presenting Author: Tobias Stoeger
Other Authors: Anke-Gabriele Lenz, Vlad Dittrich, Andrea Beyerle, Gabriele Schumann, Otmar Schmid
Affiliation: Comprehensive Pneumology Center, Institute of Lung Biology and Disease, Helmholtz Zentrum Munchen, Germany

Abstract

Nanoparticles (NPs) are produced as combustion byproducts and also in increasing amounts for industrial or biomedical applications. This raises concerns about potential health risks due to NP exposure. Intratracheal instillation of 20g carbon black, Printex90 (Ptx90) NPs or 15g zinc oxide (ZnO) and into the lungs of mice caused a distinct local inflammatory response as measured by an influx of neutrophils (50% for ZnO, 25% for Ptx90 after 24h) into the lungs. Based on these results, we also investigated the hypothesis that these two different types of NPs induce a comparable in vitro stress response in human alveolar lung cells. The human alveolar epithelial-like cell line A549 was exposed to NPs at the air-liquid interface in a novel air-liquid interface exposure system (ALICE). The cellular response was characterized by measuring cell viability, membrane integrity, and mRNA expression (qRT-PCR) of the pro-inflammatory cytokines IL8, TNF, and IL1b as well as of HO1, HSP70B and SOD2 as markers for oxidative stress. After 6h exposure of cells to 10 g/cm2 ZnO and 20 g/cm2 Ptx90 no significant impairment of cell viability was found for both particle types. However, after treatment with ZnO increases in mRNA expression were observed for IL-8 (34-fold), TNF (6.4-fold), IL1b (2.9-fold), HO1 (230-fold), HSP70B (580-fold), and SOD2 (2-fold), whereas Ptx90 exposure caused no obvious alteration in the respective gene expressions. On the other hand, both types of NPs carry an oxidative potential as measured in a cell-free DCFH assay. This indicates that using in vitro prescreening for these NPs alone potentially underestimates the in vivo stress response of carbonaceous nanoparticles such as Ptx90.

Soot Generation System for PM Study and Measurement Process Evaluation

Presenting Author: Wonnam Lee[1]
Other Authors: Sangwhan Cho[1], Sunho Park[1], Younwoo Nam[2], Gunfeel Moon[2]
Affiliation: Dankook University, Korea (South)[1], Korean Register of Shipping, Korea (South)[2]

Abstract

Soot/particulate matter (PM) as by-products of combustion are considered to play an important role in the adverse health effects. Many studies have been conducted to understand the correlation between PM level and the health effects on pulmonary and cardiovascular systems of human body. However, the significance of physical and chemical properties of PM such as size distribution, morphology, and volatile mass fraction on health effects has not been intensively investigated partly because well-controlled and adjustable combustion based PM sources are not easily available. Therefore, a new soot particle generation system has been developed and tested. The soot generation system consists of two sections, a fuel supply and a soot production. In the fuel supply module, liquid fuel precisely controlled by a syringe pump is mixed with preheated inert gas and rapidly evaporated.

The gas phase fuel concentration is able to be adjusted by setting the flow rate and temperature of inert gas. The soot production module contains a ceramic heater that can raise the gas/fuel temperature up to 1600 K. The physical and chemical properties of produced PM depend on the type and concentration of liquid fuel and the residence time and temperature in the soot production section. The controlled PM source will also be utilized to evaluate experimental sampling and analysis processes that are currently being developed for the quantitative assessment of PM and BC from ships.

The Role of Aluminas and Aluminosilicates in PCDD/F Formation from Combustion Processes

Presenting Author: Phillip M. Potter
Other Authors: Slawo Lomnicki, Barry Dellinger
Affiliation: Louisiana State University

Abstract

Metal oxides occupy an integral role in the mechanism of formation for polychlorinated dibenzo-p-dioxins and polychlorinated furans (PCDD/Fs). Chlorinated aromatics undergo surface-mediated reactions on the surface of metal oxides to form Environmentally Persistent Free Radicals (EPFRs) which can further react to produce PCDD/Fs. Previous work using fly ash surrogates composed of transition metal oxides supported on a silica matrix has confirmed their ability to produce EPFRs and PCDD/Fs. The typical fly ash sample usually contains a predominant amount of silica and alumina and their mixtures in the form of aluminosilicates, however, the ability of alumina and aluminosilicates to affect the formation of PCDD/Fs has seen very little research. We are presenting the results of the laboratory studies of the precursor pathway of dioxin formation from 2-chlorophenol over fly ash, γ-alumina, α-alumina, and mullite as the active phase.

The reaction over fly ash resulted in a similar product profile and yields as previously reported fly ash surrogate experiments. γ-alumina was very active in the complete oxidation of 2-monochlorophenol and produced low PCDD/F yields. α-alumina, the most thermodynamically favorable form of alumina at the combustion conditions, resulted in the total yield of dioxin similar to fly ash, but a plethora of polychlorinated products. Mullite yielded higher concentrations of dioxins than the mullite-containing fly ash and a similar product profile.

Demonstration of External vs. Internal Radicals

Presenting Author: Lavrent Khachatryan
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Affiliation: Louisiana State University

Abstract

Environmentally persistent free radicals (EPFRs) were previously suggested to generate reactive oxygen species (ROS) in a biological environment. This phenomenon was demonstrated by spin trapping experiments using a chemical spin trap, 5,5-dimethyl-1-pyrroline-N-oxide (DMPO) in conjunction with EPR spectroscopy. This spin trapping study found higher EPFR concentrations exhibited a higher oxidative capacity, i.e. higher rates of OH production, for EPFRs associated with particulate matter (PM2.5), designated as active samples, as well as laboratory generated EPFRs.

However, some PM2.5 samples with high radical content did not display any increased red-ox activity, and as a result, no alteration in OH generation was observed between those samples and their respective control. These passive samples were attributed to the internal location of EPFRs. Remaining internal, these radicals were inaccessible to the DMPO molecules.

Generally, the spatial distribution (internal or external location) of EPFRs in PM2.5 has not been addressed. The addition of nitric oxides, NOx (NO or NO2), as scavengers to PM2.5 (associated with organic radical) or to laboratory generated samples (CuO /SiO2 / EPFRs), may clarify this issue, because the unpaired electron of EPFRs will react with paramagnetic scavengers, such as NO or NO2 forming nitroso compounds. An elimination of the radicals in the model EPFR system and active PM2.5 was observed, while there was no radical concentration diminishment when exposed to passive PM2.5. This suggests these particular PM2.5 samples to contain internal radicals while the model EPFR system contains mainly external radicals. Consequently, this approach may be important in specifying the oxidative capacity of PM2.5.

Effect of Copper Oxide Concentration in CuO/Silica Particles on the Formation of Environmentally Persistent Free Radicals and ROS Generation

Presenting Author: Lucy W. Kiruri
Other Authors: Slawo Lomnicki, Lavrent Khachatryan, and Barry Dellinger
Affiliation: Louisiana State University

Abstract

Our series of experiment have indicated that Environmentally Persistent Free Radicals (EPFRs) are formed when hydroxyl- and chlorine-substituted aromatics chemisorbed on 5% Cu(II)O surfaces. These EPFR species are capable of generation of reactive oxygen species (ROS) in the physiological solution. The current study reports the dependents of the EPFRs yields on a different metal loading in particles (0.25, 0.5, 0.75, 1, 2, and 3% Cu(II)O/Silica). The EPFRs were generated by exposure of the vapors of the precursor adsorbates of phenol, 2-monochlorophenol (MCP), and dichlorobenzene (DCBz) to the particles containing different copper oxide loading at 230 0C resulting in formation of phenoxyl and semiquinonetype radicals, with a characteristic EPR spectra with g-value of ~2.0044 and ~2.005, respectively. The number of EPFRs formed per copper atom indicates the presence of maximum formation yield at 0.75% CuO loading for MCP and DCBz precursors and at 0.5% CuO loading for phenol. The persistency of EPFRs was also dependent on the CuO content, with 1/e half-life maximum of 18 hrs for 0.75% CuO (2-MCP precursor) and 28 hrs for 0.5% CuO (Phenol precursor). Generation of hydroxyl radicals by EPFRs with different copper oxide content was done using the spin trapping agent, 5,5-dimethyl-1-pyrroline-N-oxide (DMPO).

Differences in the radical/copper atom concentration for samples containing different CuO loading propagated to the OH radical generation by EPFRs in saline solution, clearly indicating the correlation between the ROS generation yield and EPFRs presence.

Persistent Radicals in Tar Balls

Presenting Author: Slawo Lomnicki
Other Authors: Lucy W. Kiruri, Barry Dellinger
Affiliation: Louisiana State University

Abstract

Tar balls collected from the Gulf of Mexico shores of Louisiana and Florida after the BP oil spill have shown the presence of electron paramagnetic resonance (EPR) spectra characteristic of organic free radicals as well as transition metal ions, predominantly iron(III) and manganese(II). Two types organic radicals were distinguished: an asphaltene radical species typically found in crude oil (g = 2.0035) and a new type of radical resulting from the environmental transformations of crude (g = 2.0041-47). Pure asphaltene radicals are resonance stabilized over a polyaromatic structure and are stable in air and unreactive. The new radicals were identified as products of partial oxidation of crude components and result from the interaction of the oxidized aromatics with metal ion centers. These radicals are similar to semiquinone-type, Environmentally Persistent Free Radicals (EPFRs) previously observed in combustion-generated particulate and contaminated soils.

The experiment study on the hydrocarbon synthesis by Kolbe reaction from saturated fatty acids

Presenting Author: Guangrui Liu[2]
Other Authors: Jinhu Wu[1], Guanyi Chen[2]
Affiliation: Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of the Sciences[1], Tianjin University[2]

Abstract

Considering the fuel price and environmental effects on commercial aviation, the sustainable alternative jet fuel was greatly concerned by more and more people and airline industries. In our research, a new method was developed to produce aviation jet fuels by Kolbe electrosynthesis coupled with hydrotreating technologies from the fatty acids or fatty acid methyl esters (biodiesel). In present study, we focused on the preparation of long carbon chain hydrocarbons (alkanes) by Kolbe reactions from saturated fatty acids. Several reaction conditions (such as potential, solvent, support electrolyte, reaction time, and electrode materials) were evaluated to optimize the Kolbe electrosynthesis. Besides, the mechanism was also proposed according with the electrochemical tests (cyc1ic voltammetry tests, linear sweep voltammetry tests, and tafel tests). The results show that it is a good choice for the transformation of fatty acids or biodiesel into alkanes (which will be further processed into aviation jet fuel) by Kolbe processes, which are energy efficient as the reactions are conducted mostly at ambient pressure and temperature.

Keywords: aviation; jet fuel; Kolbe; hydrotreating; mechanism.

Vasoactive circulating factors are induced by diverse inhaled pollutants and mediate effects through CD36

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Abstract

Air pollution remains a serious problem in cities throughout the world. There is emerging evidence that changes in the serum/plasma composition caused by inhaled pollutants can drive vascular inflammatory responses. Using a novel ex vivo method, treating nave vessels with serum from control and exposed mice, we have demonstrated that acute exposure to ozone (O3), as well as chronic exposure to combined diesel and gasoline engine exhaust, induces the generation of circulating bioactive factors, leading to impaired vascular responses to acetylcholine (ACh). Pattern recognition receptors (PRRs), such as CD36, have been shown to interact with many damage-related circulating molecules. CD36 has also been implicated in affecting biological processes that are essential for the function of vascular endothelial cells, but no studies to date have investigated potential links between CD36, vascular dysfunction and inhaled pollutants.

With the use of a global CD36 knockout (CD36-/-) mouse we have confirmed that the PRR CD36 plays a pivotal role in mediating cross-talk between inhaled O3-inducued circulating factors and systemic vascular dysfunction. While the lung inflammation and systemic vascular dysfunction following O3 inhalation (1 ppm x 4 h) were both dependent on CD36, the presence of circulating factors appears to be independent of CD36 and inflammatory responses. These findings provide a crucial link between inhaled toxicants and cardiovascular health that was previously unappreciated.

A realistic cell exposure system for cigarette smoke: Performance characterization, real-time dose monitoring and dose-response curves

Presenting Author: Tobias, Stoeger
Other Authors: Nirav, Barapatre[1], Alessandra, Mossina[1], Ivica Lucic[1], Anke-Gabriele, Lenz[1], Bernd, Lentner[1], Oliver, Eickelberg[1,2], Silke, Meiners[1], Otmar, Schmid[1]
Affiliation: Comprehensive Pneumology Center (CPC-M), Institute of Lung Biology and Disease, Helmholtz Zentrum Mnchen, Neuherberg, Germany[1], University Hospital of the Ludwig Maximilians University (LMU), Munich, Germany[2]

Abstract

Tobacco smoke is one of the main causal factors for chronic lung diseases. Both assessment of toxicity and research into treatment options for smoke-related diseases require realistic in vitro cell exposure systems for cigarette smoke (CS). We have developed a stagnation point flow exposure system for cells cultured under realistic (air-liquid interface conditions (ALICE-smoke). In this study, the ALICE-smoke is described and experimentally characterized with a combination of aerosol, imaging, gravimetry, photometric and biological measurement techniques.

The total number and mass concentration of the CS particles was 1.5x10^7/cm^3 and 380mg/m^3, respectively. The count and mass median diameter was 350nm and 500nm, respectively. The cell delivered particulate dose was 14g/cm^2 per cigarette, which implies that about 1% of the CS particles was deposited onto the cells. The cellular dose of CS particles in 6-well culture inserts was significantly higher than the estimated in vivo dose in the human lung (about 5 orders of magnitude).

The CS particles were uniformly distributed between 6-well inserts (+/-10%) and on each insert (pixel-to-pixel variability was 7%; pixel area: 0.1x0.1mm^2). A quartz crystal microbalance was validated as real-time monitoring system for the cell-delivered particle dose between 10 and 110g/cm^2 using a gravimetric microbalance. Finally, when we determined the cellular response to smoke exposure, we observed that A549 lung epithelial cells showed a 50% decrease in cell viability (MTT-assay) for a cell-delivered particle dose of 40g/cm^2. The ALICE-smoke is a viable tool for toxicity and health studies with highly concentrated aerosols such as cigarette smoke.

The Impact of Air Pollution on Human Mortality in Southeastern U.S.

Presenting Author: Rebecca Klemm, PhD[1]
Other Authors: Ron Wyzga, BSc.[2], Eddie Thomas, MS[1]
Affiliation: Klemm Analysis Group[1], Electric Power Research Institute[2]

Abstract

Background: We investigate the impact of air pollution on human mortality in Atlanta, GA, Birmingham, AL, and Dallas, TX. We compare the results from all three southern cities and discuss the potential impact of measurement frequency and location of monitoring sites within a geographic area, as well as imputation methods to create daily air pollution series.

Methods: PM2.5, SO2, CO, O3, NO3, and SO4 were taken from monitoring sites within geographic regions encompassing Atlanta, GA, Birmingham, AL and Dallas, TX in varying measurement frequencies and converted to daily average measurements along with daily average temperature and dew point temperature. The relative risk (RR) of mortality due to various causes of non-accidental deaths was calculated from results of Poisson regression models with daily deaths as the response variable and daily measurements of air pollution, temperature, dew point, and day-of-week as predictor variables. Models with pollutant lags up to 5 days were investigated using imputed daily series.

Results: Positive associations were identified primarily in models with lags up to 1 day for most pollutants within the Atlanta, GA region. We identified few strong positive relationships within the Birmingham, AL region and the Dallas, TX region.

Conclusion: The relationship between air pollution and mortality differs by geographic area despite similarities in air pollution concentrations and other atmospheric conditions. This may be due to differences in measurement frequency and imputation techniques to create daily measurements. The models with shorter lags tend to imply the strongest relationships between air pollution concentration and mortality.

Health effects of combustion-derived aerosols: First results on emission of a ship diesel engine and wood combustion aerosol

Presenting Author: Ralf Zimmermann
Affiliation: University of Rostock and Helmholtz Zentrum München

On-line and off-line photo ionization mass spectrometric analysis of the molecular signature of PAH and other products of incomplete combustion in gas- and particle-phase of combustion aerosols

Presenting Author: Ralf Zimmermann
Affiliation: University of Rostock and Helmholtz Zentrum München

Investigation of Free Radicals Formed in the Oxidation of Acoustically Levitated α-Pinene Droplets by Electron Spin Resonance

Presenting Author: Mariana Ghosh
Other Authors: Petre Ionita

Affiliation: Southampton University, Bucharest University

Abstract:

Free radicals control the lifetime of gases important for the Earths radiative balance (e.g. CH_4), the budget of O_3 in all parts of the atmosphere, as well as the production of acidic species. Understanding the behavior of free radicals in the atmosphere is of paramount importance for establishing the lifetime and hence spatial scales of pollutant transport. Assessment of the variability of free radical formation from reactions of ozone with terpenes is important for understanding the health effects associated with the particulate matter. Studies showed that a significant amount of reactive oxygen species is associated with secondary organic aerosol (SOA) formed under laboratory conditions during the reaction of α-pinene with ozone. (Pavlovic, 2009).

The α-pinene oxidation by ozone has been studied in individually levitated aerosol droplets using an acoustic levitator at 100 kHz encased in an environmental chamber allowing control of the gas-phase surroundings and relative humidity. In order to determine the chemical composition of free radical species from the oxidation of levitated a-pinene droplets with ozone by Electron Spin Resonance, a spin trap was employed to stabilize the radicals and increase their lifetimes for characterization (Ghosh, 2011). Our study demonstrates that it is possible to analyze free radicals by Electron Spin Resonance formed from the oxidation of α-pinene in a containerless environment with applications to studies of reaction mechanisms in atmospheric science and beyond.

References:
M. Ghosh, Study of terpenes by Raman Acoustic Levitation, EAC, 12E2, 272, 2011
J. Pavlovic, Atmos. Chem. Phys. Discuss., 9, 23695-23717, 2009

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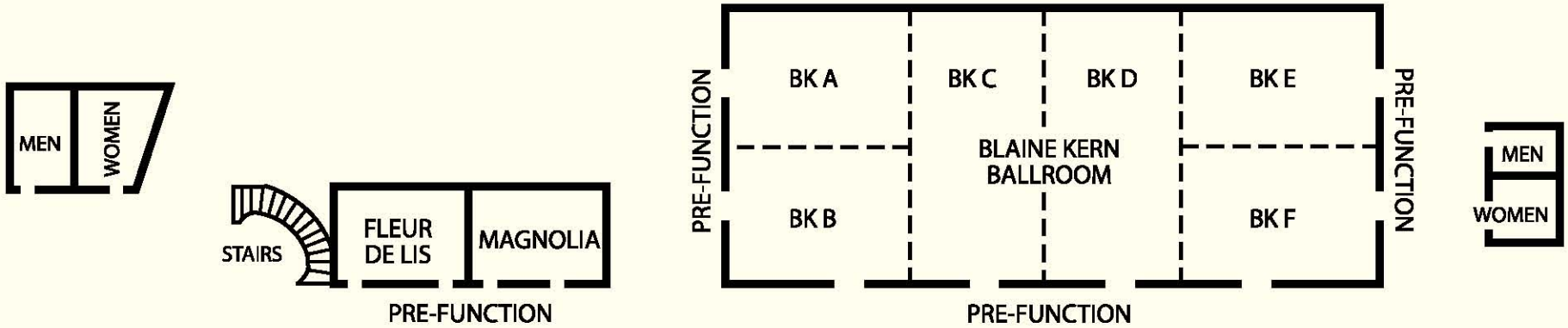
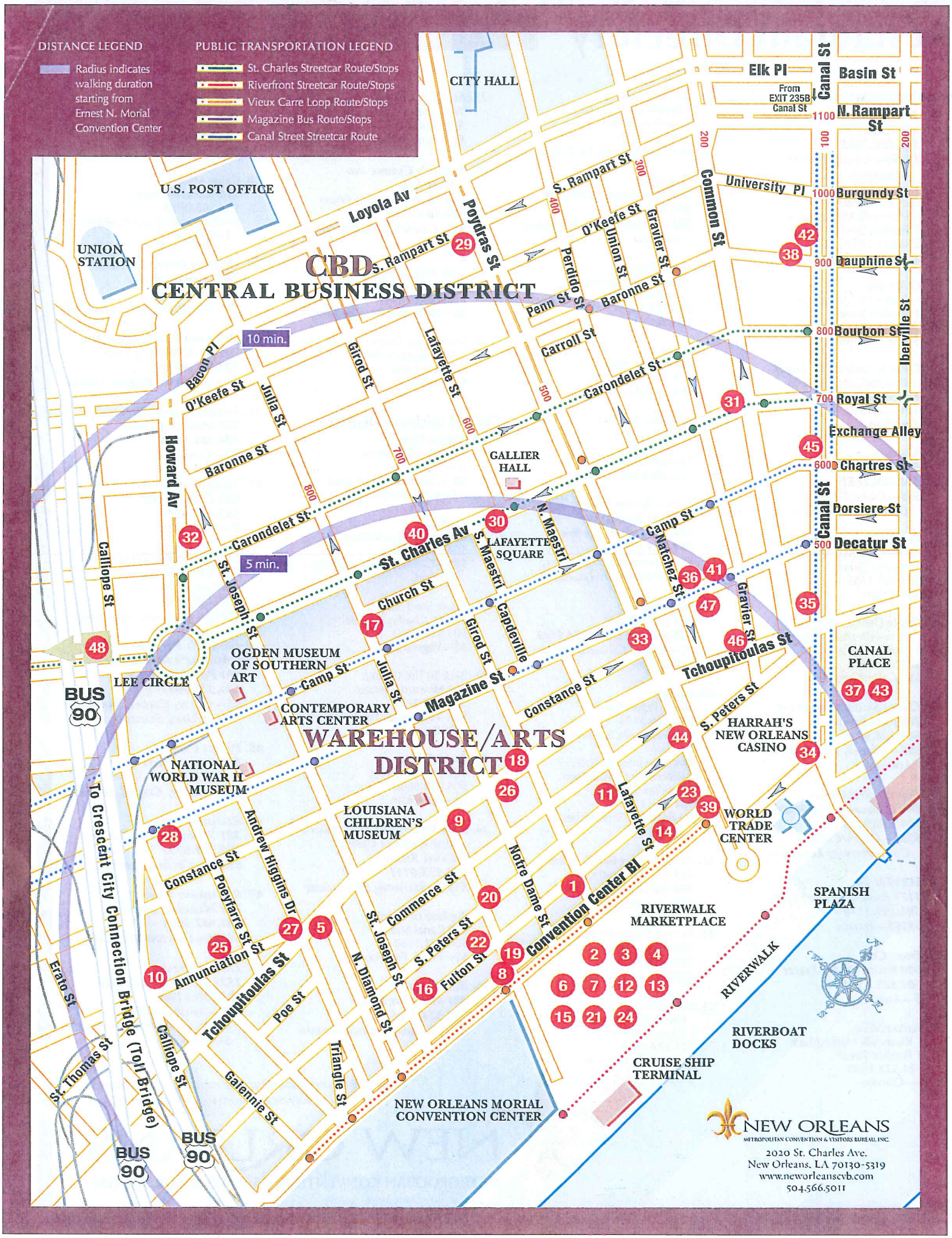
Marriott.
NEW ORLEANS AT THE CONVENTION CENTER

New Orleans Marriott at the Convention Center
859 Convention Center Blvd
New Orleans, LA
1-504-613-2888

FIRST FLOOR





NEW ORLEANS
METROPOLITAN CONVENTION & VISITORS BUREAU, INC.
2020 St. Charles Ave.
New Orleans, LA 70130-5319
www.neworleanscvb.com
504.566.5011

Restaurant Directory

$: $10 or less; $$: $11–20; $$$: $21–31; $$$$: $31–40; $$$$$: $40 or above

Warehouse/Arts District

1. *7 on Fulton*
   700 Fulton Street
   504.525.7555
   $$$$$—Contemporary Louisiana

2. Café du Monde,
   Riverwalk Marketplace
   1 Poydras Street
   504.522.1555
   $—Coffee & Beignets

3. Café Italia
   Riverwalk Marketplace
   1 Poydras Street
   504.522.1555
   $—Sandwiches

4. Cento & Fanti Italian Eatery,
   Riverwalk Marketplace
   1 Poydras Street
   504.522.1555
   $—Italian

5. *Cochon*
   930 Tchoupitoulas Street
   504.588.2123
   $$$—Cajun/Creole/Contemporary Louisiana

6. Cookin' Cajun Cooking School,
   Riverwalk Marketplace
   1 Poydras Street
   504.522.1555
   $$—Cajun

7. Creole Delicacies,
   Riverwalk Marketplace
   1 Poydras Street
   504.522.1555
   $$—Cajun/Creole

8. *Creole Skillet Restaurant*
   200 Julia Street
   504.304.6318
   $$$—Creole, Contemporary Louisiana

9. *Emeril's Restaurant*
   800 Tchoupitoulas Street
   504.528.9393
   $$$$—Cajun/Creole/Contemporary Louisiana

10. *ELEVEN 79*
    1179 Annunciation Street
    504.299.1179
    $$$$$—Italian

11. *Ernst Cafe*
    600 South Peters Street
    504.525.8544
    $—American

12. Famous Wok,
    Riverwalk Marketplace
    1 Poydras Street
    504.522.1555
    $—Chinese

13. Garden Fresh Grill,
    Riverwalk Marketplace
    1 Poydras Street
    504.522.1555
    $$—Salads/Wraps/Po-Boys

14. *Grand Isle*
    575 Convention Center Blvd.
    504.520.8530
    $$$—Cajun/Creole/Louisiana, Seafood

15. Kanno Express,
    Riverwalk Marketplace
    1 Poydras Street
    504.522.1555
    $$—Sushi

16. La Boca
    857 Fulton Street
    504.525.8205
    $$$—Steakhouse

17. Louisiana Product
    618 Julia Street
    504.529.1666
    $$—Grocery/Deli, Sandwiches/Po-Boys

18. *Lucy's Retired Surfer's Bar & Restaurant*
    701 Tchoupitoulas Street
    504.523.8995
    $$—Southern California, Contemporary Louisiana

19. *Mulate's*
    201 Julia Street
    504.522.1492, 800.854.9149
    $$—Cajun/Creole/Louisiana, Seafood

20. Rio Mar
    800 S. Peters Street
    504.525.3474
    $$$—Spanish, Seafood

21. Riverside Internet Café,
    Riverwalk Marketplace
    1 Poydras Street
    504.522.1555
    $—Breakfast/Sandwiches/Smoothies

22. *Rock-n-Sake Bar & Sushi*
    823 Fulton Street
    504.581.7253
    $$$—Japanese

23. *Ruth's Chris Steakhouse*
    525 Fulton Street
    504.587.7099
    $$$$$—Steakhouse

24. Steak Escape,
    Riverwalk Marketplace
    1 Poydras Street
    504.522.1555
    $—Steak Sandwiches

25. *Sun Ray Grill*
    1051 Annunciation Street
    504.566.0021
    $$—International, Eclectic

26. *Tommy's Cuisine and Wine Bar*
    746 Tchoupitoulas Street
    504.581.1103
    $$—Cajun/Creole/Louisiana, Italian

27. Ugly Dog Saloon & Bar-B-Que
    401 Andrew Higgins Drive
    504.569.8459
    $$—Barbecue, Bar/Pub Food

28. Warehouse District Pizza
    1068 Magazine Street
    504.529.1466
    $$—Italian, Pizza

Central Business District

29. Allegro Bistro
    1100 Poydras Street
    504.582.2350
    $$—Contemporary Cajun/Creole/Louisiana

30. Anatole
    600 St. Charles Avenue
    504.274.0105
    $$$—Cajun/Creole/Louisiana, Seafood

31. Apple Seed Shoppe
    201 St. Charles Avenue
    504.529.3442
    $$—Vegetarian

32. Back To The Garden
    833 Howard Avenue
    504.299.8792
    $$—Vegetarian, Sandwiches/Po-Boys

33. Bayou Eatery
    400 Poydras Street
    504.299.8600
    $$—American

34. *Besh Steakhouse at Harrah's New Orleans Casino*
    4 Canal Street
    504.533.6111
    $$$$—Seafood, Steakhouse

35. Big Easy of Canal
    428 Canal Street
    504.903.1763
    $$—Pizza, Fast Food

36. *Bon Ton Cafe*
    401 Magazine Street
    504.524.3386
    $$$—Cajun/Creole/Louisiana

37. Cafe Nuage
    365 Canal Street,
    Canal Place
    504.522.4191
    $$—Coffeehouse/Cafe, Fast Food

38. Cajun Mike's
    116 Baronne Street
    504.566.0055
    $—American, Cajun/Creole/Louisiana

39. *Gordon Biersch Brewery*
    200 Poydras Street
    504.522.2739
    $$—Microbrewery, American

40. *Herbsaint Bar & Restaurant*
    701 St. Charles Avenue
    504.524.4114
    $$—American, Bistros, French

41. *Liborio Cuban Restaurant*
    321 Magazine Street
    504.581.9680
    $$—Cuban

42. *McDonald's Restaurant*
    934 Canal Street
    985.651.8246
    $—Fast Food

43. *Morton's, The Steakhouse*
    365 Canal Street, Canal Place
    504.566.0221
    $$$$$—Seafood, Steakhouse

44. *Mother's Restaurant/Mother's Next Door*
    401 Poydras Street
    504.523.2917
    $$—Cajun, Creole, Sandwich Shop/Deli, Seafood

45. *Palace Cafe*
    605 Canal Street
    504.523.1661
    $$$—Cajun, Creole, Seafood

46. *Restaurant August*
    301 Tchoupitoulas Street
    504.299.9777
    $$$$$—Creole, French

47. *Restaurant Cuvee*
    322 Magazine Street
    504.587.9001
    $$$$$—Continental, Creole

48. *Zea Restaurant*
    1525 St. Charles Avenue
    504.520.8100
    $$$—American, Thai, Contemporary Louisiana, Seafood

NOMCVB member restaurants are indicated in bold italics.
Many of our hotels also have restaurants.

NEW ORLEANS
METROPOLITAN CONVENTION & VISITORS BUREAU, INC.

New Orleans Attractions

Tours

New Orleans Tour Center features City Tours, Cemetery, Ghost and Airboat tours.
New Orleans Tour Center llc
612 Pelican St.
New Orleans, LA 70114
(504) 533 – 4544

New Orleans Streetcars

One-way fares are $1.25 and can be paid with exact change when you board. One, 3 and 5-day unlimited ride passes are also available for $5, $12 and $20 respectively. See the Regional Transit Authority (RTA)'s website for a list of places to purchase these. Please note that passes are non-refundable and non-replaceable
www.norta.com

Museums

Louisiana's Civil War Museum

929 Camp St, New Orleans, LA 70130
(504) 523-4522
www.confederatemuseum.com

The National World War II Museum

945 Magazine St., New Orleans, LA 70130
(504) 527-6012
www.nationalww2museum.org

Music and Culture

Frenchmen Street

Light years removed from the glitzy neon lights and blaring cover music of Bourbon Street but, in reality, only walking distance away, is a compact musical enclave where the "locals" hang out. A two-block-long entertainment district where, on any given night of the week – including normally dead Mondays – you can hear live sounds and a wide variety of music as only New Orleans musicians can perform. It's called Frenchmen Street and it is, conveniently, only steps away from the French Quarter. Cross Esplanade Avenue at Decatur Street and you are there. Within that two-block stretch of Frenchmen Street you are likely to hear anything from jazz to Latin to blues to reggae . . . and just about everything in between.

Shopping

Magazine Street

For shopping, dining or just casual strolling, no place in New Orleans outside the French Quarter beats Magazine Street. A six-mile-long stretch of this Garden District and Uptown thoroughfare features some of the best antique stores, art galleries, craft shops and classy boutiques to be found anywhere in the city.

The French Market

Reminiscent of some European markets, this open-air mall features shopping, dining and music in a tradition that is uniquely New Orleans. From Café du Monde near Jackson Square to the market at the end of Esplanade Avenue, there are five blocks of specialty retail shops and a community flea market with locally-made jewelry, clothing and art.
Open Sunday-Saturday 9am-9pm.
2 French market Place, New Orleans, LA
(504-522-2621)
www.frenchmarket.org

It's NEW ORLEANS

You're different here.

Things To Do in New Orleans

Restaurants

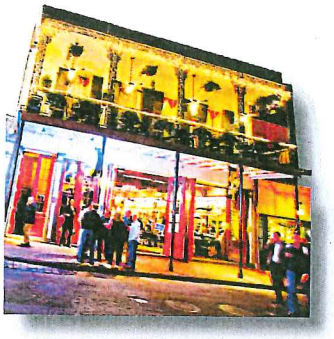
CVB member restaurants within 2 blocks of the Convention Center and Warehouse District:

Restaurant	Address	Phone (504)	Price
7 on Fulton @ Wyndham Riverfront Hotel	700 Fulton Street	525-7555	$$$
American Sector @ the National WWII Museum	945 Magazine Street	528-1940	$$$
Bouche	840 Tchoupitoulas Street	267-7485	$$$
Capdeville	520 Capdeville Street	371-5161	$$
Carmo	527 Julia Street	875-4132	$
Cochon Restaurant / Calcasieu	930 Tchoupitoulas Street	588-2123	$$
ELEVEN 79	1179 Annunciation Street	299-1179	$$$$$
Emeril's Restaurant	800 Tchoupitoulas Street	528-9393	$$$
Ernst Cafe	600 South Peters Street	525-8544	$$
Gordon Biersch Brewery Restaurant	200 Poydras Street	552-2739	$$
Grand Isle Restaurant	575 Convention Center Blvd.	520-8530	$$$
La Cote Brasserie @ Renaissance Arts Hotel	700 Tchoupitoulas Street	613-2350	$$$
Lucy's Retired Surfer's Bar & Restaurant	701 Tchoupitoulas Street	523-8995	$$
Meson 923	923 S. Peters Street	523-9200	$$$$
Mulate's - The Original Cajun Restaurant	201 Julia Street	522-1492	$$
Rock-n-Sake of New Orleans	823 Fulton Street	581-7253	$$$
Sun Ray Grill	1051 Annunciation Street	566-0021	$$
Thomas Bistro	755 Tchoupitoulas Street	527-0942	$$$
Tommy's Cuisine	746 Tchoupitoulas Street	581-1103	$$$

$: $10 or less per person
$$: $11-$20 per person
$$$: $21-$30 per person
$$$$: $31-40 per person
$$$$$: above $40 per person

Tours

Tour Company	Address	Phone (504)
American Photo Safari	828 Royal Street	298-8876
Cajun Pride Swamp Tours	110 Frenier Road	467-0758
Dat NOLA Race	3424 46th Street	460-4908
Dr. Wagner's Honey Island Swamp Tours	41490 Crawford Landing Road	641-1769
Friends of the Cabildo	701 Chartres Street	523-3939
Gray Line Tours	400 N. Peters Street	569-1401
Haunted History Tours, Inc.	97 Fountainebleau Drive	861-2727
Jean Lafitte Swamp & Airboat Tours	6601 Leo Kerner Lafitte Pkwy.	689-4186
Laura: A Creole Plantation	2247 La Hwy. 18 River Road	265-7690
Longue Vue House and Gardens	7 Bamboo Road	488-5488
Mardi Gras World, LLC	1380 Port of New Orleans Place	361-7821
Mystere Mansion/Haunted Mortuary	4800 Canal Street	579-4431
Royal Carriages, Inc.	1824 N. Rampart Street	943-8820



Nightlife

12 Bar on Fulton Street	608 Fulton Street	212-6476
Republic New Orleans	828 South Peters Street	528-8282
Lucy's Retired Surfer's Bar & Restaurant	701 Tchoupitoulas Street	523-8995
The District Lounge	711 Tchoupitoulas Street	301-1476
Capdeville	520 Capdeville	371-5161
Ernst Café	600 South Peters Street	525-8544

Shopping

Shops at Canal Place	333 Canal Street	522-9200
Riverwalk Marketplace	500 Port of New Orleans Place	522-1555
The Shops at Jax Brewery	600 Decatur Street	566-7245
French Market	1008 N. Peters Street	522-2621

Magazine Street offers 6 miles of unique boutiques.
Tax-free shopping offers international visitors even more reasons to experience New Orleans.

Getting Around

1. Taxi: There are thousands of taxis available on New Orleans' streets and at major hotels. Taxi rates are $3.50 plus $2 per mile (.25 per one-eighth mile) thereafter. There is also an additional charge of $1.00 per passenger after the first passenger.

2. St. Charles Ave. Streetcar: Ride through the Crescent City on a national historic landmark that only costs $1.25. Streetcars have been rumbling along St. Charles Avenue for over 165 years. This route runs over 13 miles downtown from Canal Street along St. Charles Avenue, past Greek Revival mansions and raised cottages, Tulane University and Audubon Park, and beyond the shops at the Riverbend, where it takes a right-hand turn onto Carrollton Avenue.

3. Riverfront Streetcar: For $1.25, you can ride the traditional green or newer red streetcars. This two-mile route includes stops at all the right places: the Convention Center at Julia Street, Riverwalk, the Aquarium of the Americas, the French Market and the Old Mint on Esplanade.

4. Canal/Carrollton Streetcar: The "newest" re-established streetcar line in New Orleans runs the length of Canal Street for only $1.25. This is the original "Cemeteries" line, which runs from the Mississippi River to the cemeteries located at the mid-city end of Canal Street. Along the line there is a Carrollton Spur, which will take you to beautiful City Park, home of the New Orleans Museum of Art and the New Orleans Botanical Gardens.

NEW ORLEANS
CONVENTION & VISITORS BUREAU

SWAMP TOUR

CAJUN ENCOUNTERS TOUR CO.

TOUR SWAMP with hotel pickup

Adults - $49 Children (under 12) - $32.50

PICKUP TIME	TOUR TIME	RETURN TIME (approx.)
8:00 - 8:30 AM	9:30 AM	12:45 PM
10:30 - 11:00 AM	12:00 PM	3:40 PM
1:15 - 1:45 PM	2:45 PM (seasonal)	5:45 PM
3:30 - 4:00 PM	5:00 PM (seasonal)	7:45 PM
6:00 - 6:30 PM	7:15 PM (seasonal)	10:00 PM

*** $2 discount for AAA, Senior Citizen (65 and older) and U.S. Military**
Discounts not valid with other coupons or specials

Guests Must be in Front of Hotel at Beginning of Pickup Time.

CAJUN ENCOUNTERS TOUR CO.

All tours subject to change due to traffic conditions or inclement weather. All tours subject to cancellation.

RESERVATION TICKET

Confirmation # _____ Agent _____

Date _____ Pickup Time _____

Name _____ Cell Phone # _____

Pickup at _____ Room # _____

Number of Adults _____

Number of Children _____ Deposit Total _____

Deposit slip required to get credit for monies paid. Balance to be paid at tour site. DEPOSITS ARE NON-REFUNDABLE. Cajun Encounters is not responsible for mathematical errors made by booking agents. Booking agents are not employees of Cajun Encounters. Subject to correction of clerical errors.

12 hour minimum cancellation notice must be given to receive refund.

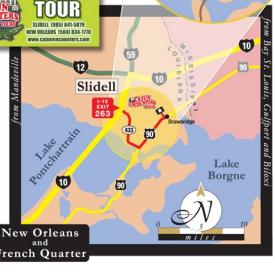
HOW TO FIND US

GPS Device Address:

55345 Hwy 90, Slidell, LA 70461

BE CAREFUL!

Make sure to turn at the Cajun Encounters sign



FROM NEW ORLEANS:
Take I-10 east to exit #263. Go right on highway 433 for 6.5 miles to highway 90 and turn left. Go 4.7 miles to **CAJUN ENCOUNTERS** sign and turn left (.3 miles past highway 190.)

FROM MISSISSIPPI HWY 10:
Take I-10 west to exit #263. Go left on highway 433 for 6.5 miles to highway 90 and turn left. Go 4.7 miles to **CAJUN ENCOUNTERS** sign and turn left (.3 miles past highway 190.)

FROM MANDEVILLE:
Take I-12 east to I-10 west and take exit #263. Go left on highway 433 for 6.5 miles to highway 90 and turn left. Go 4.7 miles to **CAJUN ENCOUNTERS** sign and turn left (.3 miles past highway 190.)

FROM MISSISSIPPI HWY 90:
Take Hwy 90 west and turn left at Pearlington. Continue on Hwy 90 west. **CAJUN ENCOUNTERS** is 11.3 miles from the stop sign on right. (Scenic Route)

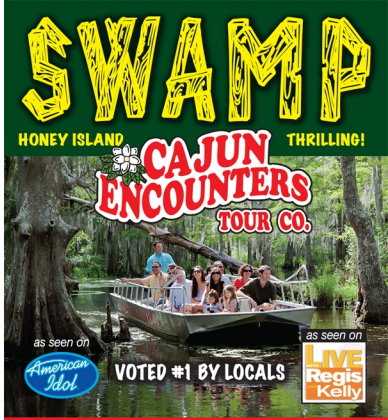
For Reservations & Information:

(504) 834-1770 (985) 641-5879

or toll-free **1-866-92TOURS (928-6877)**

See Virtual Tour at: www.cajunencounters.com

All tours subject to cancellation due to inclement weather. Tour times are subject to change.



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