

BATTELLE

# Environmental Updates

Highlights of Battelle's International Environmental Leadership

Winter 2005

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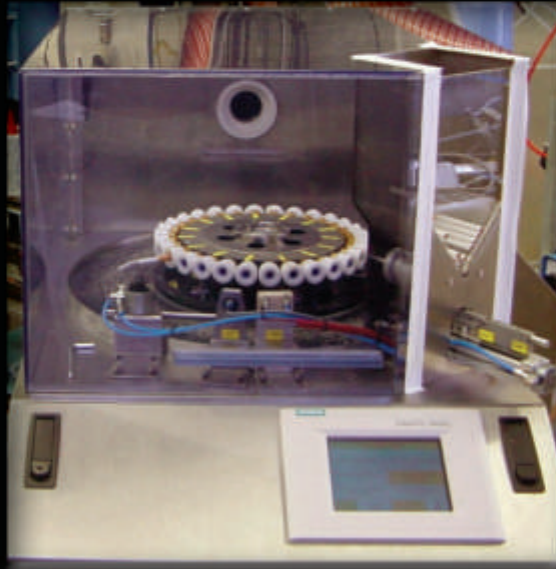
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## Examining *Sidestream Smoke Exposure* with the Centers for Disease Control and Prevention

Centers for Disease Control and Prevention (CDC) and Battelle recently conducted a study to gain a better understanding of disease risk associated with the exposure of non-smokers to sidestream smoke, which is the smoke that emits from the end of a lit cigarette. In other studies, it has been found that sidestream smoke is two to five times more concentrated in some carcinogens than the mainstream smoke inhaled by a smoker.

The study focused on how biomarkers of cigarette smoke exposure are affected by cigarette configuration (menthol vs. non-menthol), race, and gender in an attempt to further examine the finding in the Surgeon General's report on smokers, which indicated that the incidence and mortality rate for African American men was twice as high for smoking-related cancers (lung, oral, and esophageal) than for Caucasian men. This statistic is somewhat intriguing in that African American smokers often smoke substantially fewer cigarettes per day than Caucasian smokers and are generally three times more likely to smoke a menthol cigarette than Caucasian smokers.

Forty non-smokers, consisting equally of men and women, and African Americans and Caucasians, were recruited for the study. These subjects were exposed to a controlled level of sidestream smoke generated using a 30-port automated smoking machine and Battelle's large environmental chamber. The machine smoked menthol or non-menthol cigarettes to produce sidestream smoke levels similar to those found in a smoky bar. Saliva, blood, and urine samples were collected from each



subject before, during, and after exposure. During each four-hour exposure period, carbon monoxide, nicotine, particle distribution, air exchange rate, temperature, and relative humidity were measured in the chamber. CDC was responsible for analyzing the biological samples for specific tobacco-related metabolites.

Increases in serum, urine, and salivary cotinine concentrations with exposure were essentially the same for men and women, and for African Americans and Cauca-

sians. Although salivary cotinine differences between pre- and post-exposure were consistently greater for subjects exposed to sidestream smoke from menthol compared with non-menthol cigarettes, this difference was not statistically significant. Two carcinogen markers of interest (4-aminobiphenyl and NNAL) also showed relatively small differences in response according to race, gender, or cigarette type.

The carbon monoxide and nicotine measurements demonstrated similar levels for menthol and non-menthol cigarettes. However, the particle distribution indicated that the menthol cigarettes used in this study produced significantly more smaller-diameter particles than the non-menthol cigarettes. This result is important from a disease-risk standpoint, as smaller particles ( $0.3 - 0.5 \mu\text{m}$ ) are more likely to reach the alveolar region of the lung, and thus carcinogens attached to them may take a longer time to clear from the body.

For more information, contact Ms. Marielle Brinkman at (614) 424-5277, [brinkmmc@battelle.org](mailto:brinkmmc@battelle.org).







The Battelle-operated Pacific Northwest National Laboratory (PNNL) will lead a \$10 million, five-year, multi-institutional National Institutes of Health study to devise 3-D imaging and computational models of respiratory systems in humans and other mammals.

The grant will enable the Department of Energy (DoE) laboratory and its partners to devise 3-D imaging techniques and simulations of unsurpassed detail that promise better understanding and improved treatment of asthma and other respiratory ailments associated with environmental factors.

The research will culminate in a “pulmonary physiome,” a web-based model for researchers and clinicians.

“This partnership will build the foundation for studying environment-disease interactions,” said Dr. Rick Corley, PNNL staff scientist and program director. Specifically, the project aims to “provide researchers and clinicians with uniquely predictive tools to develop a quantitative understanding of the impact of airborne environmental agents and inhaled drugs on human health and to answer important questions on how respiratory structure relates to function. This will greatly assist in the evaluation, diagnosis, and development of treatments.”

PNNL established its leadership in the field in 2001 when it rolled out the model of working rat lungs it called “the virtual respiratory tract.” At the time, it offered the clearest picture yet of how pollutants enter the respiratory system, how they move and where they accumulate.

The other institutions participating in the new study are the University of Washington, University of California at Davis, the University of Iowa, Oregon State University, University of Utah, CIIT Centers for Health Research of Research Triangle Park, N.C., Mountain-Whisper-Light Statistical Consulting of Seattle, and Computational Geometry

## PNNL/Partners to Develop *Virtual Lung*

Consulting of Los Alamos, NM.

PNNL is a DoE Office of Science laboratory that solves complex problems in energy, national security, the environment, and life sciences by advancing the understanding of physics, chemistry, biology, and computation. PNNL has 3,800 employees, has a \$600 million annual budget, and has been managed by Battelle since the laboratory’s inception in 1965.

For more information, contact Dr. Rick Corley at (509) 376-8642, [rick.corley@pnl.gov](mailto:rick.corley@pnl.gov) or Mr. Kelvin Soldat at (509) 375-6810, [kelvin.soldat@pnl.gov](mailto:kelvin.soldat@pnl.gov).

# Helping the Navy Address Human Health Risks

For the past several years, Battelle has been supporting the United States Navy in remediating and closing sites as part of Installation Restoration (IR) Program activities at the former Long Beach Naval Complex (LBNC). The former LBNC, located on the south side of Terminal Island within the Los Angeles and Long Beach Harbor districts, encompasses the former Naval Station Long Beach and the former Long Beach Naval Shipyard. Over the years, industrial activities at the sites had resulted in contamination of soil and groundwater that were deemed as potential threats to human health and the environment if not addressed effectively. The ultimate goal of the IR Program at these sites is to complete the cleanup so that the former LNBC property can be transferred to the City of Long Beach with a covenant in the deed warranting that all necessary remedial action has been taken.

Human health risk assessments were conducted for the sites at the former LBNC as part of remedial investigations performed by previous contractors. Battelle prepared feasibility studies, proposed plans, and records of decision for 11 of the 16 sites.

The remedial alternatives evaluated for the feasibility studies were based on ecological risk and human health risk exposure scenarios. Because this site has been redeveloped as a port and is never expected to be used for residential or other sensitive purposes (e.g., hospital or daycare), the worker scenarios developed for the risk assessment were deemed appropriate. The evaluation of ecological risk was prompted by the fact that contaminants in groundwater have the potential to migrate to the marine environment.

A key strategy for the Navy and the port in addressing the human health risks was to isolate the areas of concern that presented an exposure risk and either treat or remove the contaminants or implement institutional controls such as land use restrictions for the impacted area. These restrictions provided safeguards to maintain the current land use and reduce the risk of exposure to site workers. Battelle continues to support the Navy in its efforts to comply with the requirements of the IR Program.

For more information on Battelle's capabilities in supporting installation restoration/base realignment and closure site closeout programs, contact Mr. Phil Jagucki at (614) 424-7081, [jagucki@battelle.org](mailto:jagucki@battelle.org).



## Emerging Environmental Contaminants and Their *Impact* on Human Health

Scientific research has shown that there are many emerging environmental contaminants that can enter, disperse, and persist in the environment to a much greater extent than first anticipated. Many household and industrial chemicals and pharmaceuticals are released to the environment after passing through wastewater treatment processes or by re-entering the environment more directly. Little is known about the extent of environmental occurrence, fate, and ultimate impact of many synthetic organic chemicals after their intended use - particularly hormonally active chemicals and pharmaceuticals. Potential concerns from the environmental presence of these compounds in humans include abnormal physiological processes and reproductive impairment, increased incidences of cancer, the development of antibiotic-resistant bacteria, and the potential increased toxicity of chemical mixtures. For many substances, the potential effects on humans, wildlife, and aquatic ecosystems are not clearly understood.

Brominated flame retardants (BFRs), widely used over the past two decades, belong to this class of emerging environmental contaminants of increasing concern. There are more than 75 different BFRs in use today primarily as flame retardants in plastics, textiles, coatings, and electrical components found in many common household and consumer products. The vast majority of this volume is comprised of, in descending order of amount used in the United States, polybrominated diphenyl ethers (PBDEs), tetrabromobisphenol-A (TBBP-A), and hexabromocyclo-

clododecane (HBCD).

Studies conducted in Sweden indicated that PBDEs rapidly accumulate in mothers' milk prompting a ban on their use in Sweden, Germany, and the Netherlands in the 1990s. However, currently in the United States there are no established safety standards on the manufacture, use, or disposal of BFRs. BFRs have been determined to be widely distributed in the U.S. environment and are increasing in concentration in the U.S. population.

One reason for the general lack of information about

these emerging environmental contaminants is that, until recently, there have been few analytical methods capable of detecting these compounds at low concentrations. Recognizing the need to further evaluate the prevalence of these compounds in the environment, Battelle has developed test methods to quantify their presence in soils, sediments, and tissue. For example, Battelle has recently brought online new low resolution GC/MS methods for high-quality and cost-effective analysis of BFRs, polychlorinated biphenyls (PCBs), and pesticides in a wide variety of environmental matrices.

For information about Battelle's analytical chemistry methods in terms of emerging environmental contaminants, contact Mr. Greg Durell at (781) 952-5233, [durell@battelle.org](mailto:durell@battelle.org). For information about Battelle's risk assessment capabilities related to these contaminants, contact Mr. Donald Gunster at (781) 952-5378, [gunster@battelle.org](mailto:gunster@battelle.org).

# Effects of *Typical Household Water Use* Activities on Breath Chloroform Levels

Chloroform, an environmental pollutant, is the major disinfection by-product of drinking water treated with chlorine for domestic usage, and a long-standing health concern. Now classified by the U.S. EPA as a probable human carcinogen, chloroform once appeared in toothpastes, cough syrups, ointments, and other pharmaceuticals; it has been banned in consumer products in the United States since 1976. Exposure to chloroform can occur when breathing contaminated air or when drinking or coming in contact with water containing it. Common household activities such as showering, bathing, drinking water, and washing clothes and dishes can increase the likelihood of individual exposure to chloroform.



Battelle recently conducted a study with the Centers for Disease Control and Prevention (CDC) in which typical household water-use activities that were thought to lead to the greatest chloroform exposures were investigated. Participants performed a variety of common water-use activities in two residences served by water utilities with relatively high and low total chloroform levels. To maintain a consistent exposure environment, the activities, exposure time, air exchange rate,

water flow and temperature, and extraneous chloroform emissions to the indoor air were carefully controlled. Water, air, and exhaled breath samples were collected during each exposure session for each activity that could potentially elevate the internal dose of chloroform. At the start of each exposure session, indoor air and exhaled breath samples were collected. Air samples were then collected during each individual activity while breath samples were collected five minutes after each activity.

Showering (for 10 minutes), bathing (for 20 minutes), and machine clothes washing activities caused significant increases in air and exhaled breath chloroform concentrations as a result of inhalation exposure and dermal contact. For the showering and bathing activities, strong correlations were observed among levels for breath and air, breath and water, and water and air. Despite the small study population, the association between specific activities and level of chloroform exposure was clearly demonstrated in this study.

For additional information, contact Dr. Sydney Gordon at (614) 424-5278, [gordon@battelle.org](mailto:gordon@battelle.org).

## Future Topics of *Environmental Updates*: We Want to Hear From You

During the following year, we will strive to address the most pressing environmental concerns that would be of interest to both our industrial and government clients. To help us attain this goal, please take a moment to fill out the below form, listing two or three important topics that you would like to see covered in future issues. Once you have completed your response, please fax this entire page to: (781) 934-2124 (no cover sheet necessary). We value your input and look forward to hearing from you.

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# Battelle Environmental Updates

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- I am interested in hearing more about what Battelle can do in the following areas:

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