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From the Director's Desk
--John Howard, M.D. Director, NIOSH
February eNews 2010

An Exposé on Exposomes

Success in mapping the human genome has fostered the complementary concept of mapping the "[exposome](#)." This is an interesting frontier for risk assessment, one that NIOSH will examine closely as one of our emerging issues for the 21st century.

The concept of the exposome can be defined as the measure of all the exposures that an individual may experience over a lifetime in his or her environment, whether those exposures may affect the person's health, and if so, in what ways. Clearly, this is a compelling topic for those of us who are in the business of preventing illnesses that are caused or exacerbated by exposures in the workplace.

Articulated in 2005 by Dr. Christopher Wild, currently the director of the International Agency for Research on

Cancer, the exposome also takes into account how the impact of exposures on health are further modified by factors such as lifestyle, physical condition, and genetics. The exposome relies on the use of all exposure assessment tools.

Understanding the contribution of environmental factors to disease susceptibility in terms of exposure and biological response has also been called "exposure biology" and is an integral part of exposure assessment. Exposure begins prenatally and includes insults-that is, injuries, irritations, or traumas-from environmental and occupational sources.

Past occupational health studies have focused on a specific exposure or multiple exposures and the relationship to a disease. Some confounders were investigated as well. Today, many studies incorporate the interaction between genetic and environmental factors. It should be noted that the exposome also includes the study of exposures in the environment that improve or enhance health or the opportunity to attain health in greater measure.

The occupational exposome is extremely important and in some cases unique from other environmental exposures. Today's occupational exposures are radically different than those of even 30 years ago. Prevention of disease should be the critical outcome from the exposome. Ironically, the measure of success will be that nothing happens-in other words, disease is prevented.

Some obvious challenges may limit progress in this field of study. The exposome is highly variable and dynamic as it evolves throughout the lifetime of an individual. Ultimately, the impact of a specific environmental exposure, regardless of its origin, may be different at the individual level for different people. Past and even present exposures are difficult or impossible to quantify. Relating an occupational disease to an exposure that occurred in the past can be challenging.

NIOSH has identified some specific areas that can help meet these challenges:

1. **Develop more sensitive exposure assessment methods and tools.** Development of new methods, exposure assessment strategies, and other tools would improve our ability to measure occupational exposures.
2. **Develop and characterize biomarkers.** The development and characterization of biomarkers is another avenue to improve measurement of exposure, effect of exposure, and susceptibility for determination of disease relationships. Identification of legacy biomarkers (a biomarker that would

quantify past exposures or effects from past exposures) would be important for evaluating the exposome and the relationship to occupational disease.

3. **Develop improved statistical tools and data sharing.** Development of improved statistical tools can help evaluate the relationship of disease to the many facets of exposure. Increased data sharing will allow for increased statistical power and a more thorough analysis of all exposures. Also needed for use in defining the exposome are improved bioinformatics tools, pattern matching techniques, and artificial neural network models.
4. **Develop gene expression matrices.** A major contribution to this area could be made through the development of gene expression matrices resulting from occupational, environmental, dietary, life-style, and other exposures. This is an area in which NIOSH has already begun to generate information for the validation of biomarkers and suites of biomarkers for exposure assessment purposes.
5. **Develop standardized criteria for designing studies and reporting results.** Development of a standardized manner for the collection and storage of data that incorporates information on epidemiology, genetics, and occupational/industrial hygiene will allow for more holistic exposure assessment. In addition, a standardized manner for the collection and publishing of exposure assessment measurements should be explored in order to make the information more accessible for data mining. Such a standardized approach for the collection, analysis, and dissemination of microarray data has been developed for genomics; these guidelines specify the minimum information about a microarray experiment (MIAME) necessary to interpret the results and to reproduce the experiment.

NIOSH's focus in the exposome lies in occupational exposures and resulting work-related diseases. I anticipate that our contributions in exposure assessment, occupational epidemiology, development of sensitive occupational methods, development and characterization of biomarkers, exposure sampling strategies, and exposure databases will advance further the field of occupational exposomics. In turn, if successful, these developments will lead to improved occupational health as occupational exposures are identified and mitigated.

I invite your attention to Dr. Wild's groundbreaking thesis at <http://cebp.aacrjournals.org/content/14/8/1847.full> and invite you to watch for a NIOSH topic page on the exposome, which we expect to post shortly on the Web. Later this month, on February 25-26 in Washington, D.C., the National Academies will convene a

national workshop to examine the exposome and the opportunities for applying the concept to improve human health. I am honored to be included as a participant in one of the panel discussions. Further information is available at <http://dels.nas.edu/envirohealth/exposome.shtml>. I look forward to seeing you there and to hearing your ideas on possible next steps forward for NIOSH and our partners. My thanks to Dr. Gayle DeBord, associate director for science in NIOSH's Division of Applied Research and Technology, for her assistance in preparing this month's column.

Free Respirator Training Videos Available

NIOSH and OSHA have produced two 5-minute videos on respirator training: *The Difference Between Respirators and Surgical Masks* and *Respirator Safety*, which includes instructions on donning (putting on) and doffing (taking off) and user seal checks. These videos are available in both English and Spanish and are available for download at <http://www.osha.gov/SLTC/respiratoryprotection/index.html>.

New NIOSH Internet Site Highlights Regulatory Agenda

NIOSH has released a new Web page (<http://www.cdc.gov/niosh/regulatory.html>) designed to make it easier for stakeholders to find, read, and track NIOSH's proposed regulations and regulatory changes. The new Web page lists and links to the proposed regulations and regulatory changes that NIOSH has posted on the federal government's Unified Regulatory Agenda (as required by EO 12866 Section 4(b) http://www.reginfo.gov/public/jsp/Utilities/EO_Redirect.jsp).

NIOSH Experts Comment on the H1N1 Pandemic

Les Boord and Roland Berry Ann, director and deputy director respectively of NIOSH's National Personal Protective Technology Laboratory (NPPTL), participated in a podcast sponsored by EHS Today magazine that examines occupational health issues related to the H1N1 pandemic. Specifically, the NIOSH officials discussed N95 respirators and CDC's H1N1 guidelines for healthcare workers. Tune in to the podcast at <http://ehstoday.com/podcasts/experts-comment-h1n1-pandemic-0110/>.

NIOSH Research on Flavorings Highlighted in News Segment

An investigative news segment February 4 on WBNS-TV, Columbus, Ohio, highlights NIOSH's

groundbreaking research on the hazard of occupational lung disease linked with job-related respiratory exposures to butter flavoring. News video and transcript at <http://www.10tv.com/live/content/teninvestigates/stories/2010/02/04/story-food-flavoring-popcorn.html?sid=102>.

NIOSH Offers Resources for Emergency Responders

As emergency responders are deployed to find survivors, save lives, and speed relief aid to earthquake-devastated Haiti, it is imperative to protect them from work-related injury and illness in the line of duty. NIOSH highlights its emergency response resources for search and rescue teams, fire fighters, and other responders at <http://www.cdc.gov/niosh/topics/emres/>.

Capt. Cheryl Estill Finalist for Federal Engineer of the Year

Cheryl F. Estill, a NIOSH engineer who holds the rank of Captain in the U.S. Public Health Service, has been selected by the National Society of Professional Engineers as one of the ten finalists for the 2010 Federal Engineer of the Year Award for outstanding service to our country. This award is the only one of its kind to solely recognize outstanding engineers employed in the federal government. The 2010 Federal Engineer of the Year will be announced at National Press Club on February 18.

NIOSH Researchers Talk Nanotechnology Abroad

NIOSH researchers Drs. Chuck Geraci and Vladimir Murashov were invited speakers at the Japan NIOSH (JNIOH) Workshop and Open Seminar for Occupational Safety and Health Promotion in January. The meeting focused on the international trends in nanoparticle occupational safety and health. Dr. Geraci presented a summary of the US NIOSH Nanotechnology Research Program and Dr. Murashov summarized key policy and regulatory activities in the US and Europe. NIOSH has an active Memorandum of Understanding with JNIOH and the group identified several areas for more deliberate collaboration.



Drs. Geraci and Murashov and other workshop participants.

Global Happenings

WHO Meeting Presentations Available

Presentations from the 8th Meeting of the Global Network of WHO Collaborating Centers in Occupational Health and the Joint CIS-CC Meeting are now posted on the NIOSH Web page at <http://www.cdc.gov/niosh/programs/global/collaborations.html>.

Former NIOSH Researcher Discusses Blogs on Microfinance Institutions as an Opportunity to Reach Millions of Workers

Former NIOSH Industrial Hygienist Dr. Richard Rinehart provides a guest post on the *Social Performance Indicators Blog* called "Defining Social Responsibility to the Community: Occupational Safety and Health." Dr. Rinehart presents examples of occupational safety and health threats commonly faced by microentrepreneurs in the developing world. "What role," he asks, "might the microfinance industry play in mitigating the negative impact of these risks on clients and the community at large?"

<http://www.spblog.org/2009/12/defining-social-responsibility-to-the-community-occupational-safety-and-health-.html>

The full proceedings of the First International Conference on Road Safety at Work held in Washington DC in 2009 are now available online.

<http://www.cdc.gov/niosh/programs/twu/global>

Two New Health Hazard Evaluation Reports Now Available

The Health Hazard Evaluation (HHE) Program evaluated exposures to hazardous metals, including lead and cadmium, during electronics recycling efforts at four prisons. Investigators recommended that these facilities be in full compliance with Occupational Safety and Health Administration standards, including record keeping requirements, communication requirements, compliance plans, and medical surveillance. HHE Program investigators also recommended that preplacement examinations for cadmium exposure be identical to periodic examinations so that baseline health status can be obtained prior to exposure. Investigators additionally recommended that a detailed job hazard analysis be conducted prior to beginning any new operation or before making changes to existing operations. <http://www2a.cdc.gov/hhe/select.asp?PjtName=47185&bFlag=3>



The HHE Program evaluated a possible excess in cancer incidence among current and former employees in the criminal investigation section of a police department. The investigation determined that the cancers likely were not work-related. Investigators recommended measures to address potential chemical exposures. They recommended that air filters in the local exhaust ventilation and heating, ventilation, and air conditioning systems be replaced routinely and that the amount of outdoor air supplied to occupied areas of the building be increased. Exhaust ventilation should also be added in rooms that house chemicals or emit nuisance odors. HHE Program investigators recommended that the super glue fuming chambers be replaced with units that minimize airborne ethyl cyanoacrylate exposures. Investigators also recommended that employees learn about cancer and get recommended cancer screenings. <http://www2a.cdc.gov/hhe/select.asp?PjtName=47155&bFlag=3>

News from Our Partners

Evaluating the Use of Respiratory Protection for H1N1 Among Healthcare Workers

This flu season, the California Department of Public Health (CDPH) Occupational Health Branch is

collaborating with NIOSH on a survey of respiratory protection policies, procedures, and work practices in California acute care hospitals. The CDPH is also administering a Web-based survey about respiratory protection knowledge and practices to healthcare workers throughout California. This project will assess best practices and gaps in implementing U.S. Centers for Disease Control and Prevention (CDC) guidance (http://www.cdc.gov/h1n1flu/guidelines_infection_control.htm) and the recent California Aerosol Transmissible Diseases standard. For more information please contact Dr. Barbara Materna at barbara.materna@cdph.ca.gov.

Take Caution When Using Disinfectants

The use of disinfectants has increased because of the concern about exposure to infectious agents, such as the 2009 H1N1 influenza virus. A patient seen recently at the Michigan State University Clinic, one of the clinics in the Association of Occupational and Environmental Clinics, complained of respiratory symptoms that had developed at work after exposure to a spray disinfectant. Aerosol cans of disinfectant had been distributed by supervisors and, when people coughed at work, disinfectant was inappropriately sprayed in the air instead of surfaces, according to the clinic. A summary of the allergenic/irritant effects of disinfectants can be found at www.oem.msu.edu/userfiles/file/News/v20n2.pdf.

American Society of Safety Engineers, Technical Report

The American Society of Safety Engineers has developed a technical report, *Guidelines for Addressing Occupational Risks in Design and Redesign Processes* (<https://www.asse.org/shoponline/products/trz790-001-2009.php>). This report provides guidance on including prevention through design concepts and processes as a specifically identified element in a safety and health management system so that decisions pertaining to occupational risks are incorporated into the design and redesign processes, including consideration of the life cycle of facilities, materials, and equipment.

Occupational Medicine Residency Matching Service

The Association of Occupational and Environmental Clinics provides an occupational medicine (OM) residency "matching service" for potential candidates looking for an open OM training slot. Candidates usually are those who have developed an interest in OM training but may have applied too late for the December acceptance deadline of many programs. If you are a potential OM resident or know of someone who is interested in pursuing a career in OM, please send a copy of your current CV and a cover letter to

r2p Corner

NIOSH Technologies Featured in Federal Laboratory Consortium Calendar



Two NIOSH technologies were highlighted in the Southeast 2010 Federal Laboratory Consortium calendar to demonstrate outstanding research and technology transfer efforts. The first technology, a cyclone bioaerosol sampler, is currently being used by public and private research institutions in the United States and internationally to examine potential air hazards. To receive a copy of the calendar or for more information contact Kathleen Goedel at KGoedel@cdc.gov.

NIOSH Science Blog

What's New on the NIOSH Blog?

NIOSH is seeking your input on occupational health and safety training, particularly the feasibility of adding additional rigor to research designs through the use of randomized controlled trials or other methodologies using comparison groups, novel methods for evaluating "transfer of training" into the workplace, and methods that facilitate the measurement of "return on investment" of training to organizations.

<https://blogs.cdc.gov/niosh-science-blog/2010/01/29/training/>

New Communication Products

Major NIOSH Finding Featured in *Emerging Infectious Diseases* Journal

NIOSH scientists published a major finding in the U.S. Centers for Disease Control and Prevention's (CDC) journal *Emerging Infectious Diseases* on the relationship between silicosis and pulmonary mycosis. Silicosis is a work-related disease caused by exposure to respirable silica dust. Pulmonary mycosis is a serious, irreversible but preventable disease caused by fungal infection. Scientists linked the two and found that some workers may be at risk for job-related co-exposure to silica dust and fungi.

<http://www.cdc.gov/eid/content/16/2/318.htm>

Workplace Safety and Health Training Positively Impacts Workers

Occupational health and safety (OHS) training is an important part of managing workplace hazards and risks. *A Systematic Review of the Effectiveness of Training & Education for the Protection of Workers* reports on a study conducted by the Institute for Work and Health and NIOSH to determine whether OHS training and education programs have a beneficial effect on workers and firms. To read the full report go to http://www.cdc.gov/niosh/topics/Training/sys_review_education_training_2010.html or go to the NIOSH Science Blog to provide comments: <https://blogs.cdc.gov/niosh-science-blog/2010/01/29/training/>.

More...

To see other new NIOSH communication products, including documents and new and updated topic pages, go to the NIOSH "What's New" page. <http://www.cdc.gov/niosh/whatsnew/>

Call for Abstracts

American Public Health Association 2010 annual meeting, November 6-10, Denver, Colorado. Deadline for submission is February 5. <http://www.apha.org/meetings/sessions/HowtobecomeaPresenter.htm>

International Occupational Hygiene Association (IOHA 2010). Call for abstracts deadline extended to March 1. Call for posters deadline extended to March 15. <http://www.ioha2010.org/>.

Look for Us!

The NIOSH exhibit will be at the Construction Safety Conference and Exposition, February 16-17, in Rosemont, Illinois, at booth #409. <http://www.buildsafe.org>

Upcoming Conferences & Workshops

NIOSH Announces Personal Protective Technology Stakeholder Meeting

The NIOSH Personal Protective Technology Program will hold a stakeholder meeting on March 2-3 at the Hyatt Regency Pittsburgh Airport. John Howard, M.D., director of NIOSH, will be the luncheon keynote speaker on March 2. Meeting participation is also available via Microsoft Live Meeting for those who cannot

attend. <http://www.cdc.gov/niosh/npptl/resources/pressrel/letters/ltr-03022010.html>

National Action Summit for Latino Worker Health and Safety - Registration Now Open!

NIOSH is cosponsoring the National Action Summit for Latino Worker Health and Safety, sponsored by the Occupational Safety and Health Administration, on April 14-15 in Houston, Texas.

<http://www.osha.gov/latinosummit/index.html>

Nanomaterials and Worker Health

NIOSH and the Mountain and Plains Education and Research Center will hold a conference, *Nanomaterials and Worker Health: Medical Surveillance, Exposure Registries, and Epidemiologic Research*, July 21-23 in Keystone, Colorado. <http://www.cdc.gov/niosh/topics/nanotech/keystone2010/>

History of Occupational and Environmental Health Conference

4th International Conference on the History of Occupational and Environmental Health, June 19-22 in San Francisco, California. <https://www.cme.ucsf.edu/cme/CourseDetail.aspx?coursenumber=MMJ10014>.

A comprehensive list of upcoming conferences can be found at <http://www.cdc.gov/niosh/exhibits.html>.

Word of the Month

Exposome -The measure of all the exposures that an individual may experience over a lifetime in his or her environment, whether those exposures may affect the person's health, and if so, in what ways.

[NIOSH eNews on the Web: www.cdc.gov/niosh/enews/](http://www.cdc.gov/niosh/enews/)

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