

RESEARCH ARTICLE

# Conference summary: International Biomass Smoke Health Effects (IBSHE)

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## Abstract

The Centers for Disease Control and Prevention (CDC) and the University of Montana's Center for Environmental Health Sciences (CEHS) co-hosted a conference entitled "International Biomass Smoke and Health Effects" in Missoula, MT, on August 21 and 22, 2007. The goal of this conference was to bring together experts from diverse fields to review the state of the science in several key areas involving biomass smoke research, as well as identify future research directions. Researchers, physicians, and representatives from regulatory agencies from around the country and world met for a cross-disciplinary exploration of many issues related to biomass smoke research. Major topics of discussion included risk assessment, biomarkers of exposure, toxicology and animal study design, health outcomes measures/study design, and communications gaps. In addition to multiple presentations, breakout sessions were focused on identifying future research directions. In this issue of *Inhalation Toxicology*, we present the findings from each of these breakout sessions in an effort to summarize what is known in these key areas, and to identify those emerging issues in the field of biomass smoke research.

**Keywords:** Biomass; conference summary; health effects; IBSHE; woodsmoke

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## Conference summary

The burning of biomass occurs in a variety of settings, including domestic heating and cooking, regeneration and clearing of agricultural lands, and intentional and unintentional wildland fires. In each case, smoke from biomass combustion produces significant levels of criteria pollutants, including ambient particulate matter (PM) and a wide variety of volatile organic compounds. In addition, these pollutants are produced at very high levels in indoor environments with no regulation. Because biofuels are relatively inexpensive and readily available, the resulting smoke exposures tend to have the greatest impacts on individuals at lower socioeconomic levels and in developing countries.

In collaboration with the Centers for Disease Control and Prevention (CDC), the University of Montana's Center for Environmental Health Sciences (CEHS) was pleased to co-host a highly informative and cross-disciplinary conference titled the International Biomass Smoke Health Effects (IBSHE) Conference on August 21 and 22, 2007. The major objective of this conference was to provide an international

forum for the exchange of information among experts from diverse fields in order to identify gaps in knowledge and to develop new research strategies that would allow us to address policy needs in this emerging area.

The conference, with approximately 75 in attendance, consisted of 6 sessions. Eighteen speakers presented informational talks, with the list of speakers and titles of their presentation provided in Table 1. The theme of the first session was focused on identifying and defining the different types of biomass smoke, and how these compare to urban PM and air pollution. The second session was focused on risk assessment and intervention strategies (i.e., woodstove changeouts). The third session was entitled "Health outcomes of air pollution: Study design and lessons learned" and was composed of presentations on epidemiological evidence of PM-related health effects, and the roles of exposure variation and study design in estimating these potential outcomes.

Session IV focused specifically on the health outcomes resulting from biomass smoke exposure, through both observational and experimental studies. Day 1 concluded

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**Table 1.** IBSHE Conference sessions and speakers.

| Session/speaker                                                             | Affiliation                                                                 | Title of presentation                                                                                                         |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Session I: Types of biomass smoke and comparison to urban PM                |                                                                             |                                                                                                                               |
| Bob Yokelson                                                                | The University of Montana                                                   | The chemistry of fresh and aging biomass burning smoke                                                                        |
| Bret Schichtel                                                              | National Park Service; Colorado State University (CIRA)                     | Contribution of smoke to fine particulate matter: Development of smoke source profiles and routine source apportionment tools |
| Betsy Kagey                                                                 | Georgia Division of Public Health                                           | Georgia wildfires: Integrating state public health into response                                                              |
| Kirk R. Smith                                                               | University of California, Berkeley                                          | Household exposures in the Third World: Status of the evidence and current research needs                                     |
| Session II: Risk assessment and intervention strategies                     |                                                                             |                                                                                                                               |
| Amanda Aldridge                                                             | U.S. Environmental Protection Agency                                        | U.S. EPA woodstove changeout program                                                                                          |
| Curtis Noonan                                                               | The University of Montana                                                   | Tracking woodstove changeout efforts in Libby, MT, and the Nez Perce Reservation                                              |
| Tony Ward                                                                   | The University of Montana                                                   | Woodstove changeout results of the Libby, MT, and the Nez Perce in-home PM <sub>2.5</sub> studies                             |
| Ryan Allen                                                                  | Simon Fraser University                                                     | Evaluating the exposure and health impacts of a woodstove changeout program in British Columbia                               |
| Session III: Health outcomes of air pollution: Study design/lessons learned |                                                                             |                                                                                                                               |
| C. Arden Pope                                                               | Brigham Young University                                                    | Epidemiological evidence of PM-related health effects                                                                         |
| Lianne Sheppard                                                             | University of Washington                                                    | Estimation of health effects: Roles of exposure variation and study design                                                    |
| Session IV: Health outcomes of biomass smoke: Observational studies         |                                                                             |                                                                                                                               |
| Sverre Vedal                                                                | University of Washington                                                    | Observational evidence on biomass smoke health effects                                                                        |
| Isabelle Romieu                                                             | National Institute of Public Health, Mexico                                 | Impact assessment of an improved stove program in Michoacan, Mexico: The PATSARI study                                        |
| Session IV (cont.): Health outcomes of biomass smoke: Experimental studies  |                                                                             |                                                                                                                               |
| John Balmes                                                                 | University of California, San Francisco; University of California, Berkeley | Biomass smoke experimental studies in humans                                                                                  |
| Joe Mauderly                                                                | Lovelace Respiratory Research Institute                                     | Laboratory studies of inhaled woodsmoke                                                                                       |
| Susan Stone                                                                 | U.S. Environmental Protection Agency                                        | Using available evidence to reconsider 1-hour health advisories                                                               |
| Session V: Biomarkers                                                       |                                                                             |                                                                                                                               |
| Larry Needham                                                               | Centers for Disease Control and Prevention                                  | Biomonitoring principles with emphasis on exposure to biomass products                                                        |
| Chris Simpson                                                               | University of Washington                                                    | Application of woodsmoke exposure biomarkers                                                                                  |
| Silvia Carraro                                                              | University of Padova, Italy                                                 | Biomarkers in exhaled air                                                                                                     |

with a panel discussion on the health outcomes of biomass smoke exposure. This panel helped frame directions for future biomass smoke research, and posed the challenge to experts in the field for finding ways to address the more difficult and as yet unanswered questions.

On day 2, Session V began with a discussion on the use of biomarkers in the field of biomass smoke-exposed populations. This session was then followed by five breakout sessions, with the topics and goals of these breakout sessions presented next.

#### ***Breakout session A, risk assessment: defining the questions***

This session examined the questions and research gaps in developing quantitative risk assessments for biomass burning. The session focused on the three major elements of quantitative risk assessment (hazard identification, dose response, and exposure assessment) needed to perform proper risk characterization.

#### ***Breakout session B, biomarkers of woodsmoke exposure***

Biological monitoring has been proposed as a potential tool to obtain reliable estimates of personal exposure to

woodsmoke. In this breakout session, participants discussed key issues regarding the application of biological monitoring in woodsmoke exposure assessment.

#### ***Breakout session C, toxicology and animal study design***

Exposure to biomass smoke has been epidemiologically associated with pulmonary disease, including asthma and respiratory infection. Mechanistic studies are few and difficult to perform on human subjects. The need to develop animal studies to study the mechanisms behind the adverse health effects of biomass smoke exposure is evident. This session explored several topics in the use and development of animal models in smoke exposure studies.

#### ***Breakout session D, health outcomes measures/study design***

Biomass smoke exposure can occur in a variety of settings, ranging from residential exposures to community-wide exposures. This session explored the commonalities and differences that should be considered when conducting health studies in these settings. Particular attention was

paid to identifying the most relevant outcomes, including subclinical biomarkers of effect.

#### **Breakout session E, communications gaps**

For public health educators and officials, communicating risk to impacted audiences is complicated by both the expected factors of varying audience demographics and the less common factor of insufficient scientific facts from which to base education and recommendations. This session examined ways in which communicators and educators have addressed these challenges.

Following the breakout sessions, Session VI was targeted toward engaging the potential funding agencies for biomass smoke research (i.e., U.S. EPA, CDC, National Institutes of Health [NIH], and local/state agencies). The conference was concluded following Session VII, where informal presentations were used to relay the findings from the breakout sessions regarding the identification of research gaps and future directions. These informal presentations also served as the basis for more formal articles summarizing the findings of the breakout sessions. These articles are presented in this issue of *Inhalation Toxicology*.

#### **Conclusions**

The University of Montana/CDC conference brought together experts in the chemistry of biomass smoke, field exposure studies, human and animal studies, and biomarkers, as well as clinical and basic research investigators, to help define our current knowledge in understanding

the health effects resulting from smoke exposure and the potential public health implications of those exposures. The conference also included working sessions with the goal of providing recommendations and prioritization on research gaps and future research directions. The conference organizers and participants hope and anticipate that this conference inspired collaborations and ongoing communication about biomass research that will eventually lead to major advances in our understanding of community, exposure, pathophysiologic, and mechanistic issues in this field.

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**Declaration of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.