About ISES

Mission

ISES works to meet humanity’s needs for public health and environmental protection through a global community of exposure science professionals. ISES encourages the open exchange of information, provides opportunities for career development, acknowledges and promotes excellence in the practice of exposure assessments and research in the field of exposure science.

For information on membership and to learn more about the ISES, please visit http://intlexposurescience.org.

Editorial Board

Eunice Varughese, Ph.D., Editor-in-Chief
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Jane Ellen Clougherty, Ph.D.
Erin Haynes, Ph.D.
Judy S. LaKind, Ph.D.

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President’s Message
by Judy S. LaKind, PhD & Amrutasri Nori-Sarma

A few weeks ago, the 4th annual Women’s Networking Event was held as part of the 2017 ISES meeting, with 110 women in attendance. At this sold-out event, women at various stages of their careers spoke about personal experiences with being a woman in science. Some of the more “senior” members reflected on the changes we have witnessed in terms of percentage of women in meeting rooms, giving presentations, and in leadership positions. Where there used to be very few, now, in some cases, women are the majority.

While this increased diversity has led to dramatic improvements, especially for women in the workplace, all the recent headlines regarding harassment across fields, disciplines, industries, and geographies illustrate the important work that still remains to be done (for a both disheartening but also encouraging examination of this issue, please see a recent exposé in C&EN News at https://cen.acs.org/articles/95/i37/Confronting-sexual-harassment-chemistry.html). One encouraging aspect of this article and increased conversations about the systemic nature of gender-based harassment is the description of efforts made by professional societies to take a leadership role in defining and disavowing harassment, which can take many forms and - of course - does not only impact women.

It is time for ISES to join in this effort. In support of our mission to bring the full value of exposure science to research and decision-making, ISES is committed to fostering the exchange of information and ideas and the enhancement of professional expertise among members in a healthy, harassment-free environment. While we cultivate a powerful learning community centered on core values and a shared dedication to excellence in the field of exposure science, ISES is simultaneously committed to creating an equitable environment where diverse voices are active in all aspects of our organization. This requires a culture of inclusion in which all individuals feel respected and are treated fairly. We understand that achieving equity is a continuous and iterative process, and we seek to maintain the highest standards of ethics, transparency, and accountability in our Society.

To this end, and in line with ongoing efforts at other international organizations, the ISES Diversity Committee and Executive Committee are currently drafting an anti-harassment policy. We welcome participation from all members in this vital effort. We expect to have a draft policy available for comments from the members in 2018, and anticipate a living, flexible document with staying power that will hold ISES members accountable to a shared code of conduct.

Thanks for reading,

Judy and Amruta
2017 Women’s Networking Event
Message from the President-Elect
by Paloma Beamer, PhD

It is an honor to have been elected to lead an international group of scientists dedicated to bettering “our world, its ecosystems, and inhabitants” by advancing and integrating “exposure science into research and action.”

Even after all the advances in improving our environment, the World Health Organization reported last year that almost a quarter of deaths and disease are still attributable to an unhealthy environment. Clearly, we have our work cut out for us.

In order to make progress and prevent environmentally-related disease, it is essential that our society highlight the importance of recognizing exposure science as its own discipline. More than 25 years after the establishment of ISES, exposure is still the least studied and least funded component in our understanding of how to prevent disease from unhealthy environments.

As president, I hope to build on the work of our past leaders and efforts. It is essential that we continue to demonstrate that improved estimates or measures of exposure are necessary for reducing uncertainty in risk assessment, misclassification in epidemiological studies, and improved interventions to reduce exposure. If the vector biologists, who study exposure sources such as mosquitoes, can have their own study section at NIH, why can’t we?

Yet, it is also important that we recognize and acknowledge that the burden of environmentally-related disease disproportionately impacts inhabitants of developing countries and marginalized communities throughout the rest of the world. My work over the last several years has underscored for me the importance of culture, beliefs and perceptions on exposure-related behaviors. In order to improve exposure science, it is essential that we increase the diversity of voices and experiences trained in our discipline from across the world.

I am committed to increasing the diversity of our membership, and I welcome suggestions for how we can collaborate on this topic. One way each of you can participate is by joining the ISES mentor program. Because of the newness of our discipline many students and new investigators across the world do not have access to mentors trained in exposure science and are encountering unchartered territory in their research efforts. This year, we are hoping to make the ISES Mentor Program its own committee. Please let me know if you are willing to be on it.

Thank you again for your support and belief in me. I am truly humbled and honored to be leading this scrappy and passionate bunch of scientists. This amazing group that is always dedicated to doing the “right science” so we can answer the “right questions” and who believe that “their science” will change the world.

Paloma Beamer, PhD
A Note of Thanks from the President

Thank you for attending the recent ISES Annual Meeting in Research Triangle Park, North Carolina; you were part of the record-breaking 700 attendees. I hope you found the meeting enjoyable and educational.

The success of any annual meeting is directly related to the time and effort of the meeting co-chairs. This year we were fortunate to have as co-chairs Drs. Jennifer Lantz (Bayer), David Balshaw (NIEHS) and Jane Hoppin (NC State). These three individuals devoted countless hours working to ensure the meeting program would be exciting and engaging and would appeal to everyone from students to retired professionals. They also worked to ensure that the social events captured the North Carolina ambience and allowed for many networking opportunities. On behalf of the Board of Directors and the Society I want to thank and congratulate them for putting together a most memorable meeting. If you have a moment, please take the opportunity to send them a thank you, as well.

I would also like to thank the meeting organizer, Infinity Conference Group. The Infinity team worked behind the scenes (and sometimes in front) to ensure that the co-chairs’ vision became reality and that the meeting logistics ran smoothly. They did a fantastic job!

Finally, kudos to the volunteer members of the Technical Organizing Committee. Their hard work was also integral to the success of the meeting.

Thank you again for participating in this event and supporting the Society. We look forward to having you join us August 26-30, 2018, in Ottawa, Canada, for the joint ISES-ISEE Meeting.

Judy S. LaKind, PhD
President, International Society of Exposure Science
The 27th Annual Meeting of the International Society of Exposure Science (ISES) took place in Research Triangle Park, NC on October 15th to 19th, 2017. The meeting was entitled Integrating Exposure Science Across Diverse Communities. The Research Triangle Park area is one of the world’s first, and largest, research parks, and is strengthened and diversified by the concentration of and close connections among industry, academia, and government, as well as local community partnerships. To reflect these sectors there were three co-chairs this year: Jennifer Lantz, Bayer CropScience representing industry, Jane Hoppin, North Carolina State University representing academia and David Balshaw, NIEHS representing government. The chairs encouraged the multi sector collaboration theme to be reflected throughout the conference. The meeting presented a great opportunity for attendees to learn about the latest advances in a wide array of exposure topics, while networking and re-connecting with colleagues from around the world.

The conference had a record attendance of over 700 scientists from academia (45%), government (29%), industry (9%), and non-government organizations dedicated to promoting and advancing exposure science (methods, measurements, models). The conference ran 7 simultaneous tracks of sessions for 3 ½ days with almost 100 sessions of 430 oral presentations. Sixty four of these were submitted symposia and the remaining sessions were made up of general abstracts. There were 166 posters presented during poster sessions over 3 days. Sessions covered numerous and diverse topics such as Population Biomonitoring, Indoor Air Quality and Particulates, Food Packaging, Wrist Bands as Sensors, Exposure to Personal Care Products, Engaged Exposure Science and Epidemiology, Environmental Justice to name a few. This year was the most successful yet for the pre-conference workshops. There were seven courses on Sunday, October 15 with attendance of 125 people. Courses covered topics such as the NIH Grant Process, Science Communication, Air...
Quality monitors and several on exposure models.

The Opening Plenary Session on Sunday evening this year included three local speakers from different areas talking about their “Visions of Exposure Science”. They were Gwen Collman of NIEHS, Tashni-Ann Dubroy currently at Howard University but recently President of Shaw University and Randy Woodson, Chancellor of North Carolina State University. The plenary was followed by the Opening Reception and the always well-attended and interesting Student Poster Contest. Other plenary speakers during the week were Karletta Chief of University of Arizona, and Brian Southwell from RTI International.

The Tuesday morning plenary was dedicated to our ISES awardees. The 2016 and 2017 Wesolowski awardees Mary Wolff, Icahn School of Medicine at Mount Sinai and Patrick Breysse, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry respectively, received their awards and gave
presentations. Other awards were presented to Ed Avol, Rancho Los Amigos Medical Center (Constance L. Mehlman Award), Nicole Deziel, Yale School of Public Health (Joan M. Daisey Outstanding Young Scientist Award) and Stephanie Hammel, Duke University (IPA/DGUV Award for Young Exposure Scientists.

And then, of course, there were the fun social events. These included the Opening Reception mentioned above, the ISES Annual Dinner, held at a local brewery/restaurant including a band, the ISES Technology/Exhibitor/Committee fair which was well-attended and had plenty of food and drink for all, the Student and New Researcher Reception, and the Women’s Networking Event with record attendance held at a local restaurant. Other special events included The NIEHS Resource Room, the Meet the Editor’s Lunch Meeting, Student and New Researcher Mentorship Program Breakfast, and Diversity and Student/New Researcher Breakfast. Many other ancillary meetings occurred during the conference; lunches were purposely not formal but were buffet or boxed so planned and spontaneous meetings and networking could take place.

The Annual ISES Meeting just keeps getting better every year! We thank the chairs and the Technical Organizing Committee and the Meeting Planner (Infinity Conferences) for all the hard work and planning, which resulted in a great and financially successful meeting for the Society!

Look forward to seeing you in Ottawa, Canada for the 2018 Meeting.

Call for Proposals for Future Meetings

2020 ISES Annual Meeting

Calling all interested parties who want to host the 2020 ISES Annual Meeting. The 30th annual meeting of ISES will be held in the western part of the US. If you have an interest in organizing a fantastic meeting that showcases exposure science and you want to host in a city located in the western part of the US, send your ideas to pjensen@infinityconferences.com with ISES Annual Meeting as the subject. ISES is now considering proposals for the 2020 meeting. The deadline to submit a proposal is June 1, 2018.

2021 ISES Annual Meeting

If the western US doesn’t work for you or 2020 is too soon to consider hosting a meeting, what about 2021 on the eastern part of the US? It’s never too soon to be thinking about our next meeting. ISES has a history of well attended, scientifically strong annual meetings. Be a part of this exciting venture and consider submitting a proposal to pjensen@infinityconferences.com with ISES Annual Meeting as the subject.
First Meeting of the New California Chapter of ISES
by Laura Kwong, MS

Our first annual conference was a huge success, with 61 participants from government, academia, and the private sector. During the keynote Arlene Blum gave an engaging presentation on the work of the Green Science Policy Institute regarding the six classes of chemicals that are known to harm human health and the environment. The keynote talk was followed by a presentation on biomonitoring for flame retardants and other contaminants as part of Biomonitoring California. We also heard about the ongoing Alternatives Analysis conducted by the Safer Consumer Products Group at the California Department of Toxic Substances Control (note that November 6th is their public workshop on lead-acid batteries and alternatives and the deadline for recommendations for the 2018-2020 Priority Product Work Plan). We also heard about CalEnviroScreen 3.0, a tool from OEHHA to help identify California communities that face a disproportionate burden of multiple sources of pollution. In addition, there were presentations on air quality sensors and the testing performed by the Air Quality Sensor Performance Evaluation Center, air quality near highways, and community-lead air quality monitoring in Imperial Valley.

We will host our next event on Thursday, December 14th at noon. Our Chapter president, Tom McKone will share thoughts on emerging areas of research in exposure science, many of which are especially applicable to California. The call-in information is Online: https://zoom.us/j/9498240548; meeting ID: 949-824-0548.

Laura is a PhD Candidate at Stanford University in Stanford, CA. Laura studies children’s exposure to fecal contamination in the domestic environment in Bangladesh and other low-income countries. She also explores the effect of the built environment on exposure to respiratory and soil-transmitted pathogens. Laura has a passion to increase the availability and use of exposure science, especially in low-income countries that have severe health challenges. You can reach her at: lakwong@stanford.edu
In the afterglow of another successful ISES Annual meeting, I wanted to highlight some of the exciting upcoming changes to JESEE. Dr. Elaine Cohen Hubal, our fourth Editor-in-Chief, has laid out a compelling mission for our journal, one that prizes rigor and innovation and substance over incrementalism and minutiae. This new vision, coupled with a number of backend technical changes to the journal production process, aims to raise the impact of JESEE across our shared field. But as with any technology update, please do let us know if you experience any technical issues – we need your help in making this transition move forward seamlessly. In fact, we want JESEE to be the first choice destination for ISES member research, and we’d love to hear your ideas on how we can make this happen.

Springer Nature has been actively improving our Society’s ability to interact with the journal. Beginning with a much needed update of the JESEE website, you can see a cleaner interface that we come to expect in well-designed web platforms. Here, you can find clear links to articles, improved ability to search and browse, and a great new article analytics platform that highlights trending papers or other insight into how our papers are being discussed online and across a variety of platforms. Gone are the days of retrieving journal reprints from dusty library stacks – our journal is now much better prepared to capture this online activity so we can better measure how our science impacts society.

You may also see exciting changes on how your manuscripts are submitted and reviewed. We recognize (and personally empathize) with long delays between paper acceptance to online production and availability of your work. Springer Nature has dramatically improved our interface for authors and reviewers by transitioning to a new production platform in order make this process smoother and more efficient for all. Our end goal is to make it easier for you to submit your high-quality (and hard-earned) work, for you to have easier access as a reviewer, and get the best research published online, in the fastest way possible.

Lastly, it’s exciting to acknowledge outstanding exposure science that is recognized by our new Society awards. Dr. Ami Zota and colleagues’ work on “Associations between metals in residential environmental media and exposure biomarkers over time in infants living near a mining-impacted site” earned the Best JESEE Paper award. Dr. Elizabeth Marder’s work as a student, “Quantification of Polybrominated and Polychlorinated Biphenyls in Human Matrices by Isotope-Dilution Gas Chromatography–Tandem Mass Spectrometry” earned her the ISES Best Student Paper. And finally, Dr. Darpa Jyethi, a visiting scientist at the Indian Statistical Institute at Tezpur on exposure to persistent organic pollutants was given the JESEE Meeting Award for Young Investigators, a Springer Nature-funded award. Well-deserved congratulations to you all!

Rick Peltier is the Deputy Editor-in-Chief of JESEE and has been an associate editor for more than six years. He is an Associate Professor in the Department of Environmental Health Science at the University of Massachusetts Amherst. Contact him anytime - to talk shop, ask a question about the journal, or just send a friendly hello - at rpeltier@umass.edu.
The National Biomonitoring Network

*Harmonizing Measurements for Use in Public Health Practice*

by Julianne Nassif

Human biomonitoring measurements of internal dose complement environmental and health outcome data when assessing chemical exposures to the public. Public health professionals use these data to respond to emergencies such as chemical spills, to investigate community concerns related to known sources of pollution or suspected environmental disease, for environmental health surveillance and to inform and evaluate public policy decisions and interventions. Government environmental health laboratories have developed advanced analytical skills through implementation of state biomonitoring programs and via resources and technical assistance provided by the Centers for Disease Control and Prevention (CDC) related to public health emergency preparedness and biomonitoring capability and capacity building cooperative agreements.

As biomonitoring capacity increases, so does the need for a national strategy for ensuring the quality of the science conducted to facilitate comparison of data from one program to another. In response, the Association of Public Health Laboratories (APHL) has launched the National Biomonitoring Network (NBN) in collaboration with the National Center for Environmental Health (NCEH) at CDC. The NBN aims to harmonize biomonitoring data for use in routine public health practice by establishing quality standards and practices, mentoring nascent...
programs, and enhancing analytical capability and capacity through technical assistance.

The work of the NBN is guided by a Network Steering Committee (NSC) co-chaired by Drs. Antonia Calafat from NCEH and Kenneth Aldous from the Wadsworth Center, New York State Department of Health, which includes representatives from CDC, the Environmental Protection Agency, the National Institutes of Environmental Health Sciences (NIEHS), the National Institutes of Occupational Safety and Health, academia and state public health laboratories and programs. The NBN has developed an organizational framework, membership eligibility criteria, and a guidance document related to program and study design, quality management and analytical measurements. To facilitate the production of these resources, the NSC established multidisciplinary workgroups of subject matter experts.

Important challenges remaining for the fledgling NBN are to define data standards, and to identify an appropriate national repository for biomonitoring data. The NBN must consider whether to establish an independent data system or to integrate state and local biomonitoring data into an existing platform such as the Environmental Public Health Track Network or the NIEHS Children’s Health Exposure Analysis Resource (CHEAR). The advantage of a comprehensive biomonitoring data platform that is accessible to all is obvious but is contingent upon use of common data ontology and structure. Considerable research and discussion are required before any decisions regarding a data repository are considered.

The NBN closely monitors and considers biomonitoring-related strategies in use both domestically and internationally by CHEAR, Human Biomonitoring for the European Union (HBM4EU), the Canadian Biomonitoring Network, and the Japan Environment and Children’s Study. While the goals of these other networks differ from those of NBN, understanding their structure, advantages and limitations informs the development and implementation of the NBN and provides opportunity for cross-network collaboration.

Currently NBN membership is limited to government laboratories working within the public health system, however with time, the network may expand to include non-laboratory and academic partners. The Association of Public Health Laboratories (APHL) is a membership organization, comprised of state and local governmental health laboratories in the United States, including public health, environmental, agricultural science and food safety laboratories. Representatives from federal agencies, nonprofit organizations, corporations and interested individuals also participate in the association. APHL works with local, state and federal health partners to strengthen the laboratory system in the U.S. and works internationally to build effective national laboratory systems and expand access to quality diagnostic testing services.

Ms. Nassif is the Director of Environmental Health Programs at the Association of Public Health Laboratories in Silver Spring, MD. She guides efforts related to human biomonitoring, chemical and radiological laboratory response, emerging contaminants, and clean drinking water. Having previously directed analytical chemistry laboratories at the state level, she strives to champion the work of the state environmental public health laboratories and to help integrate the laboratories more fully in the environmental health system. You can contact Ms. Nassif at julianne.nassif@aphl.org.
ISES Tri-State Chapter Meeting

by Kathy Black, PhD, MPH

The Tri-State Chapter of the International Society of Exposure Science (ISES) was established in 2008. The geographical area of the Chapter consists of New Jersey, New York, and Pennsylvania. The Chapter’s aim is to foster and advance the science of exposure analysis related to environmental contaminants, both for human populations and ecosystems in the Tri-State area. Member interaction is encouraged through biannual face-to-face meetings. Information about the chapter may be found on its website: http://isestristate.org/.

2017 Chapter Meeting

The Tri-State Chapter used a remote interactive meeting format for the recent June 2017 meeting. The meeting used a virtual meeting platform (Lifesize) at Rutgers School of Public Health to connect Tri-State Chapter members at Rutgers with members of New York University in Sterling Forest, New York and the chapter treasurer, Dr. Neha Sunger, at West Chester University in West Chester, Pennsylvania. The platform allowed members to share presentations and have real-time discussions on the challenges in exposure science research and application. Two keynote presentations were given by Dr. Terry Gordon, Department of Environmental Medicine at New York University Langone Health “Overview of current exposure science research projects at NYU and future directions”, and Dr. Rose Zaleski, Exxon Mobil Biomedical Sciences, Inc., “Exposure science in industry: current applications and future directions.”

Graduate students from both NYU (Ruzmyn Vilcassim and Mostafijur Rahaman) and Rutgers University (Melody Wren, Jiaqi Zhou, Nirmala Thomas, Breann Coffaro, Leonardo Calderon, Zhongyuan Mi, Longfei Chao, and Ting Cai) gave brief presentations on their current research projects.

The Chapter plans to continue to use the interactive platform for future meetings.

Chapter student travel awards: each year, the Chapter will elect a student travel award winner, now named the Paul J. Lioy Student Travel Award, to assist students in their participation in the annual ISES conference. Recent award winners
include:

2017 – Melody Wren, Rutgers University, for “Method development for the detection of pyrethroid metabolites in saliva."

2016 – Jiaqi Zhou, Rutgers University, for “Toddlers’ inhalation exposure to pyrethroids in homes.”

Sheila Tripathy, University of Pittsburgh, for “Outdoor air pollution and brain morphology in the Adult Health and Behaviour II and Pittsburgh Imaging Project cohorts.”

2015 – Shavonne Hylton, Rutgers University for “A tool to reduce uncertainty in risk characterization: combining in vitro extraction methods and cellular bioassay.”

Membership in the Tri-State Chapter

For those interested in joining the Tri-State Chapter of ISES, please use our online application at http://isestristate.org/membership-application/ The annual membership is $30 ($15 for students). Please note that we are in the process of amending our bylaws so that student members and emeritus members of the main society may join the chapter for free.

Nominations to the Tri-State Chapter Executive Committee

Elections will be held for the following positions: President, Secretary, Councilor-at-large (2 positions), and Student Councilor. We are encouraging nominations from all affiliations in the tri-state region (New York, New Jersey, and Pennsylvania). Please send your nominations to Kathy Black at kgblack@eohsi.rutgers.edu. Nominations are due December 20, 2017.

Kathy is with Rutgers-EOHSI, in Piscataway, NJ. She has been a member of the ISES Tri-State Regional Chapter since 2008 and is currently serving as a Councilor at-large for the chapter. You can contact her at kgblack@eohsi.rutgers.edu.
Positive Impacts of ISES Travel Awards

by Donghai Liang, MPH

Our annual meetings are strengthened when we have broad participation from scientists from around the world and at various career stages. The annual ISES meeting travel award supports students, new researchers, and scientists, including those from developing countries and underrepresented groups, with funds to assist with meeting-related expenses, such as registration, lodging, and transportation. Administered by Donghai Liang, Marsha Morgan, and Nicole Deziel from the ISES Diversity Committee and in collaboration with the Student/New Researcher Committee, the 2017 ISES travel award was open for applications to all ISES members from March 30th to May 17th.

Applicants were considered in one or more of the following three award categories if they met the eligibility criteria: 1) Student or New Researcher, 2) Scientist from a Developing Country, and 3) Diversity Awards. All application materials were de-identified and evaluated by at least three independent reviewers. Judges included 18 members of the Diversity Committee and 8 members of the Student and New Researcher Committee.

Based on the quality of the abstract, the need for financial support, and commitment and enthusiasm for the field of exposure science, 22 winners were selected. Winners came from 10 different countries or regions and included 21 students/ new researchers, 13 scientists from developing countries, and 14 with diverse backgrounds. A total of $18,000 was awarded.

Numerous award winners have expressed appreciation to the Society and shared feedback on the positive impact of the travel grants on their research and professional development. The
travel grants provided critical support, without which some scientists would not have been able to attend.

“Overall, it was an enriching experience for me. All this would have not been possible without the ISES Travel Award by the Diversity Committee. The award helped me to cover travel expenses from India to a great extent”, said Dr. Darpa Jyethi, a new researcher from India.

“The travel award gave an important opportunity to show my research before so many experts, from whom I can get the comments, and exchange ideas,” said Dr. Bin Han, an associate professor from China. “For the young or rookie researcher like me, the chance of communication with other scientists is of great importance, and critical for my future development.”

For graduate students, the funds and honor that comes with the travel award gave them great encouragement to move forward and continue their research career.

“The travel award was able to provide me with a truly invaluable opportunity,” said Corey Boles, a doctoral student from US, “Without the travel award, I would have been unable to listen to the ideas regarding my research of so many professionals from a variety of fields.”

“I have one year left of my PhD research and I felt I met a lot of people that I could possibly work with in the future or complete postdoctoral research,” Alison Connolly added, a doctoral candidate from Ireland.

Overall, we are glad to see that the 2017 ISES travel award succeeded in promoting the longevity of our organization and strengthening our science by drawing on the skills, knowledge, and perspectives of scientists from all parts of our society.

Donghai Liang is a doctoral candidate at Emory University, Atlanta, working on health effects associated with traffic-related air pollution using exposure assessment and environmental metabolomics. He has been a member of ISES since 2015 and attended three ISES conferences (Henderson, Utrecht, and RTP), where he received several travel award and student poster awards thanks to the great support from the society. Since 2016, Donghai has joined the Diversity Committee and led the working group on travel awards. You can contact him at: donghai.liang@emory.edu
ISES Awards

From left: Stephanie Hammel, Deborah Bennett, Ed Avol, Pat Breysse, Mary Wolfe, and Nicole Deziel

Pat Breysse & Mary Wolfe
Jerome J. Wesolowski Award

Ed Avol
Constance L. Melman Award

Nicole Deziel
Joan M. Daisey Outstanding Young Scientist Award

Stephanie Hammel
IPA/DGUV Award for Young Exposure Scientists
Annual Awards

Darpa Jyethi
JESEE Meeting Award for Young Investigators

Ami Zota
Best JESEE Paper Award

Elizabeth Marder
ISES Best Student Paper

Student Poster Awards

Breann Coffaro
1st Place

Cherie DeVore
2nd Place

Jamaji Nwanaji-Enwerem
3rd Place

Nicolas Lopez-Galvez
Honorable Mentions
The 2018 Joint ISES-ISEE Meeting will bring together scientific experts and practitioners from academia, government, industry, and non-governmental organizations dedicated to the protection of health and environment. Exposure science and environmental epidemiology are dynamic fields that:

- Develop and apply traditional and innovative methods for assessing exposures to environmental stressors and their health effects.
- Address exposures to a broad array of environmental stressors as well as factors that contribute to or mitigate exposure.
- Elucidate potential health effects from environmental stressors during the life cycle including outcomes from in utero development to death.
- Promote interdisciplinary approaches to solving complex environmental public health problems.

The Joint ISES-ISEE 2018 Meeting theme is “Addressing Complex Local and Global Issues in Environmental Exposure and Health.” We aim to highlight issues that reflect the complexities in environmental exposure and health research and policy development. For example, complexity can refer to:

- interactions between social and environmental determinants;
- combined assessments of both exposure and health;
- exposures across multiple media, sources, and stressors;
- exposures in different microenvironments;
- temporally and spatially varying exposures;
- mixtures and cumulative exposures;
- gene-environment interactions;
• the vast array of clinical and subclinical health impacts; and
• translation of research into policy and other decision making.

The meeting will address complexities in exposure and health from very big (macro/ecosystem) to very small (micro/molecular) environments.

As the capital city of Canada, Ottawa is home to a diverse and active community of scientists and policy makers engaged in local and global environmental exposure and health research. The ISES-ISEE 2018 Meeting will be inclusive to delegates from around the world, and will leverage local and international expertise to address complex local and global topics relevant to exposure science and environmental epidemiology.

The Joint ISES-ISEE 2018 Annual Meeting will leverage this expertise to address complex, locally and globally significant topics in environmental exposure and epidemiology. A detailed summary of the specific conference themes can be found at http://isesissee2018.org/scope-of-the-meeting/.

### INTERNATIONAL SOCIETY OF EXPOSURE SCIENCE

#### Symposium Proposal Submission

- Symposium proposal submission opens November 6, 2017.
- Submission will be open from November 6 until January 8, 2018 at 11:59 PM ET. Proposals submitted will undergo expedited expert review.
- Scheduling/rejection notifications will be mailed to the submitting authors on February 8.

#### Symposium Proposal Requirements

Symposium proposals will be accepted for session lengths of 90 minutes (no more than five presentations) and formats other than traditional plenary presentations are encouraged.

The proposal should address each of the following elements:

1. Symposium title (do not put your title in quotation marks)
2. Symposium organizer(s):
   - Name;
   - Affiliation;
   - Presentation title (if applicable); and
   - Brief description of the presentation (formal abstracts will be submitted by individual presenters at a later date)
3. Symposium presenters, including (for each participant):
   - Name;
   - Affiliation;
   - Presentation title; and
   - Brief description of the presentation (formal abstracts will be submitted by individual presenters at a later date)

4. Symposium abstract (approximately 500 words) comprised of:
   - Brief description of the symposium (including background and significance);
   - Relationship(s) between the presentations; and
   - Relevance to the conference theme, i.e., “Addressing Complex Local and Global Issues in Environmental Exposure and Health.”

Successful symposium proposals should demonstrate relevance to the conference theme, high-quality presentations, and diversity among the presenters (e.g., representing multiple disciplines, methodologies, home institutions, and geographic regions).

Note: All Presenters (panel, symposium, platform, posters) will need to register for the conference and pay the appropriate fee(s). ISES/ISEE does not fund speaker travel or registration fees.

For detailed information, please visit www.isesisee2018.org/abstractsubmission or contact ises.isee.2018@gmail.com.

Reminder: The deadline for submitting a symposia proposal is January 8, 2018. To submit a proposal, please go to the 2018 meeting submission page.

General individual abstract submission will open on February 15 and close on April 1, 2018.
Co-Chairs for the 2018 Joint ISES-ISEE Meeting

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Angelika Zidek, Health Canada, Ottawa, ON, Canada

Audrey Smargiassi, Université de Montréal, Montreal, QC, Canada

Veronica Vieira, University of California, Irvine, CA, USA
Exposure Science: Perspectives from Australia
by Leonid Turczynowicz, PhD, MPH

While exposure science has not been a term used in Australia until very recently, the activities that comprise that field of scientific endeavour have been pursued for over 30 years. Since the early 1980’s occupational hygiene has underpinned exposure science in the occupational setting and was the first public health area to actively examine human exposures through worker monitoring activities. In South Australia, these developed through a need for government programs to support industry assessments. The formation of an Occupational Health Branch and Radiation Control facilitated that process. The establishment of the National Occupational Health and Safety Commission (later called WorkSafe Australia) contributed to national training efforts in occupational hygiene and occupational medicine in the late 1980s and early 1990s. Since then, several Australian universities have established progressive academic programs which have trained occupational hygienists concurrent with the growing influence of the Australian Institute of Occupational Hygienists. The majority of occupational hygienists today are employed in the industry sector or privately, with the balance at academic institutions and a small number in the government sector.

In the mid 1980’s, concerns over air quality, specifically lead and particulates, led to the interest in the environmental health aspect of exposure science. Areas such as Port Pirie in southern Australia, which has the world’s largest lead smelter, and Broken Hill and Mt. Isa, which have mining facilities, became areas of increasing media focus due to residential proximity and the potential of large scale community impacts. These issues were supplemented by other
environmental health problems such as site contamination, the use of organochlorine termiticides, and the environmental bio-accumulation and human exposure to substances such as tributyltins. These concerns led to the development of a national human health risk assessment framework, stimulated by government health agencies at state and federal levels. The current enHealth Council health risk assessment framework includes exposure assessment as a key component in conjunction with toxicological understanding, and highlights the importance of the role of exposure science. In Australia, the term, 'exposure scientist' is a novel one with individuals engaged in risk assessment generally being considered as 'toxicologists', 'risk assessors', or occasionally 'public health scientists'.

In terms of academic training, exposure science is not a discipline area readily recognised across Australian academic institutions. The School of Public Health at the University of Adelaide recently celebrated the 30th anniversary of the Occupational and Environmental Hygiene laboratory, recently renamed to Adelaide Exposure Science and Health, to better reflect the research. It has highly experienced toxicologists, occupational hygienists, and public health scientists who are nationally recognised for their research, training, and consulting, with a focus towards exposure measurement. Activities within the program include research on human skin permeation of hazardous substances, developing evidenced-based indoor sampling methods for vapour intrusion, and assessing local worker exposure to isocyanates.

The Adelaide Exposure Science and Health group at the University of Adelaide, although experienced, is not the only academic institution associated with occupational and environmental health research and teaching. Other institutions include Macquarie University, Queensland University of Technology, University of Queensland, RMIT University, Monash University, Curtin University, and Edith Cowan University. Collectively however, this represents about 19% of all Australian universities and suggests a need for the establishment of a local Chapter of the International Society of Exposure Science to further the pursuit of this important area of public health.

Len is with the University of Adelaide in Adelaide, South Australia. He has some 30 years of experience in public health toxicology and human health risk assessment and has worked as a regulatory scientist in the State health department (20 years) and as a Principal Risk Assessor for multi-national consultancies (8 years). In the last few years he has been involved in consulting, research and teaching at the University of Adelaide. You can contact him at: lenid.turczynowicz@adelaide.edu.au
Budding Scientist Corner

Identification of Various Chemical Compounds from Dust Samples Collected in Local Schools

by Alex Sherwin & Farzad Mustafa

For a high school student such as myself, exposure science is not one of the first topics of study that readily comes to mind. However, it is the work of the exposure scientists that allow for the rapidly increasing wealth of information regarding household safety. Research conducted by exposure scientists affects us directly as it involves different substances that we are exposed to on a daily basis, whether it be in our homes or workplaces. The field of exposure science is not as intangible and obscure for an average person as one may think. Given the implications of the results of such important research, I decided to pursue a project in exposure science by analyzing the chemicals found at local schools near Rockville, MD. As students spend over 1000 hours in school every year, exposure to potentially harmful compounds and resulting risk of being harmed is quite significant for them. With this in mind, the goal of this study was to collect and analyze school dust samples using high-resolution mass spectrometry to locate the presence of various harmful compounds that may be health hazards for children at school.

Gaining background information on exposure science was very difficult for one who is in high school, but finding the “dirty secrets” behind the schools was made easier with the help of my mentors and a few online resources. My first mentor, Dr. Hakkinen, helped me find areas of exposure science that I could possibly explore and research. After I had selected my topic, my other mentor, Dr. Strynar, helped me greatly with processes involving lab work and general counseling with any questions about the science behind exposure science. When working on my own, I also used online health resources, such as
ToxTutor (https://toxtutor.nlm.nih.gov/) and ChemSpider (http://www.chemspider.com/Default.aspx) to learn more about what I was working on and about various chemical structures that appeared in the results.

For this investigation, dust samples were collected via vacuum bags from 10 local schools, (2 elementary, 3 middle, and 5 high) between late October 2016 to mid-November 2016. Vacuum cleaner bag dust was sieved to 150 μm to remove large particles. About 500 mg of dust was then sonic extracted with 5 mL of methanol, and cleaned up with silica gel solid phase extraction (SPE). A portion (100 μl) of the extract was taken for analysis by Time of Flight Mass Spectrometry (TOFMS) operated in (+) and (-) mode. Samples were suspect screened against three personal compound database lists (PCDL): Perfluorinated Compounds (internal EPA database), and Forensics Toxicology and Pesticides (Agilent commercially available databases) among others. Chemicals with a match score of accurate mass, spectral isotope spacing and spectral isotope intensity of >90% were kept as tentative chemical identifications.

**Results.** Perfluorinated compounds, fipronil/fipronil sulfone, TDCPP, and triclosan were all confirmed chemicals; other analytes were tentatively identified based on database matching. Thousands of compounds were observed across the dust samples from each school. Ultimately, 792 unique chemical formulas were located, each passing strict match criteria, meaning that they had a score that was greater than or equal to 90. This is based on neutral exact mass, isotope distribution, and isotope spacing. Data were analyzed using R Studio and visualized using R and ggplot2, Plotly and Candela libraries to better present data and correlations pertaining to the study. Many of the chemicals found appear to be toxic, such as the pesticide Fipronil, and the frequency of their applications in many schools put the health of many at risk of being impacted in a negative manner. Other chemicals identified are tentative as they are identified by matching them against public databases and EPA in-house databases. Among these included many unexpected findings, such as the presence of illegal designer drugs very similar in structure to THC (shown in Figure 2), such as O-1602 and BMDP, and fungal treatments, such as...
undecylenic acid. These come as a surprise because the designer drugs were found in elementary, middle, and high schools alike, and the origin of these drugs are a mystery, especially in the elementary schools where they were found. An alternate conclusion may be a chemical exists in the dust samples that shares a molecular formula with these tentatively identified compounds. Many of the compounds found in the dust were not able to be identified by NIDA (National Institute on Drug Abuse), and have not yet been tested by the FDA or enforced by law enforcement.

We analyzed the dust samples presents in local schools, and identified many chemical substances, notably pesticides, such as Fipronil (found in all samples), insect repellants, like DEET (in 8/10 schools), various antidepressants (i.e. Propazine), and designer drugs (i.e. O-1602 and BMDP, with the former found in 6 schools and the latter found in 7 schools). These compounds range in toxicity with pesticides, insect repellents, and flame retardants being of moderate toxicity, and antidepressants, such as the aforementioned Propazine being very toxic. Painkillers and sedatives were also prominent throughout the 10 schools. For example, we identified phenyl acetylsalicylate, which is a common ingredient found in ibuprofen, and a sedative named dihydroxymethyl phenylbutane. The results were unfortunately marred by various factors, such as the non-disclosure and lack of transparency with how the dust was collected. Information regarding which rooms in the school were vacuumed using the collected bag, as well as the inability to have an entirely random sample of schools add to these factors, as many schools were not willing to give out their dust for use in this experiment.

Overall, this experiment was not particularly easy, but with the unconditional help of my mentors, I was ultimately able to make and share interesting results. I was able to share these findings at the county science fair, which allowed me to attend various awards ceremonies and receive recognition for this work from various organizations, such as the Clean Air Partners and the Achievers’ League. In future experiments, I hope to further my findings by collecting samples from other counties and comparing to the results of this study and avoiding the aforementioned problems. Additionally, samples can be collected from the schools that reside on the edge of the county rather than having schools that are relatively close to one another to have a more representative sample of all schools in the county. This study has made me interested in pursuing other areas of study within exposure science in the future and find other ways various chemical compounds could be affecting the life of an average high school student such as myself. My advice to mentors looking to help high school students with an otherwise inaccessible topic is to just share your interest for the field, as I was fortunate enough to have happen to me with my mentors, Dr. Strynar and Dr. Hakkinen. This interest spreads easily and will pique your student's interest as well.

Alex Sherwin is a 10th grade student at Richard Montgomery High School (Rockville, MD) and Farzad Mustafa is a 10th grade student at Wooton High School (Rockville, MD). They started this project to explore a field of science that peeked their interest and to compete in the county science fair. The mentors for this project were Dr. Pertti Hakkinen of the National Library of Medicine (NLM) and Dr. Mark Strynar of the Environmental Protection Agency (EPA).
SILICONE WRISTBANDS as Personal Chemical Monitors

by Steven O’Connell, MS, PhD & Marc Epstein

Photo courtesy of Cristian Lozan
Why did people impacted by Hurricane Harvey, firefighters, roofers, elementary school children, agricultural workers, and pregnant women all wear silicone wristbands? To monitor personal environmental exposures.

Fit for purpose
Considerations for using silicone wristbands as personal chemical monitors

Silicone wristbands are new personal monitoring devices for organic chemicals. While passive sampling technologies and methods have been around for decades, using silicone wristbands as passive samplers for personal monitoring is an approach less than five years old (1). Developed in a laboratory at Oregon State University (1), run by Kim Anderson, PhD, and commercialized by MyExposome, this approach is becoming a significant new tool for environmental chemists and epidemiologists to gather exposure data (Figure 1). There is growing interest in the use and application of these devices, including a recent publication in JESEE. Storage and stability data from 148 compounds at various temperatures are available in the recent issue of JESEE, entitled: “Preparation and performance features of wristband samplers and considerations for chemical exposure assessment” (Vol. 27, 551-559).

Below we will compare silicone wristbands with existing passive and active samplers and provide some considerations for use. To date, there are several published studies that have used wristbands as organic chemical monitors and there are more publications on the way. In a study examining flame retardants among children, wristband compliance remained high (>80%) among this sensitive, and potentially difficult to sample population (2). In another study, agricultural farm workers in Senegal were found to be exposed to a wide range of pesticides and the wristbands absorbed chemicals that would have been missed if demographic data was relied on exclusively (3). Pesticides found in agricultural communities in Peru were examined in context with associated demographics, and more personal care products were detected in urban over rural communities (4). When comparing the wristbands to hand wipes, wristbands had higher correlations with urinary metabolites suggesting that the wristband data was more relevant to internal exposure under the study parameters (5). Finally, DNA damage found in children’s hair follicles was found to be associated with the number of pesticides found in agricultural households (6). One unique feature of not having a housing around the sampling media is that the silicone is likely sampling compounds from skin, sweat, and from direct contact with contamination. This represents an additional exposure pathway than air alone that is not captured by any other commercially available device (Table 1).

Currently there are several commercial personal passive samplers available to purchase. These include stainless steel tubes used in thermal desorption, the Radiello® diffusive sampler, the SKC ULTRA® Passive Sampler, the SKC VOC Chek 575, as well as 3M™ and Assay Technology 566 Organic Vapor Monitors (Table 1). Many of these personal monitors are variations of a common theme. Namely, a polymer or metal housing, with

Full disclosure: We currently work for MyExposome, Inc., which is commercializing this technology to expand the tool beyond academic pursuits. Patent: US 9,757,774.
a screen or barrier between the environment and the sampling media inside the device. The sampling media can be as simple as activated charcoal which has been used in personal monitoring since at least 1980 (7), or as complex as a combination of commercially available sorbents with proprietary functional groups. Widely used sampling media include Tenax® TA and XAD®-2, both of which are used in desorption tubes in active or passive sampling, and are highlighted in several U.S. and international agency methods for sampling atmospheric organic pollutants (e.g., EPA IP-1, IP-2, and TO-1, OSHA 44 and 62, ISO 16000-6:2011, and NIOSH 5600 and 5602, see Table 1).

Traditional methods for personal sampling typically rely on active sampling, which necessitates the purchase, maintenance, and calibration of an external pump. If the method does list passive alternatives, it is limited to volatile organics (i.e., compounds with boiling points lower than 250°C). To the best of the authors’ knowledge, there are very few, if any, established methods by the EPA, OSHA, or NIOSH to passively sample semi-volatile organic compounds (SVOCs) such as pesticides, PAHs, flame retardants, and personal care products for personal exposure.

Commonly used passive sampling media have their own limitations and strengths, with some not appropriate for humid or outdoor applications (e.g., charcoal and silica gel), or others that are highly specialized for a smaller subset of organic sampling (e.g., carbon molecular sieves, good for very volatile compounds, n-C2 to n-C6) (8). There is a learning curve to understand separate housings and sorbents that each supplier addresses with webpages, guides, videos and consultations. However, with adequate background or guidance, appropriate sampling media can certainly be matched with the customer’s application.

This fit-for-purpose philosophy brings us back to using wristbands as personal samplers. If used appropriately, silicone wristbands are an easy, relatively inexpensive alternative or complementary tool to existing approaches with significant advantages. As shown in Table 1, and mentioned previously, there are several applications and considerations that silicone wristbands are useful for:

- Capturing a wide range of organic chemicals (log Koa 2.1-13.7)
- Comparing results among a population normalized by weight (ng/g silicone) or time (ng/g/day)
- Providing a sampling device that is easy to wear, even for children
- Flexible study durations depending on analytes of interest
- An approach capable of high sample integrity even if not refrigerated (2 weeks VOCs, 4 weeks SVOCs)
- A long-term archival option for delayed analyses (3 months or more for VOCs at -20°C, 6 months or more for SVOCs at -20°C)
- A device capable of correlating external exposure data with internal biomarkers through multiple routes of exposure (air and/or skin)

However, there are also several known wristband limitations which are frequently shared with many of the other passive sampling alternatives. MyExposome, Inc. and others are actively researching many of these constraints.

- The wristbands cannot sample biological insults (viruses/bacteria), gases like CO2, N2, or methane, or metal contamination (mercury, arsenic, etc.)
- Exact sources of exposures can only be inferred unless target exposures are known from the location (e.g., occupational settings), or by forensic chemistry (e.g., alkyl-PAH ratios)
• Research necessary to back-calculate concentrations from the wristbands into a time-weighted average of exposure is still underway
• Even if silicone concentrations are accurately back-calculated to air equivalencies, context could remain unclear if there are no permissible exposure limits (PELs) or other benchmarks in which to compare the air concentration results

Current data for chemicals detected using the wristbands are usually presented as nanogram per gram silicone (ng/g). Using ng/g is effective to compare levels of the same compound between participants (or normalized by time if timespans differ, e.g. ng/g/day). This comparison information can be useful for communicating results to participants, shareholders, and study groups. However, the analysis will be much more expansive when we can normalize concentrations in the wristband by silicone partitioning differences of each compound (i.e. Ksa values). Normalizing by partition coefficients would allow quantitative comparisons between different compounds, and is also one of the first steps to back-calculating silicone concentrations to equivalent air concentrations (e.g. µg/m³). Additionally, limitations of context could potentially be overcome if enough people use the wristbands so that background levels from empirical data can be established.

Wristband projects are currently underway at universities, non-profit organizations, international agencies, and federal laboratories. Choices about archiving samples, portioning wristbands into separate samples for varied analyses, pooling samples to save costs, and which tests are appropriate for the length of deployment must be made carefully to maximize successful outcomes. As more information becomes available, and the use of technology becomes more widespread, these simple pieces of silicone can be an easier and less expensive way to answer complex exposure questions.

Steven O’Connell, MS, PhD is a senior scientist and co-founder at MyExposome, Inc. He is currently the Principle Investigator for Phase II funding of an SBIR grant through the DoD. His background includes analytical and environmental chemistry, exposure science, and toxicology. Past work includes government, academic, and private industry appointments. Steven.OConnell@MyExposome.com

Marc Epstein is the CEO and co-founder of MyExposome, Inc. His business background includes company creation, marketing, leadership and business development. His technical background includes data mining, software development, machine learning and data analytics. Marc.Epstein@MyExposome.com
Figure 1. Examples of data reports created with wristband information outside of those listed in publications.
<table>
<thead>
<tr>
<th>Name</th>
<th>Picture</th>
<th>Supplier</th>
<th>What is it?</th>
<th>Active/Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wristband personal sampler</td>
<td><img src="image" alt="Picture" /></td>
<td>MyExosome</td>
<td>Specially prepared silicone wristband, no housing</td>
<td>Passive</td>
</tr>
<tr>
<td>Diffusive Thermal Desorption Tubes</td>
<td><img src="image" alt="Picture" /></td>
<td>Many, including SKC, Inc. and Markes International</td>
<td>Stainless steel tube filled with a sorbent with porous caps on either end for sampling. Wearable clip sold separately.</td>
<td>Passive and active</td>
</tr>
<tr>
<td>ULTRA® Passive Sampler</td>
<td><img src="image" alt="Picture" /></td>
<td>SKC</td>
<td>Badge-type polymer housing with sorbent fill. Outer sleeve slides up and down to start and stop sampling.</td>
<td>Passive</td>
</tr>
<tr>
<td>Radiello ® diffusive sampler</td>
<td><img src="image" alt="Picture" /></td>
<td>Supelco/ Sigma-Aldrich</td>
<td>Absorbent cylinder inside a porous tube housing</td>
<td>Passive</td>
</tr>
<tr>
<td>3M™ Organic Vapor Monitor</td>
<td><img src="image" alt="Picture" /></td>
<td>3M™</td>
<td>Clip on housing with a filter and one or two charcoal pads</td>
<td>Passive</td>
</tr>
<tr>
<td>566 Organic Vapor Monitor</td>
<td><img src="image" alt="Picture" /></td>
<td>Assay Technology, Inc.</td>
<td>Clip on housing with a plastic housing and filled with charcoal</td>
<td>Passive</td>
</tr>
<tr>
<td>Polyurethane foam Sorbent tubes (PUF)</td>
<td><img src="image" alt="Picture" /></td>
<td>Many, including SKC Inc.</td>
<td>Polyurethane foam in a housing (filters purchased separately). Wearable clip is not currently sold.</td>
<td>Commonly used in active sampling only, adapted for passive use in publications</td>
</tr>
</tbody>
</table>

Table 1. Commercially Available Personal Passive Organic Chemical Monitors
<table>
<thead>
<tr>
<th>Receiving phase</th>
<th>Route of exposure</th>
<th>Samples what</th>
<th>Established methods</th>
<th>Extraction method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone</td>
<td>Air, skin, sweat, direct contact</td>
<td>Alkanes, BTEX, aromatic YOAs, pesticides, flame retardants, PAHs, PCBs, personal care products, others</td>
<td>Used in publications</td>
<td>Solvent and thermal</td>
</tr>
<tr>
<td>Any commercially available sorbent that can be packed into the stainless tube.</td>
<td>Air</td>
<td>Depends on sorbent: Gases, solvents, alkanes, BTEX, aromatic YOAs, capable of SVOCs</td>
<td>Many methods over the last 30 years use sorbent tubes (active and passive): IP-1, IP-7, TO-1, TO-17, EPA 325, ISO 16000-6:2011, ISO 16017-2:2003</td>
<td>Thermal</td>
</tr>
<tr>
<td>Five sorbents sold from SKC including Tenax TA, activated charcoal, and other proprietary sorbents</td>
<td>Air</td>
<td>Depends on sorbent: Gases, solvents, alkanes, BTEX, aromatic YOAs, capable of SVOCs</td>
<td>Not directly mentioned by agencies, but can fill with Tenax TA sorbent or charcoal, which is listed in several agency methods</td>
<td>Solvent (charcoal), or thermal with a desorption tube</td>
</tr>
<tr>
<td>Multiple proprietary sorbents with trade names (RAD145, RAD141, etc.) that are functionally similar to more commonly sold sorbents</td>
<td>Air</td>
<td>Depends on sorbent: Solvents, alkanes, BTEX, aromatic YOAs, and gases like H2, N2, S2</td>
<td>Used in publications</td>
<td>Solvent</td>
</tr>
<tr>
<td>Charcoal</td>
<td>Air</td>
<td>Organic vapors</td>
<td>Listed in publications, and uses charcoal which is listed in several agency methods</td>
<td>Solvent</td>
</tr>
<tr>
<td>Charcoal</td>
<td>Air</td>
<td>Organic vapors</td>
<td>Uses charcoal which is listed in several agency methods</td>
<td>Solvent</td>
</tr>
<tr>
<td>Polyurethane foam</td>
<td>Air</td>
<td>Used for SVOCs: OC pesticides, PCBs, and PAHs</td>
<td>EPA methods (active sampling): IP-7 (PAHs), IP-8 (OC pesticides in air): Used as passive device in publications</td>
<td>Solvent</td>
</tr>
</tbody>
</table>


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