CHE Collaborative for Health & Environment

Webinar Highlights

Hormonal Activity of Chemicals Detected with Silicone Wristbands

In this webinar, **Dr. Anna Young** presented a new study which used silicone wristbands as a novel method to monitor exposures to known and potentially unknown chemicals in the office environment.

The presentation discussed the role of buildings and personal care products in exposures to endocrine disrupting chemical mixtures. The presentation also highlighted concerns about chemicals that are not yet identified or thoroughly studied.

Featured Speaker: Anna Young, PhD, Research Associate in the Department of Environmental Health at the Harvard T.H. Chan School of Public Health, speaking February 15, 2023.

This fact sheet has been created by CHE based on information presented in an EDC Strategies Partnership webinar. Selected quotes in bold are from the webinar speaker(s). For the full set of resources provided by the webinar presenters, see the webinar page, where you'll also find associated Slides & Resources.

The Problem

In just the last decade, about 70,000 chemicals were registered globally. About 16% of those aren't publicly identifiable, due to confidential business information. Traditional research methods generally evaluate a small number of chemicals at a time, rather than examining mixtures. The widespread use of chemicals, along with the limited research done on chemical mixtures, could mean that people are being unknowingly exposed to hormone-disrupting chemicals.

Hormone-disrupting chemicals mimic hormones in ways that can disrupt human health. These hormone disruptions can have negative impacts on fertility, pregnancy, and development. Some of these chemicals are also associated with thyroid disease, diabetes, obesity, and certain cancers. Hormone-disrupting chemicals can be found in building materials, furniture, flooring, consumer products, and personal care products.

Young stressed that testing and regulating chemicals individually was insufficient for safety, given our exposure to complex chemical mixtures. Therefore, Young's study set out to evaluate the hormone-disrupting potential of the mixtures of known and unknown chemicals that humans are personally exposed to in the real world. To do this, they had 243 office workers wear silicone wristbands in the USA, UK, China, and India during four work shifts. With the Stapleton Lab at Duke and other collaborators, they then analyzed chemical extracts from the wristbands for the following:

- Ninety-nine known, targeted chemicals. These chemicals included flame retardants, plasticizers, and pesticides.
- About 1,000 potentially unknown chemical features.
- Total hormonal activities towards estrogen, androgen, and thyroid hormone receptors in human cell assays. To do this, they exposed human cells in the lab to the extracts of the chemical mixtures from the wristbands and measured the amount of interference with the cells' hormone receptors. These assays:
    - rapidly quantify an immediate "health" indicator of exposures.
    - reflect impacts from all the chemicals, not just the known or measurable ones.
    - capture any combined mixture effects.

Key findings:

- The study detected 94 of the 99 targeted chemicals.
- Each study participant was exposed to about 800 different chemical features.
- Every single wristband sample was hormonally bioactive. This shows that the chemical mixtures that these people were exposed to could mimic or block hormones.
    - 99% of the samples blocked thyroid hormone at its receptor.
    - 96% blocked testosterone at its androgen receptor.
    - 58% mimicked estrogen at its receptor.

Female office workers had greater chemical exposures. Their exposures were significantly more estrogenic, more anti-androgenic, and more complex with higher numbers of chemical features. One possible explanation for this finding is that they were also reportedly heavier cosmetic users than the male participants.

The study's statistical models found that several known and unknown chemicals were important individual drivers of the identified mixture effects. Six targeted chemicals were identified as major drivers of the mixture effects on hormonal activities: DiBP (a phthalate),

TPHP (an organophosphate), PCB-11 (a polychlorinated biphenyl), DDE (a pesticide), DnBP (a phthalate), and TnBP (an organophosphate). Numerous other chemical features with unknown identities or unknown sources were also important drivers of the overall mixture effects.

The study also looked at the variability of participant exposures within the same building and between different buildings. It found more variability in exposures between individuals within the same building than between different buildings. This shows that a person can be exposed to very individualized chemical profiles, such as due to different micro-environments within a building, a person's "activity cloud," and the use of personal care products.

In summary, the study found that participant exposures:

- were highly complex chemical mixtures.
- included many usually unknown or unmeasured chemicals.
- showed strong interference with hormone receptor function.
- demonstrated potential gender disparities.
- were influenced by both the indoor building environment and by personal care products.

Recommendations

"Traditional targeted methods that test only one chemical at a time cannot keep up with the rate of new chemicals entering the market. We need to evaluate our exposures to chemicals as the complex mixtures they are in the real world, not just as individual chemicals."

Silicone wristbands are a novel, useful way to sample external exposures to chemicals in the real world.

In order to protect the health of office workers, organizations should commit to only purchasing healthier building materials that eliminate entire chemical classes of concern.

To Find Out More

- Watch the February 15, 2023 webinar: Office Workers' Exposures: Hormonal Activity of Chemicals Detected with Silicone Wristbands
- Read the webinar slides: Hormonal Activity of Chemicals Detected with Silicone Wristbands

- Read the full study: Hormone receptor activities of complex mixtures of known and suspect chemicals in personal silicone wristband samplers worn in office buildings
- Read a report about the study: Exposure to hormone-disrupting chemical mixtures common among office workers
- Watch the CHE webinar about use of silicone wristbands to assess personal chemical exposures: Silicone wristbands: Novel approach to assess personal chemical exposure
- Watch the CHE webinar about Promoting Environmental Justice with Safer Building Materials
- Find out more about efforts to make buildings healthier: https://www.hsph.harvard.edu/healthybuildings/

About the Speaker

Anna Young is a Research Associate in the Department of Environmental Health at the Harvard T.H. Chan School of Public Health and Associate Director of the Harvard Healthy Buildings program. Her research focuses on our indoor exposures to complex mixtures of hormone-disrupting chemicals and builds evidence for healthier materials as a strategy to reduce these chemical exposures in buildings. She earned her PhD and MS in Environmental Health from the Harvard Chan School, and she also holds a BA in Computer Science and Environmental Studies from Yale University.