2025 GETA Fall Symposium

TOX or TREAT?

Exploring Potential Health Risks Lurking in Our Food

Dr. Alyson Mitchell, PhD
University of California, Davis
"Ultra-Processed Foods Unpacked: Composition, Classification, and Emerging Health Risk"

Dr. Michele La Merrill, PhD
University of California, Davis
"Screening the Potential Toxicity of Food Contact Chemicals Using New Approach Methods"

Dr. Carla Ng, PhD
University of Pittsburgh
"Unintentional Cycles of Persistent and Mobile Chemicals in the Global Food System"

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October 21, 2025
1 pm to 5 pm PST
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GETA Fall Hybrid 2025 Symposium

Tox or Treat? Exploring Potential Health Risks Lurking in Our Food

Tuesday, October 21st, 1-5 PM (PST)
California EPA Building, Sierra Hearing Room, 2nd Floor
1001 I Street, Sacramento, CA 95814

Program

1:00 – 1:10 PM	Opening remarks
1:10 – 2:00 PM	*Ultra-Processed Foods Unpacked: Composition, Classification, and Emerging Health Risks* **Alyson E. Mitchell, Ph.D., University of California, Davis**
2:00 – 2:50 PM	*Unintentional Cycles of Persistent and Mobile Chemicals in the Global Food System* **Carla Ng, Ph.D., University of Pittsburgh**
2:50 – 3:00 PM	Break and poster session
3:00 – 3:10 PM	*Lightning Talk #1: Characterizing Individual and Mixtures-Based Chemical Contributions to Wildfire Smoke Toxicity Through In Vitro Transcriptomics Screening* **Sarah Miller, Ph.D. Candidate, University of North Carolina at Chapel Hill**
3:10 – 3:20 PM	*Lightning Talk #2: Exposures to Contemporary and Emerging Chemicals among Young Children in the United States Environmental Influences on Child Health Outcomes (ECHO) Program* **Jiwon Oh, MPH, Ph.D., University of California, Davis**
3:20 – 4:10 PM	*Screening the Potential Toxicity of Food Contact Chemicals Using New Approach Methods* **Michele La Merrill, Ph.D., University of California, Davis**
4:10 – 4:30 PM	Panel discussion
4:30 – 4:40 PM	Concluding remarks
4:40 – 5:00 PM	Poster session and networking

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Featured Speakers

Speaker #1:

Ultra-Processed Foods Unpacked: Composition, Classification, and Emerging Health Risk

Alyson E. Mitchell, Ph.D.
Professor of Food Chemistry
Department of Food Science and Technology
University of California, Davis
aemitchell@ucdavis.edu

Biography:

Alyson E. Mitchell is a Fellow of the American Chemical Society and currently serves as Chair of the Agricultural and Environmental Chemistry Graduate Group at UC Davis. Dr. Mitchell received her B.S. in Environmental Toxicology and her Ph.D. in Pharmacology and Toxicology, both from UC Davis.

Her research program focuses on advancing the chemical understanding of foods with the goal of enhancing their quality, promoting health, optimizing the use of co-product streams, and innovating food processing for a more sustainable food supply.
Dr. Mitchell's work addresses the urgent need to better understand the chemical composition of food crops and how modern processing, packaging, and storage affect food quality. As food systems become increasingly industrialized and globalized, there is a growing demand for robust analytical methods to assess food safety, quality, and authenticity. At the same time, the worldwide rise in consumption of ultra-processed foods has been associated with a host of negative health outcomes, including all-cause mortality, obesity, type 2 diabetes, cardiovascular disease, and poor mental health. These effects are often due to the displacement of nutrient-rich, whole foods.

Her research addresses these challenges by developing strategies to improve the nutrient density and healthfulness of both fresh and, especially, processed foods. Her program also explores sustainability-focused innovations, such as the use of almond shells—a major agricultural byproduct—as a filtration medium for removing phenolic compounds from winery wastewater. This approach not only mitigates environmental contamination but also supports circular economic practices that benefit both the almond and wine industries.

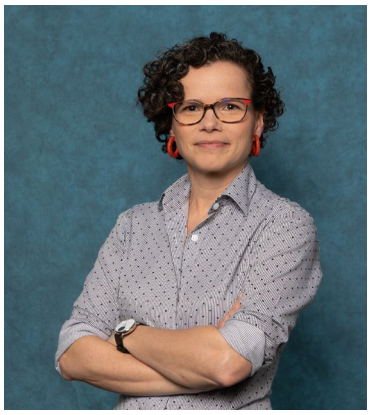
Collectively, Dr. Mitchell's research supports public health priorities and advances science-based innovations that promote a more sustainable, nutritious, and resilient food system.

Abstract:

Ultra-processed foods (UPFs) are increasingly recognized as major contributors to poor diet quality and chronic disease risk, yet their definition, classification, and mechanisms of harm remain widely debated. This talk will unpack what UPFs are—examining their formulation, industrial processing, and additive use that distinguish them from minimally processed foods. It will also address the limitations of the NOVA classification system and explore how the "invisible dimensions" of food processing challenge any attempt to categorize foods solely by processing level. Finally, the presentation will review findings from recent meta-analyses and umbrella reviews linking UPF intake to adverse health outcomes, while highlighting key challenges and research gaps that must be addressed to advance understanding and inform effective public health policy.

Speaker #2:

Unintentional Cycles of Persistent and Mobile Chemicals in the Global Food System



Carla Ng, Ph.D.
Associate Professor
Civil and Environmental Engineering
University of Pittsburgh
carla.ng@pitt.edu

Biography:

Carla Ng is an Associate Professor and Fulton C. Noss Faculty Fellow in the Department of Civil and Environmental Engineering at the University of Pittsburgh, with secondary appointments in Environmental and Occupational Health and in Chemical and Petroleum Engineering. She received her PhD in Chemical & Biological Engineering from Northwestern University. Her research focuses on the development of computational and in vitro approaches to evaluate the fate and effects of legacy and emerging chemicals in organisms and ecosystems, with a particular focus on per- and polyfluoroalkyl substances (PFAS).

Abstract:

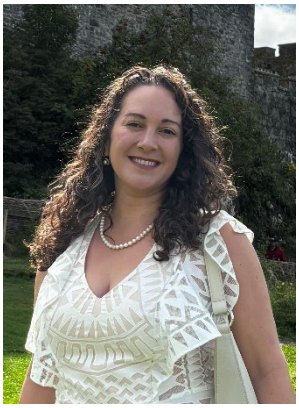
The global food system is more connected than ever before. Production, processing, and packaging of foods now routinely cross regional and even hemispheric borders. While this has helped improve access to diverse foodstuffs, including fresh produce, meats, seafood, and processed foods, it has also led to an unintended circular economy of contaminants. Persistent and mobile chemicals, including per- and polyfluoroalkyl substances (PFAS), flame retardants, and other industrial compounds, can no longer be off-shored by moving industrial production or waste disposal to remote locations. Rather, they enter the environment through multiple pathways and at diverse global hot spots and return to consumers as part of the globally traded

food basket. In this talk, I will discuss several studies my group has undertaken to understand how international food trade, bioaccumulation, and food production practices define the exposure landscape for consumers, and what interventions may be most effective to reduce risk.

Speaker #3:

Screening the Potential Toxicity of Food Contact Chemicals Using New Approach Methods

Michele La Merrill, Ph.D.
Professor and Vice-Chair in the Department of Environmental Toxicology
University of California, Davis
mlamerrill@ucdavis.edu



Biography:

Michele La Merrill is Professor and Vice-Chair in the Department of Environmental Toxicology at the University of California at Davis. Her lab research focuses on susceptibility, e.g. developmental, dietary, and genetic, to metabolic and endocrine disruption in integrated studies of cells in tissue culture, animal models and people. She joined UC Davis in 2013 after earning a BA in Biology at Reed College, her PhD in Toxicology at the University of North Carolina in Chapel Hill and a MPH in epidemiology during her postdoctoral fellowship at Mount Sinai School of Medicine in New York City. She is a member of the Pharmacology & Toxicology Graduate Group, the Integrative Genetics and Genomics Graduate Group, Epidemiology Graduate Group, the UC Davis Genome Center and the UC Davis Comprehensive Cancer Center. She is also an adjunct professor in the Division of Environmental Genomics and Systems Biology at the Lawrence Berkeley National Lab. Michele enjoys cooking, hiking, kayaking and cycling.

Abstract:

The potential for food contact chemicals to disrupt genetic programs in development and metabolism raises concerns. Nuclear receptors (NRs) control many of these programs, and the retinoid-X receptor (RXR) is a DNA-binding partner for one-third of the NRs. RXR disruption could generate adverse outcomes in several NR pathways. We used machine learning and other in silico methods to identify RXR-interacting candidates from a list of over 57,000 chemicals. Butylphenols comprised the largest, high-probability, structural group (58 compounds); several are food contact chemicals with widespread commercial use. In vitro ToxCast data suggested that bulky, aliphatic substitution at C4 of 2,6-di-tert-butylphenol facilitated RXR activation. We tested six butylphenols with increasing bulk at C4 in vivo for their ability to disrupt thyroid hormone receptor (TR) signaling, using an integrated luciferase reporter driven by TR-RXR binding and quantifiable morphological changes in a *Xenopus laevis* precocious metamorphosis assay. Three tert-butylphenols potentiated TH action at nanomolar concentrations. Molecular

modeling showed the three positives formed more frequent, stable interactions with RXRα, and bulkiness at C4 increased steric complementarity with the RXR ligand-binding pocket. Our findings establish a paradigm for machine learning coupled with a convenient, in vivo validation approach to identify chemicals interacting with RXR-NR-controlled genetic pathways.

Lightning Talks and Poster Presentation Abstracts

Lightning Talk #1

Characterizing Individual and Mixtures-Based Chemical Contributions to Wildfire Smoke Toxicity Through In Vitro Transcriptomics Screening

Sarah L. Miller[1,2], Elise Hickman[1,2], Jessie R. Chappel[1,2], Yong Ho Kim[3], Cynthia Rider[4], David M. Reif[4], Scott Auerbach[4], Ilona Jaspers[1,5], Meghan E. Rebuli[1,5], and Julia E. Rager[1,2,5]

[1] Curriculum in Toxicology & Environmental Medicine, UNC School of Medicine, Chapel Hill, NC
[2] Department of Environmental Sciences & Engineering, UNC Gillings School of Global Public Health, Chapel Hill, NC
[3] Center for Public Health & Environmental Assessment, US EPA, Research Triangle Park, NC
[4] Division of Translational Toxicology, NIEHS, Research Triangle Park, NC
[5] Center for Environmental Medicine, Asthma and Lung Biology, UNC School of Medicine, Chapel Hill, NC

Wildfire incidence and severity have steadily increased in recent decades, leading to increases in smoke emissions that pose risks to public health. Due to the wide variety of chemical mixtures in smoke from wildfires, there is a need to couple high-throughput toxicity screening approaches with computational methods to assess wildfire-relevant mixtures toxicity. This study sought to evaluate transcriptomic responses of respiratory epithelial cells to individual components, defined mixtures, and complex woodsmoke mixtures with two goals: (1) identifying potential modes of action that are shared versus distinct between wildfire components, and (2) quantifying relative impacts across these various mixtures to inform human health risk estimates. The six chemicals prioritized for this study frequently co-occur across ten different wildfire-relevant burn scenarios (eucalyptus, pine, pine needles, peat, and red oak burned under flaming or smoldering conditions) and were previously positively or negatively correlated with toxicity endpoints in exposed mice through mixtures modeling. Spanning polyaromatic hydrocarbon, methoxyphenol, and metal chemical classes, they included: benzo(a)pyrene, benz(a)anthracene, coniferyl aldehyde, vanillin, sodium dichromate, and copper sulfate. Human bronchial epithelial (16HBE) cells in 12-well plates were exposed at 5 different concentrations to these single chemicals, equimolar binary mixtures, an equimolar defined mixture of all 6 candidate chemicals, and 4 complex biomass mixtures (flaming or smoldering eucalyptus and flaming or smoldering pine). Bulk RNA sequencing was performed in samples collected at 4 hours post-exposure. Differentially expressed genes (DEGs), gene set enrichment, benchmark concentration (BMC) modeling, transcriptomic point of departure (tPOD) derivation, and concentration addition mixtures modeling (CAM) analyses were

performed to evaluate transcriptomic response. Patterns in DEGs, significantly enriched pathways, BMCs, and tPODs were shared between the complex biomass mixtures, defined mixture, sodium dichromate alone, and sodium dichromate in binary mixture with copper sulfate. Ras/ERK and Ras/PI3K signaling were identified as top ranking enriched pathways highly shared across these exposure conditions, suggesting a shared mode of action involved in response to these wildfire-relevant mixtures perhaps driven by sodium dichromate. Comparisons of observed versus CAM-predicted tPODs revealed that the metals binary mixture and defined mixture exhibited synergistic effects (e.g. 0.120 µM observed versus 0.265 µM predicted for metals, and 0.006 µM observed versus 0.05 µM predicted for the defined mixture). Altogether, these results suggest that metals and metal mixtures may be a particular chemical class and/or mixture of public health concern when considering the respiratory health effects of wildfire smoke exposure. However, the nearly 10-fold difference in observed versus predicted tPODs in the defined mixture indicates that interactions with other chemical classes must also be considered when determining wildfire smoke exposure risk.
[This abstract does not represent the views or policies of the U.S. Environmental Protection Agency.]

Lightning Talk #2 and Poster #1

Exposures to Contemporary and Emerging Chemicals among Young Children in the United States Environmental Influences on Child Health Outcomes (ECHO) Program

Oh J,[1] Buckley JP,[2] Kannan K,[3,4] Pellizzari ED,[5] Miller RL,[6] Bastain TM,[7] Dunlop AL,[8] Douglas C,[5] Gilliland FD,[7] Herbstman JB,[9] Karr C,[10] Porucznik C,[11] Hertz-Picciotto I,[1,12] Morello-Frosch R,[13] Sathyanarayana S,[14] Schmidt RJ,[1,12] Woodruff TJ,[15] Bennett DH,[1] the ECHO Cohort Consortium

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[5]RTI International
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[7]University of Southern California
[8]Emory University School of Medicine
[9]Columbia University Mailman School of Public Health
[10]University of Washington
[11]University of Utah
[12]UC Davis MIND Institute
[13]University of California, Berkeley
[14]University of Washington and Seattle Children's Research Institute
[15]University of California, San Francisco

Prenatal and early-life exposure to environmental chemicals can increase the risk of multiple adverse child health outcomes. However, biomonitoring data for young children remain limited. This study leveraged the nationwide Environmental influences on Child Health Outcomes

(ECHO) Cohort to assess chemical exposures in 201 children aged 2–4 years between 2010 and 2021. A total of 111 analytes across multiple chemical classes were simultaneously quantified in single spot urine specimens collected from each child and their mother during pregnancy, and concentrations were compared between child and prenatal maternal samples. Among the 111 analytes, 96 were detected in at least five children and 48 analytes in over 50% of children. Thirty-four were ubiquitously detected (>90%), nine of which have not been included in U.S. national biomonitoring: benzophenone-1, triethyl phosphate, and metabolites of six phthalates and one alternative plasticizer. Concentrations of bisphenol S, three pesticide biomarkers, and two phthalate biomarkers were higher in children than mothers, while those of triclosan and monoethyl phthalate were higher in mothers. This study reveals frequent exposure to multiple chemicals in young U.S. children, often exceeding prenatal levels. Expanded biomonitoring of emerging chemicals of concern and studies of their health effects in this vulnerable population are warranted.

Poster #2

Acute Lung Injury and Survival Following Chloropicrin Inhalation in Mice

S. Arriola, A. Arredondo, A. Lundberg, P. Venkatesh, A. Castro, D. Li, M. Domanico, KJ Bein, L.S. Van Winkle

School of Veterinary Medicine and CHE, University of California, Davis, CA, USA

Chloropicrin (trichloronitromethane) is a broad-spectrum soil fumigant and former chemical warfare agent that causes acute sensory and pulmonary toxicity. Despite its widespread use and human exposure risk, inhalation dose response relationships and sex differences aren't well characterized for inhalation exposure in mice. We exposed 6 male and 6 female C57BL6J mice per dose and timepoint to nose-only inhalation of chloropicrin vapor at concentrations of 0.75, 1.5, 3, 6, and 12 parts per million (PPM) for 4 hours and monitored weight change, survival, and clinical morbidity up to 3 days post exposure. Animals meeting a 20% body weight reduction were euthanized and considered non-survivors. Both sexes exhibited concentration and time dependent lethality, with females demonstrating greater sensitivity. At 3.0ppm, mortality reached 25% in females compared with 10% in males. At 12ppm, mortality was markedly higher, with nearly complete lethality in females (92%) versus 56% in males. Surviving animals displayed significant weight loss 24-72 hours post exposure, Histologic examination in high resolution resin sections revealed dose-dependent pulmonary epithelial necrosis, with prominent sloughing and cell death occurring in bronchiolar club cells. These findings demonstrate that chloropicrin induces reproducible, concentration dependent acute lung injury in mice, and identifies sex related differences in toxicity. Establishing this model provides a foundation for future mechanistic studies and development of medical countermeasures for chloropicrin exposure. Funded by: NIH R01 ES034419, NIH T32 ES007059, and with support from P30 ES023513

Poster #3

Biomarkers of Oxidative Stress in Children and Teenagers from California

E. Li et al.

University of California, Berkeley

Air pollution is a growing concern in California due to persistent traffic emissions, coal-fired power plants, and increased wildfires. Exposure to air pollutants is linked to adverse health effects such as cancer, cardiovascular diseases, obesity, and asthma. Children are more vulnerable to air pollution due to their faster breathing rates and higher air intake per kg body weight. This study examines 8-Isoprostane (8-Isop), a validated biomarker of oxidative stress and lipid peroxidation, in children from the Children's Health and Air Pollution Study (CHAPS) cohort in relation to demographic variables and metabolic markers. Participants (6.5 – 18.2 yrs) were recruited from Fresno and San Joaquin Valley, CA and urine samples (N = 372) were collected from 209 children between 2022-2025 (1-2 visits per participant). 8-Isop concentrations were measured by enzyme-linked immunosorbent assay (ELISA) and specific gravity normalized 8-Isop values were compared against age, sex, BMI (kg/m2), and systolic and diastolic blood pressure. We observed that older children had higher 8-Isop levels compared to younger children, but there were no significant gender-related differences. Higher 8-Isop levels were found in children with higher BMI, though differences were not statistically significant. No significant associations were identified between 8-Isop and blood pressure. In a sub cohort (N = 191) of CHAPS, 8-Isop levels were strongly and positively correlated with 8-hydroxy-2'-deoxyguanosine (8-OHdG), biomarker of oxidative damage to DNA, in same subject samples. These findings highlight urinary 8-Isop as a useful biomarker of oxidative stress in children and its application for assessing health effects of air pollution exposure.

Poster #4

Hepatotoxic Effects of HFPO Homologues in Mice: Evaluating the Safety of PFOA and PFOS Replacements

David S. Guzman[1], Michael L. Goodson[2], Bea A. Lachter[1], Allison K. Ehrlich[1], Michele A. La Merrill

[1] Department of Environmental Toxicology, University of California, Davis
[2] School of Veterinary Medicine-Anatomy, Physiology, & Cell Biology, University of California, Davis

The ubiquitous drinking water contamination by the well-studied per- and polyfluoroalkyl substances (PFAS) perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) have been recently restricted due to their toxicity. Their replacements include hexafluoropropylene oxide (HFPO) homologues, including dimer acid (HFPO-DA), trimer acid (HFPO-TA), and tetramer acid (HFPO-TeA). However, their toxicity is relatively uncharacterized. This study evaluated the immunotoxic and hepatotoxic effects of these HFPO homologues in adult female C57BL/6J mice. Mice were orally exposed to HFPO-DA (5880 ng/ml), HFPO-TA (58.8, 5.9, or 0.6 ng/ml), or HFPO-TeA (58.8, 5.9, or 0.6 ng/ml) or a vehicle control (drinking water) for 28 days,

with immunotoxicity assessed through a T-cell-dependent antibody response (TDAR) assay following immunization with sheep red blood cells (SRBCs) (n = 8 per treatment group). Additional mice underwent a 14-day exposure to HFPO-DA (588 ng/ml), HFPO-TA (588, 58.8, or 5.9 ng/ml), HFPO-TeA (588, 58.8, or 5.9 ng/ml), or a vehicle control (drinking water), without SRBC immunization (n = 8 per treatment group). In a subsequent experiment, mice were exposed for 7 days to vehicle, HFPO-DA, HFPO-TA, HFPO-TeA, or PFOS at the European Food Safety Administration (EFSA) tolerable daily intake (TDI) value for PFOS (Lai et al., 2017) (2117.7 ng/mL) or a sub-EFSA dose (63.6 ng/mL). Analysis revealed a dose-dependent increase in liver weight associated with HFPO-TA in all three exposure studies, indicating significant hepatotoxicity, while no similar effects were observed for HFPO-DA or HFPO-TeA. Efforts to ensure scientific rigor included the use of appropriate controls, statistical analysis of liver weight changes, and replication of findings. Biological variables, such as average body weight per cage, were controlled to reduce variability, and adequate sample sizes ensured robust detection of dose-dependent trends. These findings demonstrate the hepatotoxic potential of HFPO-TA and highlight the need for further mechanistic and long-term toxicity studies to assess the safety of HFPO homologues as replacements for PFOA and PFOS.

Poster #5

An In-Vitro Cytotoxicity Evaluation of Triple Negative Breast Cancer Cells through PFAS 'Forever Chemical' Exposure

Sehej S. Johal, Michael L. Goodson, David S. Guzman, Brenda J. Mengeling, Allison K. Ehrlich, Michele A. La Merrill

Department of Environmental Toxicology, University of California, Davis

Per- and polyfluoroalkyl substances (PFAS) are pervasive environmental pollutants found in household items such as non-stick cookware and food packaging material. The International Agency for Research on Cancer classifies PFOA as carcinogenic to humans (Group 1), based on evidence of epigenetic alterations in exposed humans. Moreover, PFOS is classified as possibly carcinogenic to humans (Group 2B). Thus, industries are introducing alternative PFAS. Currently, replacement PFAS, such as hexafluoropropylene oxide trimer acid (HFPO-TA) and hexafluoropropylene oxide tetrameric acid (HFPO-TeA), remain largely untested toxicologically. We investigated the effects of HFPO-TA and HFPO-TeA on the viability of human Hs578T triple-negative breast cancer cells. Hs578T cells were exposed to concentrations of 10 µM, 1 µM, 100 nM, and 10 nM of HFPO-TA and HFPO-TeA over 48 hours. Toxicity was assessed by membrane integrity, and both compounds showed toxicity at various concentrations. Within 12h, HFPO-TA and HFPO-TeA significantly decreased Hs578T cell viability at 10 nM. Within 12h and 24h, HFPO-TA, but not HFPO-TeA, significantly reduced cell viability at 1 µM. These cytotoxic levels align with HFPO-TA concentrations found in human serum (median: 2.93 ng/mL ~ 5.47 nM). These results indicate that HFPO-TA may be cytotoxic at levels typically found in humans. Whether these PFAS could be considered as chemotherapeutics would depend, in part, on cytotoxicity testing of non-cancerous human cells at similar concentrations. We exposed differentiated U-937 human macrophages to HFPO-TA and HFPO-TeA and observed similar

cytotoxic effects. This suggests that their toxicity is non-selective and utilizing them as chemotherapeutic agents is likely not plausible.

Poster #6

Developing Human Health Reference Levels for Pesticide Residues in Groundwater

Chunbo Zhang, David Bonnar, Brandon Brown, Qiaoxiang Dong, Mitra Geier, Anna Kalashnikova, Scott Tiscione, Peter Lohstroh, Svetlana Koshlukova, Shelley DuTeaux

Human Health Assessment Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA

In accordance with California's Pesticide Contamination Prevention Act (PCPA), the Department of Pesticide Regulation (DPR) established pesticide detection and response processes to prevent potential contamination of groundwater from legal agricultural use of pesticides. Detection of pesticides in groundwater following routine monitoring may trigger a request to DPR's Human Health Assessment (HHA) Branch for a human health risk evaluation. These evaluations are fit-for-purpose formal reviews that determine if the pesticide was detected after legal agricultural use and, if so, whether uses can continue with or without added restrictions. HHA evaluations establish one or more Groundwater Human Health Reference Levels (HHRLs) for screening pesticides in groundwater. An HHRL is the threshold pesticide concentration for a maximum water intake that results in the maximum safe oral exposure. DPR uses established regulatory reference doses (RfDs) and high-end drinking water intakes (DWIs) to calculate HHRLs. Pesticide concentrations in groundwater at or below the HHRL are considered to have no significant health concern. Detections above the HHRL may indicate potential pollution of groundwater as defined by PCPA. Unique HHRLs may be used to screen residues of the parent pesticide as well as chemically related pesticides and degradates with equivalent toxicity. In summary, DPR HHRLs are based on health-protective and scientifically supportable assumptions and are specific for evaluations of pesticides in groundwater. They provide context for interpreting the potential human health impact of groundwater pesticide monitoring data.

Building Logistics

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Check-in and obtain a badge from security in the main lobby of the building. The Sierra Hearing Room is on the second floor and is accessible via stairs or elevator.

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