SUMMARY STATEMENT

The CIRI + USGBC Building Resilience for Health Summit

Chemical Insights
An Institute of Underwriters Laboratories Inc.

ATLANTA, GEORGIA | AUGUST 24-25, 2023

PARTNERSHIPS

In August 2023, Chemical Insights Research Institute (CIRI) of UL Research Institutes and the U.S. Green Building Council (USGBC) co-hosted a multi-day technical work session focused on resilience for health in the built environment. Collectively, our organizations crafted a series of presentations and activities designed to expand the conversation around what resilience means, how indoor environments contribute to resilient buildings, and potential paths forward to expand the industry's work to support human health and well-being in the built environment.

An experienced green building practitioner and educator served as Facilitator.

Jaime Van Mourik, Associate AIA, LEED AP BD+C
U.S. Department of Energy Building Technologies Office

Representatives from the two host organizations served as Program Leaders.

Seema Bhangar, Ph.D.
U.S. Green Building Council (USGBC)

Holley Henderson, LEED Fellow, Fitwel Ambassador, WELL AP
Chemical Insights Research Institute (CIRI) of UL Research Institutes

PREFACE

The following summary provides an overview of the information captured by third-party sources during the CIRI + USGBC Building Resilience for Health Summit held in Atlanta, Georgia, August 24–25, 2023. This summary is provided to share the breadth of the topics and accompanying discussions. The summary is not intended to provide an accurate or complete transcription of each speaker's presentation or of a participant's specific comments.

SUMMIT PARTICIPANTS

With gratitude, we acknowledge the partnership between CIRI and USGBC, along with the facilitator, program leaders, contributors, and observers. Their engaging discourse and professional commitment to finding solutions for mitigating climate stressors that impact our built environment, ecosystems, and the health of building occupants and communities are appreciated.

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1.0 INTRODUCTORY INSIGHTS PROVIDED BY CIRI AND USGBC

The vision for this Summit was to advance action steps for fostering safer, healthier, and more equitable buildings and communities.

The Summit commenced with the hosts' welcoming remarks and introduction of the participants. Participating thought leaders represented three groups: 1) building practitioners, 2) public health practitioners, and 3) scientists and researchers.

Peter Templeton, President & CEO of USGBC and Green Business Certification Inc. (GBCI) highlighted the importance of continuing the conversation on climate resilience, health, and well-being. He discussed the impact of climate change, the frequency of disaster events, and the need to safeguard our communities, promote health and well-being, and protect lives. Highlighting the work already shaping the built environment in positive ways, he pointed to the LEED Platinum and LEED Zero Certified Kendeda Building for Innovative Sustainable Design in Atlanta, Georgia, as an example. The Kendeda Building was designed to foster regeneration and restoration for humans and nature and features net-positive energy and water, a successful waste diversion program during construction, and focuses on regional resources benefiting the local economy while utilizing best practices in sustainable design. In closing, Mr. Templeton referenced the Summit as embracing solutions from research and practice to show what is necessary and possible, emphasizing accelerating our collective action on resilience and health.

Marilyn Black, Vice President and Senior Technical Advisor of CIRI, addressed concerns about climate changes impacts on human health and well-being. Extreme heat can cause health effects ranging from heat exhaustion and strokes to death. Air pollution is a significant risk factor affecting our lungs, hearts, and other physiological systems. ***The purpose of convening this multidisciplinary group was to develop a paradigm ensuring the resilience of the built environment for safeguarding public health.***

1.1 CLIMATE IMPACTS ON BUILDING RESILIENCE AND HUMAN HEALTH

Extreme climate conditions, particularly those related to temperature and moisture, can lead to weather events that expose people to environmental health risks. Prolonged heat and moisture increase ground ozone, mold, and pathogen growth, while droughts and wildfires increase exposure to chemicals, pollen, and particulate matter, all of which can impact human health. External environmental stressors, including extreme temperatures, wind, and water disasters, can influence or even generate internal stressors that contribute to a building's resilience and the health of the people in the building. These internal stressors include chemicals, biological contaminants such as mold and allergens, building dust, airborne particles, air and material temperatures, and moisture.

These factors play a role in exposure risks that lead to human health outcomes, such as heat-related illness and death, cardiovascular illness, asthma and allergy-related illness, waterborne and food-related infections, drowning, injury, and stress-related disorders. Certain groups are more susceptible to adverse effects, including children, pregnant people, the elderly, and those with pre-existing medical conditions. Commonly, exposures are higher—and access to mitigation strategies lower—for low-income and marginalized communities. Significant human exposure to pollutants can result from inhalation, ingestion of contaminated dust and potable water as well as dermal transfer, when people come in contact with a material containing the pollutant and it migrates through the skin and into the body.

The combination of the rise of synthetic product use and the focus on airtight buildings in the 20th century led to the chemical exposure issues that we face today. After World War II, synthetic materials began being mass-produced and readily available to the public, leading to more synthetics in our buildings and homes. In the 1970s, the energy crises necessitated energy conservation, which led to tight building envelopes with little or no natural ventilation in spaces filled with synthetic materials. This led to elevated levels of airborne chemicals, resulting in degradation of indoor air quality (IAQ) and resulting adverse health impacts on building occupants.

In the 1970s, the term "sick building syndrome" came into use, referring to a condition in which people develop symptoms of illness or chronic diseases from pollutant exposures in the buildings they occupy. There are many significant examples of buildings with registered IAQ complaints, including the United States Environmental Protection Agency's headquarters building, Waterside Mall. Numerous buildings with sick building syndrome in Washington State shuttered, prompting them to initiate the East Campus Plus Program with design specifications for healthy buildings. The study of these health issues led to the understanding that construction materials, finishes, and furnishings were the primary sources of indoor pollution, and that ventilation was needed to help reduce their impact. The East Campus Plus Program specified the use of low-emission, low-toxicity products along with assurance of effective ventilation and the introduction of clean outside air to achieve better IAQ.

Sustainable design approaches and energy codes used today focus primarily on mitigating climate change by reducing carbon emissions (decarbonization). Designing for resilience necessitates approaches that focus on adaptation to climate change and mitigation from health hazards. This combination is needed to take a proactive (rather than reactive) approach to the design process, considering climate over the lifespan of the building and the impact of design on human health.

Currently, CIRI is researching the impact of weatherization on common building materials and how they may impact the indoor environment. Specifically, CIRI is using environmental chamber technology to evaluate the emissions of common building materials at elevated and ambient temperatures. Elevated temperatures may be experienced during prolonged power outages or in unconditioned spaces during extreme weather events. This research evaluates chemical release across various building materials as a function of environmental conditions and measures chemical levels for health risks based on known regulatory and toxicity criteria. Initial results show that significant increases in pollution emissions can occur with elevated heat and that new chemicals of concern, which would not otherwise be present, can be released.

1.2 LEED AND RESILIENCE

The LEED rating systems have been around for 25 years and have driven resilience and health outcomes in green buildings. One of the goals of LEED is to create a more resilient and adaptable built environment that can expand and recover from natural hazards and cope with the uncertainties of a changing climate.

LEED rating systems benchmark the success of buildings, cities, and interior spaces through strategies that are reflected in the 100-point scale based on defined credits. Within the LEED framework, projects reduce greenhouse gas emissions through increased energy efficiency and renewable energy use, material circularity, life-cycle analysis, and improved environmental quality. Many projects achieve health co-benefits by integrating active transportation, reducing urban heat islands, reducing water consumption and scarcity, ambient air pollution, habitat loss, flooding, and more.

Over time, LEED has added more focus on resilience to the rating systems. The LEED for Cities and Communities rating system incentivizes the processes of resilience assessment and mitigation planning. The LEED Building Design and Construction rating system offers pilot credits dedicated to resilience that were introduced in 2015. These credits address aspects that include hazard identification, risk assessment and mitigation, and passive survivability and backup power. Currently over 400 projects have registered to pursue resilience-related pilot credits. The next rating system version, LEED v5, will evolve this work further.

To increase the implementation of scientific and data-driven best practices and drive change at scale, the USGBC Resilience Working Group (RWG) is delving into subjects like incorporating prominent building standards and codes, integrating advanced building systems and technologies, and considering the impact of natural events on buildings, such as wildfire smoke, heat waves, and floods. The RWG is considering how these acute and chronic stressors can be mitigated to improve public health, including occupant, worker, and community health.

Through rating systems, education and outreach, partnerships and collaborations, USGBC drives the creation of a more sustainable world, raises awareness, and builds capacity for the changes we need to co-create a resilient and healthy built environment.

1.3 INTEGRATIVE DESIGN PROCESS

An "integrative design process" brings the owner, design team and stakeholders together early in the design process, and throughout a project timeline, to define goals, priorities, and synergies. Integrative design invests more time upfront to ensure that the team has an effective process and a better product overall. This approach extends the discovery phase and examines the big challenges the team wants to solve. LEED encourages project teams to conduct workshops early in their process to identify goals and set established outcomes for the project, which helps streamline and make sustainability and health goals cost-effective to achieve. In addition to the project owner and operator(s), and the design and construction teams, additional stakeholders may participate, including community members, financial representatives, health professionals, government officials, contextual experts, ecologists, and resilience experts.

Within LEED, the Integrative Process credit includes analysis for energy and water systems in the building, and adds resilience, health, and well-being to the list of potential priorities for a project team to analyze early in the design process.

2.0 SITE SELECTION AND PROTECTION FOR COMMUNITIES

Summit attendees presented and discussed issues related to resilience in the built environment and the impacts on human health, specifically around site selection and protection for communities. The following key points were presented:

- Exposure science and toxicology need to understand interactions between the natural world and the built environment. Our existence coincides with both environments.
- Ensuring that community health is a top priority. Local and regional health departments cater to diverse populations, offering diverse services. Most local health departments collaborate with K–12 schools, community-based organizations, and higher education; however, less than half of these organizations report regular collaboration with private businesses.
- Climate risk is a health and financial risk that, from a real estate perspective, needs focused action across the industry and, in the business case, needs a connection to be established between the moral perspective and health risk. Businesses close due to poor IAQ, and flooding and mold affect business costs and reduce business opportunities.
- Communities need social cohesiveness and adaptive capacity to be flexible and responsive to natural disasters and benefit from shared human, social, economic, and environmental health values.
- Evaluation of environmental exposure is needed to quantify the impact on community health. It should be based on population health needs at the neighborhood scale.
- Demographic disparities limit access to safe and healthy indoor environments. Designing to minimize heat gain should be a priority. One way to improve resilience in communities is to have community spaces with backup power sources.
- Exposure to indoor air pollution varies based on activity patterns, socio-economic status, and the position of people in the home. Creating maps to help determine where wildfires are located, where

they persist, and how long they last will improve design for resiliency and disaster planning. Heat stress and indoor and outdoor environment exposures coincide; we should also consider other indoor environmental quality factors, such as light and sound.

- Resilient design costs include initial, service and maintenance, operating, and disposal costs as well as human health and environmental costs.
- There are many unknowns about chemistry and its impact on human health. Translational research with implications for design can address concerns like how IAQ impacts productivity, how materials and other products in the indoor environment react in a fire, and how toxic indoor chemicals impact occupants during normal use and during a disaster.
- Utilizing a systems approach to integrated, research-driven design improves the understanding of the complex variables involved in climate change, resilience in the built environment, and human health outcomes.

3.0 BUILDING DESIGN, CONSTRUCTION, AND INDOOR AIR QUALITY

Attendees also presented and discussed issues around building design, construction, and IAQ. The following key points were highlighted:

- Buildings are responsible for about 40% of our energy use, generating indoor and outdoor air pollution. A reduction in use could lead to health and climate benefits for our ecosystem and people.
- Buildings are public health interventions, and every building impacts health in some way. No building is an isolated component; rather, it is a part of a system that is hopefully a living system for that building and the surrounding neighborhood and area. It should have a positive ripple effect. An integrated design process and performance requirements have delivered buildings that exceed expectations. Increased integration with design teams can improve performance outcomes, reduce costs, and create beautiful architecture that is meaningful and impactful.
- Resilient design and construction need to protect against various external stressors, such as wind, wildfire, hail, and wind-driven rain. There are science-based, low-cost construction techniques that can increase the durability of a structure.
- Strategies for wildfire mitigation in residential construction include a Class A fire-rated roof, which reduces the risk of igniting from embers, removal of mulch and pine bark from the home ignition zone, and removal of dead debris from the home vegetation area. These design criteria are affordable changes in standard home design.
- Sustainability is the defense of the basic elements of health and the perseverance of knowledge and social and human capital.
- Our buildings are built from combustible materials. A typical 2,000 sq ft home in the U.S. contains an equivalent of nearly 60,000 lbs of fuel.
- The U.S. has an annual 2% new building rate; the remaining 98% are existing buildings that may need retrofitting to be resilient against threats like wildfires.
- In the event of a fire, in addition to life safety, we need to ensure the building's continued resiliency and the health of the surrounding community. One building has the potential to create local pollution. Seventy-two lives were lost in the 2017 London Grenfell Tower fire because, although it was an

energy-efficient renovated building, the exterior products helped fuel the fire's upward spread at a fast rate. Resiliency in the built environment and human health should be multidisciplinary and not discussed in silos.

- Various codes are available for compliance and adaptability. Although they might meet today's baseline safety requirements, they are not focused on health or a changing climate. However, certification programs may encourage design beyond just meeting codes. Demonstration projects can make acceptance of a focus on resilient building design more widespread.
- Codes are minimum standards and do not define best practices in the design and construction of the built environment.
- New opportunities for innovation need to be explored, rather than creating new synthetic materials that will lead to the same concerns about human health in the next cycle. At the same time, we need better tools to deal with products that are already in place within our homes, schools, and places of work and play.
- Public health is an economic externality in the real estate industry. Public health is a systematic challenge, like the green building challenge, which is larger than one building; nonetheless, it can be addressed, and we are making incremental progress. A business case is needed for healthy buildings; the environmental and green elements have been proven for a while, but the health case still needs to be better understood and quantified.

4.0 WHAT IS NEXT FOR BUILDING RESILIENCE FOR HEALTH?

In small groups, attendees developed criteria for defining resilience for the built environment and human health. The following are statements from those discussions.

Buildings that are resilient for health:

- Utilize effective communication strategies
- Anticipate, mitigate, and provide a safe haven before, during, and after climate events
- Provide passive survivability and active responses
- Prioritize vulnerable populations
- Function in everyday life
- Dynamically respond to and recover from both expected and unexpected extreme events and conditions, reducing exposure and supporting human health
- Are resources within a community that provide protection and support IAQ, human health, inclusive access, and environmental well-being
- Foster resilience for occupants at scale and consider occupants, stakeholders, and the supply chain
- Change immediate and long-term behavior and building operations to respond to climate adversity and to preserve and promote physical, mental, and social health and well-being
- Are designed, operated, and maintained to preserve and protect the health and safety of occupants in the face of climate stressors

5.0 IDENTIFYING ACTION STEPS

In small groups, attendees focused on three key issues related to resilience and its connection to human health: 1) heat, 2) fire, and 3) chemicals.

From those discussions, a variety of next steps were identified to minimize human health risks:

A framework was developed based on the presentation of nine key lessons:

- Research
- Guidelines to translate research into practice
- Legislation to turn guidelines into law
- Public education and advocacy to create demand for widespread adoption
- Strategic plans
- Harnessing of market forces
- Subsidy and enforcement
- Evaluation
- Primary prevention (act before harm occurs)

5.1 HEAT

Relative to weather changes and extreme heat, the following opportunities were identified:

Communication

- Developing a strategy for communication and education
- Messaging heat as an “invisible” threat
- Ensuring that outdoor workers know their rights regarding breaks and shade

Research and Data Acquisition

- Acquiring data
- Quantifying and communicating lost productivity and return on investment due to heat and health issues
- Focusing on risk to vulnerable populations
- Conducting health resilience analyses

Strategies

- Developing key partnerships
- Publicizing hospital visit incidences due to heat-related illnesses
- Clarifying terminology for heat warning, heat watch, and heat alert
- Naming heat events
- Adhering to heat warnings
- Driving government programs through research
- Identifying resources to support health—infrastructure, churches, cooling centers, etc.

5.2 FIRE

Fire concerns focused on the increasing incidence and severity of wildland and wildland urban interface (WUI) fires. The opportunities and needs that were identified include:

Communication

- Creating public service announcements (PSAs) and webinars
- Communicating valid existing information
- Campaigning for outreach to children—like stop, drop, and roll

Research and Data Acquisition

- Collecting available National Institutes of Health (NIH) disaster rapid response data
- Conducting short-term research studies to meet immediate needs
- Establishing long-term exposure cohort studies
- Identifying hazards—toxicology (on materials we do not know anything about)
- Identifying and quantifying toxins found in the human body
- Researching materials to determine characteristics and parameters related to everyday use and combustive toxicities; and how materials and products behave in the fire, and combustive toxicity testing

Strategies

- Identifying legacy issues
- Bringing stakeholders to the table—fire victims, homeowners, real estate professionals, insurance agencies, builders, and developers—to drive adoption (e.g., incentivize homeowners to implement qualified mitigation strategies for discounted insurance premiums)
- Developing consensus standards
- Developing an inventory of existing stakeholders
- Mitigating risk
- Utilizing photos of buildings surviving a WUI fire and pairing it with existing mitigation guidance and research
- Advocating for funding for homeowners to renovate their homes

5.3 CHEMICALS

Exposure to hazardous chemicals is a health hazard in both indoor and outdoor environments. Extreme heat can change chemical emission profiles of materials and combustion characteristics of building materials in combination with burning biomass can add significant toxicity to humans and the environment. The following educational and research opportunities were identified:

Communication

- Running education and PSA campaigns around key topics such as unvented gas heaters and DIY air cleaners with box fans and air filters
- Educating about common chemical exposures and how those are changing in a warming climate
- Summarizing what to do with changing emissions profiles from interior finish materials and how to mitigate those harms today

Research and Data Acquisition

- Supplementing existing data analysis on chemical exposure with new data
- Investigating remediation strategies following disasters
- Identifying cross-beneficial applications across design elements to improve hardiness and chemical safe environments
- Identifying appropriate test methods for measuring chemicals
- Conducting research along the continuum from mitigation strategies to prevention strategies to align with a focus on positive human and environmental health outcomes

Strategies

- Continuing to research the impact of changing emission profiles in a warming climate
- Updating performance criteria for new products and materials to address resilience
- Focusing immediately on known health outcomes to inform designers and architects about cross-beneficial solutions (e.g., a fire barrier that is chemically safe and prevents open flame)
- Evaluating and developing standards, regulations, and guidelines by pulling from existing standards and guidelines to identify and fill gaps in design strategies
- Developing an IAQ-specific standard with a baseline allowable level of contaminants, ventilation, and steps for maintaining good IAQ
- Developing dissemination strategies to inform various stakeholders as research comes to fruition

6.0 SUMMIT SUMMARY

First and foremost, the Summit brought together an expert group of thought leaders, who provided insights and brainstormed strategies for advancing the protection of public health as we implement resilience practices for the built environment. These practices include concepts for research, education, and the delivery of information across multi-media platforms, networks, and programmatic activities.

For building resilience, it was identified that research should have translational implications for the design and construction of a resilient built environment, with positive consequences for human health and well-being. Policies should be adopted that are evidence-based and supplemented by education and communication plans to maximize impact. In summary, the consensus among participants was that ***resilience for the built environment should consider protection from the elements, adaptability, recovery from adverse events, and risk reduction in promoting the health of individuals, communities, and society.***

Summit participants provided open access resources for promoting resilience and human health in the built environment. This collection will continue to be open for additional resources, expand in content, and be readily available to all stakeholders and interested parties.

https://chemicalinsights.org/education-hub/resiliency-and-human-health-resources/