National Institute of BUILDING SCIENCES™

MOVING FORWARD

FINDINGS AND RECOMMENDATIONS FROM THE CONSULTATIVE COUNCIL

2020

Innovative Solutions for the Built Environment

National Institute of BUILDING SCIENCES™
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Moving Forward

INTRODUCTION

The National Institute of Building Sciences (NIBS) is authorized by the U.S. Congress to serve the public interest as the essential forum for discussing issues and identifying opportunities within the building community. The NIBS Consultative Council assembles high-level building community leaders to make collective recommendations directly to policymakers – and by NIBS to the President of the United States – to improve our nation's buildings and infrastructure.

Each year, the Consultative Council publishes the Moving Forward Report to investigate key challenges facing the building industry and to make recommendations to policymakers to help overcome those challenges. The 2020 Moving Forward Report will examine the critical area of "Ensuring Healthy Buildings: How Buildings Can Protect and Promote Public Health."

THE CRITICAL NEED TO DEVELOP AND PROMOTE HEALTHY BUILDINGS

On average, Americans spend approximately 90% of their time indoors, according to the U.S. Environmental Protection Agency (EPA). One of the most difficult facets of the COVID-19 pandemic has been a fear of interacting with our loved ones, acquaintances, colleagues, or even with total strangers while indoors. Ensuring that the spaces where we work and live are healthy and safe for continued occupancy is critical to overcoming the COVID-19 pandemic, and should be seen as a fundamental pillar of public health and community resilience.

The concept of healthy buildings does not simply include continual sanitation of a building's indoor environment to eliminate pathogens. The Healthy Buildings for Health program at the Harvard T.H. Chan School of Public Health developed the 9 Foundations of a Healthy Building report, highlighting nine key areas for ensuring healthy buildings.

- Ventilation
- Air Quality
- Thermal Health
- Moisture
- Dust and Pests
- Safety and Security
- Water Quality
- Noise
- Lighting and View

Developing and promoting healthy buildings is intricately tied to community resilience and social equity, and includes the full spectrum of a building's lifecycle: planning, design, construction, commissioning, ongoing operations and maintenance, and renovation. It also includes ensuring continual communication and knowledge transfer between building owners, operators, regulators and public health and public safety officials to protect the health and safety of occupants.

This report examines and provides recommendations for policymakers and building owners regarding three components of healthy buildings:

- Indoor environmental quality
- The importance of design in promoting health
- Promoting knowledge transfer between building owners and public health officials

INDOOR ENVIRONMENTAL QUALITY

The National Institute for Occupational Safety and Health (NIOSH) refers to indoor environmental quality (IEQ) as "the quality of a building's environment in relation to the health and wellbeing of those who occupy the space within it."[1] The indoor environment presents unique risks to building occupants, and varies greatly by building type, building operations, and geographic location. Studies by the U.S. EPA have shown that harmful contaminants can be present in concentrations that are two to five times higher than outdoors.[2] These pollutants have been shown to negatively affect hundreds of thousands of individuals every year, including incidence of respiratory issues, cancer, and even adverse behavioral impacts. Promoting healthy IEQ in our nation's buildings can lead to healthier, happier, and more productive occupants.

The COVID-19 pandemic, transmitted by an airborne pathogen, spotlights the particular importance of indoor air quality (IAQ) in promoting public health in the built environment. Though pandemic conditions perhaps require a change in a building's normal operations[3], clean, properly-ventilated, and well-filtered air is critical to healthy occupants at all times. Poor IAQ can have both an immediate and/or long-term impact on a building's occupants, with some effects not materializing for years. As cited in the Harvard Business Review, one CDC study of 3,000 individuals across 40 buildings found that 57% of sickness can be attributed to poor ventilation.[4] Improper operation and maintenance of HVAC systems is one of the most common

1 "Indoor Environmental Quality." National Institute for Occupational Safety and Health. Center for Disease Control and Prevention. https://www.cdc.gov/niosh/topics/indoorenv/buildingventilation.html

2 Indoor Air Quality." U.S. Environmental Protection Agency. https://www.epa.gov/report-environment/indoor-air-quality

3 ASHRAE Building Readiness Guide. https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-building-readiness.pdf

4 Allen, Joseph and Macomber, John. "What Makes an Office Building "Healthy"". Harvard Business Review. April 2020. https://hbr.org/2020/04/what-makes-an-office-building-healthy

problems that impact indoor air quality,[5] and can increase indoor pollutant levels via improper ventilation and filtration, high temperatures, and high humidity levels.

There are many common sources that may contaminate indoor air:[6]

- Building materials such as paints, coatings, sealants, carpeting, and furniture that may emit unhealthy volatile organic compounds (VOCs)
- Combustion processes from mechanical systems
- Cleaning materials
- Mold from indoor moisture
- Radon, methane, or other harmful substances off-gassing
- External inputs, such as particulates and smoke from wildfires and other disasters

In addition to safe indoor air, there are other factors that impact indoor environmental quality. Building performance and resilience, especially as it relates to IEQ, is critical to ensuring public health. Other factors that can promote healthy indoor environments include:[7,8]

- Low VOC materials
- Access to daylight, views, and proper lighting
- Improved building controls, including occupant enabled controls
- Good acoustics
- Maintaining healthy work practices during construction and renovation
- Replacing combustion appliances and equipment with electric counterparts
- Pest control
- Safety and security from natural hazards

The building industry and policymakers should prioritize investments in IEQ, including increased funding for research, real world testing, and incentives to promote healthy IEQ in new and existing buildings, with particular focus on disadvantaged or underserved communities. In fact, of critical importance will be understanding the full impact of the potentially disruptive change (both positive and negative) brought on by a society-wide change in remote work for our communities.

THE IMPORTANCE OF DESIGN TO PROMOTE HEALTH

Architects and engineers have been increasingly focused on the importance of health in building design and operations; this trend needs to continue to accelerate. As the American Institute

5 "Indoor Environmental Quality." National Institute for Occupational Safety and Health. Center for Disease Control and Prevention. https://www.cdc.gov/niosh/topics/indoorenv/buildingventilation.html

6 Volatile Organic Compounds." U.S. Environmental Protection Agency. https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality

7 "Green Building 101: What is indoor environmental quality?" U.S. Green Building Council. https://www.usgbc.org/articles/green-building-101-what-indoor-environmental-quality

8 Continental Automated Building Association. "Intelligent Buildings and COVID-19." https://www.caba.org/wp-content/uploads/2021/02/CABA-IBCOVID-ES-WEB.pdf

of Architects "Design and Health Initiative" notes, "when health impacts and equitable access to healthy places become central to the design and planning process, transformational outcomes quickly appear."[9] A 2016 SmartMarket report showed that upwards of 70% of building owners and designers indicated that the impact of buildings on occupant health influenced the building's designs and operations, an increase from a previous survey in 2014. The American Society of Interior Designers "2020 Interior Design Resiliency Report" noted that, due to the COVID-19 pandemic, more than one-third of surveyed interior designers anticipated changes involving material specifications and certifications focused on health as well as product specification or certifications focused on health.[10]

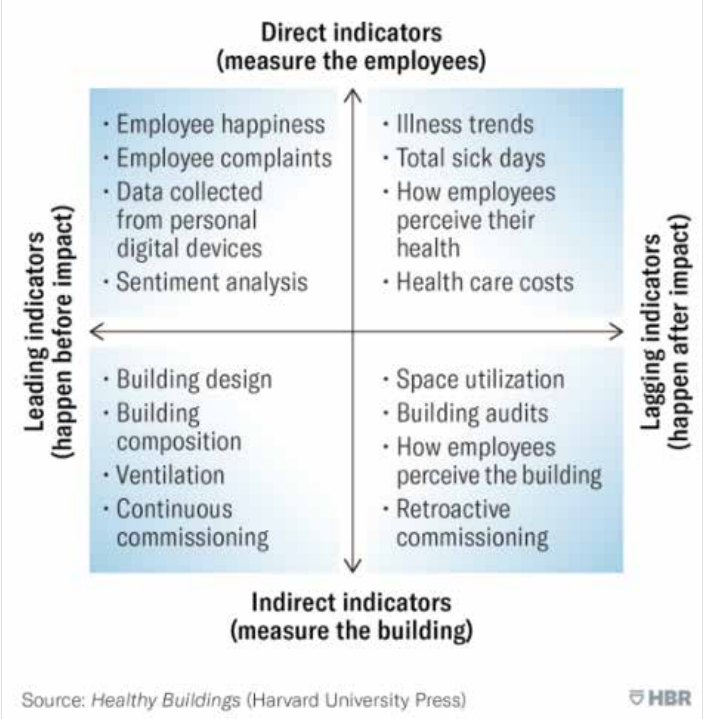
There are currently several rating systems, certification programs, and building codes that focus on occupant health, and provide pathways and tools toward developing and maintaining healthy buildings:

- Fitwel Standard
- Green Globes Standard
- Indoor AirPLUS
- International Green Construction Code (IgCC)
- LEED Green Building Rating System
- NGBS Green Certification
- RESET Standard
- Verified Healthy Buildings Program (UL)
- WELL Building Standard

Healthy buildings are a critical component of our national infrastructure, and should be intricately entwined with the concepts of resilience and social equity, both on a building by building basis and in the surrounding community.[11] Sustainable land use, walkability, multimodal transportation, access to healthcare and healthy food options, and the surrounding landscape all contribute to a healthy, vibrant workforce. Building owners and public health officials should work with planners, architects, and designers to ensure that sound practices in building design and resilience are core components of community development.[12] The federal government must also recognize the critical role that buildings play in our national infrastructure, and encourage healthy buildings programs that enable occupant health and happiness in both our homes and workplaces.

PROMOTING CONSISTENT KNOWLEDGE TRANSFER BETWEEN BUILDING OWNERS AND PUBLIC HEALTH OFFICIALS

The U.S. EPA, in its Healthy Buildings, Healthy People: A Vision for the 21st Century report, listed as a primary goal the importance of improving professional education and communications, both within and between the building community and medical/public health professionals.[13] Particularly critical is the development of common risk assessment methodology, research into common risks associated with health and buildings, common baselines from which to measure risk, and the quick communication of those risks and proposed solutions. Establishing clear



communication protocols and promoting data-sharing among the building industry and public health and medical officials can help to protect public health and provide additional tools for combating future crises.

John Macomber and Joseph Allen, of Harvard University, developed "Health Performance Indicators" to help determine

9 American Institute of Architects. "AIA's Design and Health Initiative." http://new.aia.org/pages/3461-aias-design-health-initiative

10 American Society of Interior Designers. "2020 ASID Interior Designer Resiliency Report.

11 National Institutes of Health. "Elements That Contribute to Healthy Building Design." Environmental Health Perspectives. June 2007. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1892106/

12 The Alliance for National & Community Resilience's (ANCR) Community Resilience Benchmarks (CRBs) provide tools to look across community functions to support resilient communities.

13 U.S. Environmental Protection Agency. "Healthy Buildings, Healthy People: A Vision for the 21st Century." https://www.epa.gov/indoor-air-quality-iaq/healthy-buildings-healthy-people-vision-21st-century

leading and lagging indicators of worker health and building performance.[14] Building owners and operators should work with public health and medical professionals to incorporate baseline metrics into their facilities.

The industry must convene and discuss the optimal way to ensure that medical professionals, including general practitioners, pediatricians, and mental health professionals, are aware of the critical nexus between the built environment and public health. A survey by McGraw Hill Construction found that a bare majority of medical professionals in these groups were aware of this connection.[15] Additionally, the survey noted that only 15% of medical professionals receive any information on the connection between health and buildings. A majority of those surveyed indicated that receiving additional information on this topic would have an impact on their practice and advice for patients. The building industry should work with public health officials and advocates or associations on developing a common framework for communicating to medical professionals and the general public the importance of the built environment in promoting health.

Additionally, the building industry should streamline the regulatory development process in order to make it more anticipatory of emerging hazards.[16] Anticipating the impacts of climate change in building regulations, which will include an increase in the risk of natural disasters and pandemic events, will be critical to ensuring healthy, resilient, and equitable communities.[17] This will require a sustained connection between the building industry and science and public health officials.

NIBS AND CONSULTATIVE COUNCIL ACTIVITIES IN 2020

In 2020, the NIBS Consultative Council hosted a series of virtual town halls related to COVID-19 and its impact on the built environment. The series was designed to engage with experts in the buildings and public health communities to help America's workforce prepare to reenter buildings during and/or after the COVID-19 pandemic, in accordance with current (and shifting!) health and safety guidelines.

- Preparing for Re-Entering Buildings (May 7, 2020): an expert panel covered preparing the office or workplace (cleaning, disinfecting, and decontamination), HVAC and water systems, elevators, and transportation, and what to do if a colleague contracts a virus in a shared workspace.
- Mental Health and Sanitation of COVID-19 Facilities (May 19, 2020): an expert panel covered re-occupancy of spaces used to house COVID-19 patients and/or medical personnel, sanitation of spaces, and workforce mental health.
- The Future of Design and Construction (June 29, 2020): an expert panel covered how offices may be redesigned moving forward, the importance of facility management, what will become of co-work spaces, and the future of commercial buildings.
- Healthy Buildings and the Effect on Public Health During the Pandemic (August 25, 2020): an expert panel will discuss the importance of healthy buildings, public health, climate justices, and the green energy sector.

The National Institute of Building Sciences also established a COVID-19 resource hub on the NIBS Whole Building Design Guide. The WBDG team built a permanent resource for those looking for recent developments, financial assistance information, webinars and events, continuing education, and other impacts of the coronavirus on the building sector.

LOOKING AHEAD TO 2021

In December 2020, the Consultative Council held a CEO Roundtable entitled "Improving the Workforce of the Built Environment through Social Equity." The roundtable discussed the current state of diversity, equity, and inclusion (DEI) within the building industry and how leaders present could help drive the industry forward. This included the need to develop survey work related to DEI to inform industry activities, develop core metrics for tracking progress, and partner with core industry stakeholders to drive critical DEI initiatives. Throughout 2021, the Consultative Council will lead these efforts to affect positive change in diversity, equity, and inclusion in our workforce and the larger built environment.

RECOMMENDATIONS:

- The Administration, DOE, CDC, EPA, NIST, and other relevant federal agencies should increase investment into critical research on the impacts of IEQ and resilience on health and productivity. Of particular importance is research into how retrofits to the nation's existing building stock can be used

14 Allen Joseph and Macomber, John. "What Makes an Office Building 'Healthy?'" Harvard Business Review. April 2020. https://hbr.org/2020/04/what-makes-an-office-building-healthy

15 McGraw Hill Construction SmartMarket Report. "The Drive Toward Health Buildings: The Market Drivers and Impact of Building Design and Construction on Occupant Health, Well-Being and Productivity." http://content.aia.org/sites/default/files/2016-04/DH-Drive-Toward-Healthier-Buildings-SMR1_0.pdf

16 Diamond, Rick and Eisenberg, David. "After COVID-19: Opportunity for Changing Building Regulations?" Buildings and Cities. May 2020. https://www.buildingsandcities.org/insights/commentaries/after-covid-19-regulation.html

17 American Institute of Architects. "Disruption, Evolution, and Change: AIA's Vision for the Future of Design and Construction." https://content.aia.org/sites/default/files/2019-06/ADV19_Disruption_Evolution_Change.pdf

to improve IEQ.

- Federal agencies, including DOE, NIST, EPA, GSA, and HUD, should support research aimed at identifying improvements to building codes and other criteria that can provide cost-effective approaches to enhanced building performance. This should include opportunities to shorten the regulatory and code development process, and enable it to be more anticipatory of current and future disruptions to public health.
- Congress, DOT, HUD, DOE, FEMA, and EPA, with input from the community-based organizations, advocates, and the private sector should identify and enact policies, including incentive programs, that encourage building owners and operators to invest in critical activities that promote healthy IEQ. Clean water, healthy high performing buildings, clean interior and exterior air, and fair and equitable access to healthy and resilient places are critical components of our nation's infrastructure. Particular incentive should be given to supporting improvements in disadvantaged communities or populations that are impacted by flaws in existing structures, those constructed with unsafe or toxic materials, or that present unsafe living or working conditions to occupants.
- The Administration and GSA should encourage federal agencies to "lead by example" and adopt best practices in healthy buildings in all federal facilities. This should include that all new federal buildings meet standards that promote healthy buildings.
- The Administration, DOE, EPA, HHS, CDC, other relevant federal agencies, and the private sector should develop and engage in a national campaign to increase awareness of the importance of the indoor environment to public health. A specific goal of this campaign should be to increase awareness among medical practitioners on the critical role of buildings in promoting and protecting public health, and how medical professionals can communicate with building owners and public health professionals regarding potential risks, dangers, and solutions.
- The Administration, DOL, and the U.S. Department of Education should extend their efforts to advance apprenticeships and workforce development to include careers within the buildings and construction workforce, with additional programs focused on promoting women and minority groups in the trades.

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- American Institute of Architects
- American Institute of Steel Construction
- American Planning Association
- American Society of Civil Engineers
- American Society of Heating, Refrigerating and Air-Conditioning Engineers
- Associated Builders and Contractors
- Associated General Contractors of America
- Association for Equipment Management Professionals
- ASTM International
- Building Owners and Managers Association International
- Connex FM
- Construction and Demolition Recycling Association
- Construction Management Association of America
- Construction Specifications Institute
- Continental Automated Buildings Association
- EEBA
- Green Building Initiative
- IIBEC
- Insurance Institute for Building and Home Safety
- International Association of Plumbing and Mechanical Officials
- International Code Council
- Modular Building Institute
- National Energy Management Institute Committee
- National Ready Mixed Concrete Association
- New Buildings Institute
- Royal Institution of Chartered Surveyors
- U.S. Green Building Council

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