

WELL v2™

The next version of the
WELL Building Standard™



INTRODUCTION

As humans, we have always been dependent on our environments to nurture and sustain us. We rise with the sun, we eat off the land, we make shelter of stones and trees. We need water, air and light to *survive*. We need good water, good air and good light to *thrive*.

We build structures to protect ourselves – from nature and other forces. And we spend increasing amounts of time in these structures, living more than 90% of our lives indoors. Our buildings are designed to keep us safe, to protect us from the elements. But many of the places where we spend our time also get in the way of our health, putting one degree of separation between us and that which has always kept us alive.

Nature has long been our caretaker. With intentional design, our buildings can be too.

Thanks to an evolving and growing evidence base, we understand more about the relationship between our environments and our health than ever before. We know how to create spaces that enhance, rather than hinder our health and well-being. We can measure- and then improve – the quality of our air, water and light. We know how to design environments that fuel our bodies, keep us moving, inspire our best work and facilitate a good night's sleep.

Through the vehicle of WELL, IWBI helps to translate what we know into what we practice.

WELL is premised on a holistic view of health: human health as not only a state of being free of disease - which is indeed a fundamental component of health - but also of the enjoyment of productive lives from which we derive happiness and satisfaction. Healthy spaces protect us from that which can make us sick, promote practices that can keep us well, and facilitate opportunities for us to connect with one another and live our lives to the fullest.

We aspire to advance healthy buildings for all. This has been our mission since we launched WELL in 2014, but today we know a lot more about how to achieve it. We've learned alongside our customers, early adopters of the healthy buildings movement and brave pioneers on the frontier of human-centered design. To create this new version of WELL, we did a lot of research and a lot of listening. We tried to channel all that we learned and all that we heard into a product that is more accessible, more adaptable and more equitable, while still anchored by the latest scientific and medical knowledge.

WELL v2: Equitable, Local, Dynamic

WELL v2 builds upon the pioneering foundation of WELL v1, drawing from the community of users and practitioners, and from health and building researchers and experts around the world.

One of our main goals in developing WELL v2 was to drive equity into the very architecture of the standard. We wanted to reduce barriers to entry, while maintaining WELL as a mark of true leadership. We wanted to offer more choice while retaining rigor. We wanted to create a single version of WELL that could evolve to meet the needs of any type of building in any part of the world. We have done this by re-affirming and building upon the scientific evidence base for effective health intervention through built spaces and organizational practices, homing in on the essential elements of what a healthy building *must* be and introducing new options for what a healthy building *could* be. All the while, we asked ourselves: could a well-intentioned project achieve this intent? Could an existing building meet our requirements without major capital expenditure? How might a WELL space create equal opportunities for all? How do we ensure that those on the outside benefit as much as those on the inside?

WELL is already a global tool being utilized in more than 30 countries. In order to make WELL v2 a better fit for people and spaces around the world, we approached the goal of globalization through a strategy of localization; taking into consideration regional health concerns, cultural norms and market realities. This new version of WELL will be regularly and proactively adapted to varying contexts and constructs, making it even more relevant and readily applicable to spaces and places across the globe.

What makes all of this possible is that WELL v2 is dynamic. We built a system that can continuously learn, evolve and improve. Moving away from a fixed scorecard gives you the opportunity to focus on the outcomes that matter most for your project and your community, and it gives us the opportunity to regularly introduce new pathways and parts to make WELL a better and better fit for all buildings everywhere.

Powerful Opportunities for Health Promotion

As designers, engineers, builders, operators and owners of buildings, we too are caretakers.

We have an obligation to create spaces that move us—all of us—in the direction of health.

Together, we can create spaces that inspire; spaces that are inclusive; spaces that allow us to flourish; spaces that help us become happier and healthier people. With every WELL project comes a powerful opportunity to catalyze our built spaces as mechanisms to deliver health and wellness benefits to all people within them.

Principles of WELL v2

The development of WELL v2 is founded on the following principles:

Equitable: Provides the greatest benefit to the greatest number of people, inclusive of all demographic and economic groups and with special consideration of groups of the least advantage or vulnerable populations.

Global: Proposes interventions that are feasible, achievable and relevant across many applications throughout the world.

Evidence-based: Undergirded by strong, validated research yielding conclusions that can reasonably be expected to receive acceptance by the scientific community.

Technically robust: Draws upon industry best practices and proven strategies, offering consistency in findings across the relevant field or discipline.

Customer-focused: Defines program requirements through a dynamic process, with multiple opportunities for stakeholder engagement, and by tapping the expertise of established leaders in science, medicine, business, design and operations.

Resilient: Responds to advances in scientific knowledge and technology, continuously adapting and integrating new findings in the field.

The Architecture of the Standard

A Unified Standard: One WELL

WELL v2 consolidates previous iterations and pilots into one WELL for all project types. The system is designed to grow in specificity and specialty over time, adapting to accommodate diverse project types and geographies and in response to new evidence and ever-evolving public health imperatives.

Dynamic WELL Scorecard

WELL Online guides project teams through the development of a unique scorecard. The digital platform recommends a selection of features based on project-specific parameters that can be further defined and refined by the project team.

Ten Concepts

There are ten concepts in WELL v2: Air, Water, Nourishment, Light, Movement, Thermal Comfort, Sound, Materials, Mind and Community.

Each concept is comprised of features with distinct health intents. Features are either preconditions or optimizations.

Universal Preconditions

Preconditions define the fundamental components of a WELL space and serve as the foundation of a healthy building. WELL v2 offers a universal set of preconditions for all projects.

All preconditions are mandatory for certification. All parts in preconditions are mandatory.

Flexible Optimizations

Optimizations are optional pathways for projects to demonstrate achievement in WELL.

Project teams choose the optimizations they want to pursue. Further, projects may choose which parts to pursue within optimizations up to the point maximum established for the optimization.

Meaningful Weightings

WELL v2 operates on a points-based system, with a total of 110 points available to each project. All optimizations have maximum point-values. The point-value of a feature is determined by its potential for impact. This is defined as the extent to which a feature addresses a specific health and wellness concern or opportunity for health promotion, and the potential impact of effective intervention.

All parts in optimizations hold a point-value equal to or less than the optimization maximum. Projects may pursue parts under the optimization to accrue points up to the maximum point-value established for the optimization. If an optimization contains more parts and points than the maximum, these parts are to provide more options, but projects may still not receive credit for more than the maximum point-value established for the optimization.

Note: for some optimizations, achieving points in one part is contingent upon achieving points for another part.

Accommodating All Space Types

All parts of WELL v2 are designated for specific space types. Space types in WELL refer to spaces *within* a project. These space types do not refer to the project as a whole.

Many parts in WELL are denoted for “all spaces”, which indicates that the part must be applied to all spaces within the project, for all project types. Some features list distinct parts for specific space types; depending on the part, these additional requirements may be required on top of the requirements for all spaces or used in place of the requirements listed for all other spaces.

Scoring and Certification Levels

Projects must achieve all preconditions as well as a certain number of points to earn different levels of certification:

- WELL Silver Certification: 50 points.
- WELL Gold Certification: 60 points.
- WELL Platinum Certification: 80 points.

Projects must earn a minimum of two points per concept. Projects may earn no more than 12 points per concept.

Projects can earn an additional ten points for Innovation.

WELL Core

WELL Core Certification is a distinct pathway of achievement for core and shell buildings seeking to implement fundamental features in the base building for the benefit of tenants. All building types can pursue WELL Core certification provided that the owner occupies 25% or less of the gross floor area of the project, with the remainder of the space occupied by tenants.

Scope

At least 2.5% of the total building floor area must be available for performance testing. The available testing area must

include all common areas and spaces directly under the control of the building management team. If common areas and spaces under owner control comprise less than 2.5% of total building floor area, the project must supplement with tenant spaces.

Some performance-based optimizations explicitly state that they require testing in tenant spaces in order to be awarded.

Applicability

WELL Core requires, at minimum, achievement of certain features directed at common areas and spaces under owner control. Some features must be achieved for the entire building in order for the WELL Core project to receive credit.

WELL Core projects may earn additional points for achieving those same features for tenants, whether by directly offering benefits to tenants or sizing for tenant capacity. Further guidance on applicability and additional point-earning potential for WELL Core is provided online.

Certification Levels

WELL Core projects must achieve all preconditions as well as a certain number of points to earn different levels of certification:

- WELL Core Certification: 40 points.
- WELL Core Silver Certification: 50 points.
- WELL Core Gold Certification: 60 points.
- WELL Core Platinum Certification: 80 points.

For WELL Core Certification, projects must earn a minimum of one point per concept. Projects may earn no more than 12 points per concept.

This WELL Building Standard version 2 pilot ("WELL v2") constitutes proprietary information of the International WELL Building Institute pbc (IWBI). All information contained herein is provided without warranties of any kind, either express or implied, including but not limited to warranties of the accuracy or completeness of the information or the suitability of the information for any particular purpose. Use of this document in any form implies acceptance of these conditions.

IWBI authorizes individual use of WELL v2. In exchange for this authorization, the user agrees:

1. to retain all copyright and other proprietary notices contained in WELL v2,
2. not to sell or modify WELL v2, and
3. not to reproduce, display or distribute WELL v2 in any way for any public or commercial purpose.

Unauthorized use of WELL v2 violates copyright, trademark and other laws and is prohibited. International WELL Building Institute™, IWBI™, WELL™, the WELL Building Standard™, the WELL Community Standard™, WELL Certified™ and others and their related logos are trademarks of the International WELL Building Institute pbc in the US and other countries. All third-party trademarks and Standards referenced herein such as GREEN STAR™, BREEAM™, LEED™ and others are trademarks and/or Standards of their respective owners.

Disclaimer

None of the parties involved in the funding or creation of WELL v2, including IWBI, or its affiliates, members, employees, or contractors, assume any liability or responsibility to the user or any third parties for the accuracy, completeness, or use of or reliance on any information contained in WELL v2, or for any injuries, losses, or damages (including, without limitation, equitable relief) arising from such use or reliance. Although the information contained in WELL v2 is believed to be reliable and accurate, all materials set forth within are provided without warranties of any kind, either express or implied, including but not limited to warranties of the accuracy or completeness of information or the suitability of the information for any particular purpose. This document and WELL v2 are intended to educate and assist building stakeholders, real estate owners and tenants in their efforts to create healthier spaces and communities, and nothing in this document or in WELL v2 should be considered, or used as a substitute for, quality control, safety analysis, legal compliance (including zoning), comprehensive urban planning, medical advice, diagnosis or treatment.

As a condition of use, the user covenants not to sue and agrees to waive and release IWBI, its affiliates, members, employees, or contractors from any and all claims, demands, and causes of action for any injuries, losses or damages (including, without limitation, equitable relief) that the user may now or hereafter have a right to assert against such parties as a result of the use of, or reliance on WELL v2.

About the WELL Building Standard (WELL™)

Launched in October 2014 after six years of research and development, WELL is the premier Standard for buildings, interior spaces and communities seeking to implement, validate and measure interventions that support and advance human health and wellness.

WELL was developed by integrating scientific and medical research and literature on environmental health, behavioral factors, health outcomes and demographic risk factors that affect human health with leading practices in design, operations and management. WELL also references existing standards and best practice guidelines set by governmental and professional organizations.

About the International WELL Building Institute™ (IWBI™)

The International WELL Building Institute (IWBI) is leading the global movement to transform our buildings and communities in ways that help people thrive. IWBI delivers the cutting-edge WELL Building Standard, the first Standard to be focused exclusively on the ways that buildings, and everything in them, can improve our comfort, drive better choices, and generally enhance, not compromise, our health and wellness.

IWBI's work extends to advancing health through design for entire neighborhoods through the WELL Community Standard, and convening and mobilizing the wellness community through management of the WELL AP credential.

WELL Certification and the WELL AP credentialing program are third-party administered through IWBI's collaboration with Green Business Certification Inc. (GBCI), which also administers LEED certification, the global green building program, and the LEED professional credentialing program.

Alignment with Green Building Standards

Human health is inextricable from planetary health. WELL is designed to work harmoniously with leading green building Standards. Projects are encouraged and incentivized to pursue dual certifications under WELL and green building Standards.

AIR

The WELL Air concept aims to ensure high levels of indoor air quality across a building's lifetime through diverse strategies that include source elimination or reduction, active and passive building design and operation strategies and human behavior interventions.

People spend approximately 90% of their time in enclosed spaces^[1] – in homes, offices, schools or other building environments. During this time, inhalation exposure to indoor air pollutants can lead to a variety of poor health and well-being outcomes. Humans breathe more than 15,000 liters (530 ft³) of air every single day,^[2] consuming approximately four times more air than food and liquid together. Health effects associated with exposure to indoor air pollutants can be short- and long-term and can range in severity. Less severe symptoms of exposure can include headaches, dry throat, eye irritation or runny nose, while more severe outcomes can include asthma attacks, infection with *Legionella* bacteria, carbon monoxide poisoning and cancer.^[3,4] Exposure to air pollutants has also been shown to increase the risk of respiratory and cardiovascular diseases, myocardial ischemia, angina, high blood pressure and heart disease.^[5] In the most recent global burden of disease study, household air pollution was rated as the third most important cause of ill health for the world's population.^[6]

The most common indoor air contaminants are combustion sources, such as candles, tobacco products, stoves, furnaces and fireplaces, that release pollutants such as carbon monoxide, nitrogen dioxide and small particles into the air.^[7] Additionally, building materials, furnishings, fabrics, cleaning products, personal care products and air fresheners can all emit volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs) into the indoor environment.^[8] Outdoor air pollution can also influence indoor exposure when pollutants diffuse indoors through building envelope openings, so there is a need to simultaneously address outdoor air quality.

Achieving the goal of clean indoor air requires both professionals and building users to engage not just in the conversation but also in the implementation of adequate approaches. Although indoor air quality can be properly managed primarily through eliminating individual sources of air pollution and through adequate design solutions and human behavior modification, some WELL features require installation of a specific treatment method or technology. Regular maintenance of selected air treatment systems is critical to ensure their optimal operation and expand their "life expectancy".

It is evident that the impact of improving indoor air quality is substantial. The World Health Organization estimated that, globally, air pollution contributed to approximately seven million premature deaths in 2012.^[9] Around 600,000 of those were children under 5 years old.^[10] There is also emerging evidence that air pollution can disrupt human physical and cognitive development.^[11]

WELL seeks to implement holistic design strategies to promote clean air and minimize human exposure to harmful contaminants in order to maximize benefits to productivity, well-being and health.

A01 FUNDAMENTAL AIR QUALITY | P

Intent: Ensure a basic level of indoor air quality that contributes to the health and well-being of building users.

Summary: This WELL feature requires projects to provide acceptable air quality levels as determined by public health authorities.

Issue: Inhalation exposure to indoor air pollutants can lead to a variety of poor health and well-being outcomes. Health effects associated with exposure to indoor air pollutants can be short- and long-term and can range in severity. Pollutants such as Volatile Organic Compounds (VOCs), carbon monoxide, and ozone can cause symptoms, ranging from headaches, dry throat, eye irritation and runny nose to asthma attacks, poisoning and cancer.^[3,4] Exposure to air pollutants such as ozone, particulate matter, carbon monoxide and others has been shown to increase the risk of respiratory and cardiovascular diseases including asthma, myocardial ischemia, angina, high blood pressure and heart disease.^[5] It is therefore important to define indoor air quality levels that minimize risk to human health.

Solutions: The World Health Organization (WHO) and other regulatory bodies such as the U.S. Environmental Protection Agency (EPA) identify a list of “criteria” air pollutants. These pollutants include ozone, particulate matter, carbon monoxide, nitrogen oxides, lead and sulfur dioxide.^[12] The WHO and EPA have established permissible levels for such criteria pollutants based on epidemiological studies that show the relationships between concentrations of these pollutants, duration of exposure and health risks. Achieving the goal of clean indoor air as defined by permissible levels requires the joined efforts of both professionals and building users in the implementation of adequate approaches. Indoor air quality can be properly managed through different features listed in the WELL Air concept, including source control strategies, passive and active building design and operation strategies and human behavior interventions.

Impact: The quality of the air people breathe indoors directly impacts their health and well-being and constitutes one of the most important aspects of healthy buildings.

Part 1 Meet Thresholds for Particulate Matter

For All Spaces except Commercial Kitchen Spaces:

The following thresholds are met:

- a. PM_{2.5} less than 15 µg/m³.^[12]
- b. PM₁₀ less than 50 µg/m³.^[13]

OR-----

Note: Projects pursuing this strategy are limited in WELL Certification level to Gold regardless of total points achieved.

The following thresholds are met for a project located where the annual average ambient PM_{2.5} level is 35 µg/m³ or higher.

- a. PM_{2.5} less than 25 µg/m³.^[14]
- b. PM₁₀ less than 50 µg/m³.^[14]

OR-----

Note: Projects pursuing this strategy are limited in WELL Certification level to Silver regardless of total points achieved.

The following thresholds are met for a project located where the annual average ambient PM_{2.5} level is 35 µg/m³ or higher.

- a. PM_{2.5} equal to 30% of the 24- or 48-hour average of outdoor levels on the day(s) of performance testing.
- b. PM₁₀ equal to 30% of the 24- or 48-hour average of outdoor levels on the day(s) of performance testing.

For Commercial Kitchen Spaces:

The following threshold is met:

- a. PM_{2.5} less than 35 µg/m³.^[12]

OR-----

Note: Projects pursuing this strategy are limited in WELL Certification level to Silver regardless of total points achieved.

The following thresholds are met for a project located where the annual average ambient PM_{2.5} level is 35 µg/m³ or higher.

- a. PM_{2.5} equal to 30% of the 24- or 48-hour average of outdoor levels on the day(s) of performance testing.
b. PM₁₀ equal to 30% of the 24- or 48-hour average of outdoor levels on the day(s) of performance testing.

Part 2 Meet Thresholds for Organic Gases

For All Spaces except Commercial Kitchen Spaces:

The following thresholds are met:

- a. Formaldehyde less than 27 ppb.^[15]
b. Individual component VOCs less than or equal to the limits listed in the table below:^[16]

Compound Name	CAS No.	Allowable Concentration (µg/m ³)
Benzene	71-43-2	30
Carbon disulfide	75-15-0	400
Carbon tetrachloride	56-23-5	20
Chlorobenzene	108-90-7	500
Chloroform	67-66-3	150
Dichlorobenzene (1,4-)	106-46-7	400
Dichloroethylene (1,1)	75-35-4	35
Ethylbenzene	100-41-4	1000
Hexane (n-)	110-54-3	3500
Isopropyl alcohol	67-63-0	3500
Methyl chloroform	71-55-6	500
Methylene chloride	75-09-2	200
Methyl tert-butyl ether	1634-04-4	4000
Styrene	100-42-5	450
Tetrachloroethene	127-18-4	17.5
Toluene	108-88-3	150
Trichloroethylene	79-01-6	300
Vinyl acetate	108-05-4	100

Xylene (m, o, p combined)	108-38-3 + 95-47-6 + 106-42-3, 179601-23-1 + 95-47-6, or 1330-20-7	350
---------------------------	--	-----

For Commercial Kitchen Spaces:

The following threshold is met:

- a. Formaldehyde less than 81 ppb.^[17]

Part 3 Meet Thresholds for Inorganic Gases

For All Spaces except Commercial Kitchen Spaces:

The following thresholds are met:

- a. Carbon monoxide less than 9 ppm.^[12]
- b. Ozone less than 51 ppb.^[14]

For Commercial Kitchen Spaces:

The following thresholds are met:

- a. Carbon monoxide levels less than 30 ppm.^[19]

Part 4 Meet Radon Threshold

For All Spaces:

If project has a regularly occupied space at or below grade, one of the following requirements is met:

- a. The radon level is less than 0.15 Bq/L [4 pCi/L], as tested by a professional demonstrated not to have a conflict of interest. One test is conducted per 2,300 m² [25,000 ft²] of regularly occupied space at or below grade.
- b. All regularly occupied spaces at or below grade meet the 'Mechanically ventilated spaces' option of Part 1: Ensure Adequate Ventilation in Feature A03: Ventilation Effectiveness.

Part 5 Monitor Fundamental Air Parameters

For All Spaces:

The following requirements are met:

- a. The pollutants listed in this feature, except radon, are monitored in regularly occupied spaces at intervals no longer than once per year, and results are annually submitted through WELL Online.
- b. The number and location of sampling points for on-going monitoring complies with the requirements outlined in the Performance Verification Guidebook.

Note: Projects are not required to use devices that comply with the requirements described in the Performance Verification Guidebook. Projects may monitor total VOCs instead of the individual VOCs listed in Part 2: Meet Standards for Organic Gases. However, if measurements are undertaken by a performance testing agent in compliance with the Performance Verification Guidebook, results from each year may be aggregated together and utilized for recertification purposes.

A02 SMOKE-FREE ENVIRONMENT | P

Intent: Deter smoking, minimize occupant exposure to secondhand smoke and reduce smoke pollution.

Summary: This WELL feature requires projects to ban indoor smoking and ban or restrict outdoor smoking within its boundaries.

Issue: Exposure to tobacco smoke persists as an important cause of ill health for both smokers and those exposed to secondhand smoke. The average life expectancy of a smoker is 10 years less than that of a nonsmoker.^[20] In addition to nicotine, cigarettes contain about 600 ingredients that form over 7,000 compounds when burned, of which at least 69 are known to be carcinogenic.^[21] Secondhand smoke exposes nonsmokers to the same contaminants, increasing the number of people subject to health risks from smoking. Examples of health issues include asthma attacks, respiratory infections, coronary heart disease, stroke, lung cancer and sudden infant death syndrome.^[22] There are also strong links between exposure to cigarette smoke and impaired cognitive development, including where pregnant mothers are exposed to either primary or secondary cigarette smoke.^[23,24] In addition, emerging evidence suggests that there are serious health consequences associated with exposure to thirdhand tobacco smoke,^[25] secondhand marijuana smoke and emissions from e-cigarettes.^[26,27] The thirdhand smoke (residual chemicals left on indoor surfaces by tobacco smoke) clings to walls, furniture, clothes, bedding, carpets and other surfaces long after smoking has occurred. Globally, 93% of the population lives in countries not protected by 100% smoke-free regulations.^[29]

Solutions: The only way to protect people from secondhand and thirdhand smoke is to implement a 100% smoke-free environment. Smoke-free environments reduce instances of childhood asthma and other associated diseases later in life.^[28] In order to prevent intrusion of cigarette smoke from the outdoors, projects must also take steps to ensure that smoking is not allowed in the vicinity of building entrances, operable windows and building air intakes.

Impact: Smoke-free environments are a fundamental step toward achieving high quality indoor air quality.

Part 1 Prohibit Indoor Smoking

For All Spaces:

The following requirement is met:

- a. Smoking and the use of e-cigarettes is prohibited in interior spaces within the project boundary.^[30]

Part 2 Prohibit Outdoor Smoking

For All Spaces:

The following requirements are met:

- a. Smoking is prohibited within 7.5 m [25 ft] (or the maximum extent allowable by local codes) of all entrances, operable windows and building air intakes.^[15] Signage is present to clearly communicate the ban.
- b. Smoking is prohibited on all decks, patios, balconies, rooftops and outdoor galleries. Signage is present to clearly communicate the ban.
- c. In outdoor areas within the project boundary that allow smoking (if any), signs are placed along walkways (not more than 30 m [100 ft] between signs) that describe the hazards of smoking.^[31]

Note:

Projects should consider primary language(s) spoken by the local population when creating signage.

A03 VENTILATION EFFECTIVENESS | P

Intent: Prevent indoor air quality issues through the provision of adequate ventilation.

Summary: This WELL feature requires projects to bring in fresh air from the outside through mechanical and/or natural means in order to dilute human- and product-generated air pollutants.

Issue: Poorly ventilated spaces contribute to symptoms — such as headache, fatigue, dizziness, nausea, cough, sneezing, shortness of breath and eye, nose, throat and skin irritation — collectively called sick building syndrome (SBS).^[32,33] The economic costs of SBS in under-ventilated buildings are significant and far exceed the energy-related cost savings.^[34,35] Poor ventilation is also linked to increased rates of absences, higher operational costs and decreased productivity.^[36,37] One U.S.-based study reported that the sick leave attributable to insufficient provision of fresh air in buildings is estimated to be 35% of total absenteeism.^[38]

Solutions: Many indoor and outdoor sources of air pollution emit particulate matter and volatile organic compounds (VOCs) that can cause discomfort and trigger asthma and eye, nose and throat irritation. In order to maintain healthy indoor environments for building users, it is necessary to provide sufficient ventilation required to maintain acceptable air quality. In addition to proper HVAC system design, mechanically ventilated projects need to perform regular system maintenance as inadequate maintenance is associated with reduced ventilation performance and poorer indoor air quality and thermal conditions.^[39] For naturally ventilated spaces, it is necessary to ensure that adequate outdoor air quality and noise levels are met.

Impact: Proper design and operation of a ventilation system is essential for supporting indoor air quality and plays a fundamental role in creating healthy buildings.

Part 1 Ensure Adequate Ventilation

For All Spaces except Dwelling Units:

Mechanically ventilated spaces

Projects utilizing mechanical ventilation comply with ventilation supply and exhaust rates set in one of the following:

- a. ASHRAE 62.1-2010 or any more recent versions (Ventilation Rate Procedure or IAQ Procedure).^[40]
- b. CEN Standards EN 15251:2007 and EN 13779:2007 or any more recent versions. The requirements of CEN Standard EN 15251:2007 must be met as well as the performance requirements of CEN Standard EN 13779:2007 related to ventilation and room conditioning systems (excluding sections 7.3, 7.6, A.16 and A.17). Note that projects must meet Category I or II as described in the standards.^[42,43]
- c. AS 1668.2-2012 or any more recent version. Note that projects that wish to comply with AS 1668.2 must assume a minimum density of 16 m² [170 ft²] per person.^[44]
- d. CIBSE Guide A: Environmental Design, version 2007 or any more recent version.^[45]

OR-----

Naturally ventilated spaces

Projects using natural ventilation only (no mechanical ventilation) meet the following requirements:

- a. Outdoor PM_{2.5}, PM₁₀, carbon monoxide and ozone levels within 4 km [2.5 mi] of the building are compliant with the levels specified in Feature A01: Air Quality Standards for at least 95% of all hours in the previous year.
- b. One of the following design criteria:
 1. Natural Ventilation Procedure in ASHRAE 62.1-2010 or any more recent version (as appropriate for number of floors above grade).^[40]
 2. CIBSE AM10: Natural Ventilation in Non-Domestic Buildings (2005 or any more recent version) section 2.4 – Natural ventilation strategies and chapter 4 – Design Calculations.^[46]

OR-----

Naturally ventilated spaces

Note: Projects pursuing this strategy are limited in WELL Certification level to Gold regardless of total points achieved.

Projects using natural ventilation only (no mechanical ventilation) meet the following requirements:

- a. Outdoor air meets the following thresholds for at least 95% of all hours in the previous year:
 1. $PM_{2.5}$ less than $25 \mu g/m^3$.^[14]
 2. PM_{10} less than $50 \mu g/m^3$.^[14]
- b. One of the following design criteria:
 1. Natural Ventilation Procedure in ASHRAE 62.1-2010 or any more recent version (as appropriate for number of floors above grade).^[40]
 2. CIBSE AM10: Natural Ventilation in Non-Domestic Buildings (2005 or any more recent version) section 2.4 – Natural ventilation strategies and chapter 4 – Design Calculations.^[46]

OR-----

Naturally ventilated spaces

Note: Projects pursuing this strategy are limited in WELL Certification level to Silver regardless of total points achieved.

Projects using natural ventilation only (no mechanical ventilation) meet the following requirements:

- a. Outdoor air meets the following thresholds for at least 95% of all hours in the previous year:
 1. $PM_{2.5}$ less than $35 \mu g/m^3$.^[14]
 2. PM_{10} less than $70 \mu g/m^3$.^[14]
- b. One of the following design criteria:
 1. Natural Ventilation Procedure in ASHRAE 62.1-2010 or any more recent version (as appropriate for number of floors above grade).^[40]
 2. CIBSE AM10: Natural Ventilation in Non-Domestic Buildings (2005 or any more recent version) section 2.4 – Natural ventilation strategies and chapter 4 – Design Calculations.^[46]

OR-----

Mixed-mode ventilated spaces

Projects using mixed-mode ventilation meet one of the following requirements:

- a. Project complies with the requirements set for naturally ventilated spaces when mechanical system is not in use and the requirements for mechanical ventilation when the mechanical system is in use. Mechanical ventilation must be operated when outdoor air quality conditions are above the limits in Feature A01: Fundamental Air Quality.
- b. Operate with mechanical ventilation CIBSE AM13: Mixed Mode Ventilation, version 2000 or any more recent version.^[47]

For Dwelling Units:

Mechanically ventilated spaces

Projects utilizing mechanical ventilation comply with ventilation supply and exhaust rates set in one of the following:

- a. ASHRAE 62.2-2016 (continuous or intermittent ventilation system requirements) or any more recent version.^[41]
- b. CEN Standards EN 15251:2007 or any more recent version. Note that projects must meet Category I or II as described in the standards.^[42]
- c. AS 1668.2-2012 or any more recent version.^[44]
- d. CIBSE Guide A: Environmental Design, version 2007 or any more recent version.^[45]

OR-----

Naturally ventilated spaces

Projects using natural ventilation only (no mechanical ventilation) meet the following requirements:

- a. Outdoor PM_{2.5}, PM₁₀, carbon monoxide, ozone and nitrogen dioxide levels within 4 km [2.5 mi] of the building are compliant with the thresholds specified in Feature A01: Air Quality Standards for at least 95% of all hours in the previous year.
- b. One of the following design criteria:
 1. Natural Ventilation Procedure in ASHRAE 62.1-2010 or any more recent version.^[40]
 2. CEN Standards EN 15251:2007 or any more recent version. Note that projects must meet Category I or II as described in the standards.^[42]
 3. CIBSE Guide A: Environmental Design, version 2007 or any more recent version.^[45]

OR-----

Naturally ventilated spaces

Projects using natural ventilation only (no mechanical ventilation) meet the following requirements:

- a. Outdoor air meets the following thresholds for at least 95% of all hours in the previous year:
 1. PM_{2.5} less than 25 µg/m³.^[14]
 2. PM₁₀ less than 50 µg/m³.^[14]
- b. One of the following design criteria:
 1. Natural Ventilation Procedure in ASHRAE 62.1-2010 or any more recent version.^[40]
 2. CEN Standards EN 15251:2007 or any more recent version. Note that projects must meet Category I or II as described in the standards.^[42]
 3. CIBSE Guide A: Environmental Design, version 2007 or any more recent version.^[45]

OR-----

Naturally ventilated spaces

Note: Projects pursuing this strategy are limited in WELL Certification level to Silver regardless of total points achieved.

Projects using natural ventilation only (no mechanical ventilation) meet the following requirements:

- a. Outdoor air meets the following thresholds for at least 95% of all hours in the previous year:
 1. PM_{2.5} less than 35 µg/m³.^[14]
 2. PM₁₀ less than 70 µg/m³.^[14]
- b. One of the following design criteria:
 1. Natural Ventilation Procedure in ASHRAE 62.1-2010 or any more recent version.^[40]
 2. CEN Standards EN 15251:2007 or any more recent version. Note that projects must meet Category I or II as described in the standards.^[42]
 3. CIBSE Guide A: Environmental Design, version 2007 or any more recent version.^[45]

Part 2 Conduct System Balancing

For All Spaces:

Mechanically ventilated spaces

To verify compliance with the ventilation rate requirements specified in Part 1: Ensure Adequate Ventilation, the following requirements are met (as applicable):

- a. Newly installed mechanical ventilation system or ventilation system that undergoes significant alterations is tested and balanced in accordance with ASHRAE 111.^[48]
- b. Existing mechanical ventilation system is tested and balanced every five years to verify that the minimum ventilation rates (as determined in Part 1: Ensure Adequate Ventilation) are within $\pm 10\%$ of the minimum design values.

- c. Projects using the elevated air speed method for thermal comfort verify that air speed complies with design specifications.

Note:

Reasons for adjustment or modification of the mechanical ventilation system that result in a requirement for system rebalancing include significant building alterations, significant changes in occupant density, changes in building use or occupancy category or other changes inconsistent with system design assumptions.^[40]

A04 CONSTRUCTION POLLUTION MANAGEMENT | P

Intent: Minimize the introduction of construction-related pollutants into indoor air, remediate construction-related indoor air contamination for human health and protect building products from degradation.

Summary: This WELL feature requires projects to protect indoor air quality during building construction and renovation through a combination of strategies such as envelope protection, moisture and dust management, filter replacement, air flush and proper equipment selection.

Issue: Air pollution originating from construction and demolition works can impact the health and quality of life of people working and residing nearby and is associated with increased mortality owing to chronic obstructive pulmonary disease.^[97] Increased emissions of PM₁₀ in the vicinity of construction sites are positively correlated with people's suffering from respiratory diseases.^[98] Building construction and renovations are mostly a source of coarse particulate matter, but they are also a source of airborne ultrafine particles.^[99]

Solutions: The indoor air quality levels can be compromised during building construction.^[100] Care should be taken during construction to prevent dust intrusion and/or to clear the space of dust, chemical vapors and other debris to avoid significant aggravation of indoor air quality. Air duct protection, moisture and dust management, filter replacement and proper equipment selection are strategies that improve indoor air quality by limiting the exposure to an intense contamination period.^[101] In addition, an air flush or building flush is a technique that can be used whereby air is forced through a building after construction and prior to occupancy in order to remove or reduce pollutants such as volatile organic compounds and particulate matter that were inadvertently introduced indoors during construction.

Impact: Minimizing the introduction of construction-related pollutants into indoor air improves indoor air quality, which is ultimately beneficial for human health and well-being.

Part 1 Mitigate Construction Pollution

For All Spaces:

For construction occurring after project registration, at least three of the following requirements are met:

- a. Projects meet one of the below:
 1. Ducts are sealed and protected from possible contamination during construction.^[15]
 2. Ducts are cleaned prior to installing registers, grills and diffusers.
- b. If permanently installed ventilation system is operating during construction, projects meet the below:
 1. Media filters with a minimum efficiency reporting value (MERV) of 8 are used to filter outdoor air.^[102]
 2. All filters are replaced prior to occupancy.^[15]
- c. The below moisture and dust management procedures are followed:
 1. Carpets, acoustical ceiling panels, fabric wall coverings, insulation, upholstery and furnishings and other absorptive materials are stored in a separate designated area protected from moisture damage.^[15]
 2. All active areas of work are isolated from other spaces by sealed doorways or windows or through the use of temporary barriers.^[15]
 3. Walk-off mats are used at entryways to reduce the transfer of dirt and pollutants.^[15]
 4. Saws and other tools use dust guards or collectors to capture generated dust.^[15]
- d. To reduce particulate matter emissions from both on-road and non-road diesel fueled vehicles (excluding delivery vehicles) and construction equipment, the below are met:
 1. All non-road diesel engine vehicles comply with the U.S. EPA Tier 4 PM emissions standards or local equivalent when applicable. Engines may be retrofitted with verified technology (required to be U.S. EPA or California Air Resources Board approved) at the time the equipment is first placed on the job site.^[103]
 2. All on-road diesel engine vehicles meet the requirements set forth in the U.S. EPA model year 2007 on-road standards for PM or local equivalent when applicable. Engines may be retrofitted with verified technology (required to be U.S. EPA or California Air Resources Board approved) at the time the equipment is first placed on the job site.^[103]

3. All equipment, vehicles and loading/unloading zones are located at least 7.5 m [25 ft] away from air intakes and operable openings of adjacent buildings when possible.^[103]
- e. Upon completion of construction (including installation of woodwork, doors, acoustic tiles, paints, carpets, movable furnishings and other interior finishes), a building air flush is performed while maintaining an indoor temperature of at least 15 °C [59 °F] and relative humidity below 60%, at one of the below volumes:
 1. A total air volume of 4,300 m³ of outdoor air per m² of floor area [14,000 ft³ per ft² of floor area] prior to occupancy.^[15]
 2. A total air volume of 1,100 m³ of outdoor air per m² of floor area [3,500 ft³ per ft² of floor area] prior to occupancy, followed by a second flush of 3,200 m³ of outdoor air per m² of floor area [10,500 ft³ per ft² of floor area] post-occupancy. While the post-occupancy flush is taking place, the ventilation system must provide at least 0.1 m³ per minute of outdoor air per m² of floor area [0.3 CFM outdoor air per ft² of floor area] at all times.^[15]

A05 ENHANCED AIR QUALITY | O (MAX: 4 PT)

Intent: Encourage and recognize buildings with enhanced levels of indoor air quality that promote the health and well-being of people.

Summary: This WELL feature requires projects to go above current guidelines to provide enhanced air quality levels that have been linked to improved human health and performance.^[49,50]

Issue: Studies have shown that air pollution contributes to the large global burden of respiratory and allergic diseases, which include asthma, chronic obstructive pulmonary disease, pneumonia and possibly tuberculosis.^[51] There is an emerging body of evidence that air pollution can disrupt physical and cognitive development in children.^[11] Researchers have also identified a clear relationship between indoor air quality and human productivity in buildings.^[52] On average, 10% of productivity loss could be attributable to health issues related to poor indoor air quality in office buildings.^[53]

Solutions: Enhanced air quality is positively correlated with improved health, cognitive and physical development, higher incomes and better economic performance.^[49,50] For example, the premature mortality rate could be reduced by up to 15% if PM₁₀ is reduced from 70 to 20 µg/m³.^[54] Indoor air quality can be properly managed primarily through source control strategies, passive and active building design and operation strategies and human behavior intervention. High levels of indoor air quality require both professionals and building users to collaborate in the implementation of adequate approaches.

Impact: Provision of enhanced air quality indoors positively impacts human health, well-being and performance and constitutes one of the most important factors of healthy buildings.

Part 1 Meet Enhanced Thresholds for Particulate Matter (Max: 2 Pt)

For All Spaces:

The following requirement is met:

- a. Projects comply with the thresholds specified in the table below:

Particulate Matter Thresholds	Points
PM _{2.5} < 12 µg/m ³ . ^[12] PM ₁₀ < 30 µg/m ³ . ^[14]	1
PM _{2.5} < 10 µg/m ³ . ^[14] PM ₁₀ < 20 µg/m ³ . ^[14]	2

Part 2 Meet Enhanced Thresholds for Organic Gases (Max: 1 Pt)

For All Spaces:

The following thresholds are met:

- a. Formaldehyde less than 13.4 ppb.^[16]
- b. Benzene less than 3 µg/m³.^[55]

Part 3 Meet Enhanced Thresholds for Inorganic Gases (Max: 1 Pt)

For All Spaces:

The following thresholds are met:

- a. Carbon monoxide less than 6 ppm.^[17]
- b. Ozone less than 25 ppb.^[56]
- c. Nitrogen dioxide less than 21 ppb.^[58]

A06 ENHANCED VENTILATION | O (MAX: 3 PT)

Intent: Expel internally generated pollutants and improve air quality in the breathing zone through an increased supply of outdoor air or increased ventilation efficiency.

Summary: This WELL feature requires implementation of advanced ventilation strategies that can secure higher air quality levels and thus benefit human health and productivity.

Issue: The majority of ventilation standards specify ventilation rates and other measures intended to provide indoor air quality that is merely “acceptable” to building users and that reduces the risk of adverse health effects.^[60] Even with proper ventilation designed to meet ventilation standards, the concentration of indoor pollutants can exceed concentrations found in outdoor air.^[61,62] Ventilation rates less than 10 L/s [21 CFM] per person in all building types are associated with negative perception of air quality and actual health outcomes.^[63]

Solutions: Unusually high building occupancy, a high risk of accidents that might degrade air quality or limited space capacity to install filtration make exceeding standard ventilation requirements a worthwhile strategy. Scientific research suggests that an airflow rate significantly exceeding that recommended by standards is needed to minimize sick building syndrome symptoms and to improve human performance and productivity.^[64,65] Because it is difficult to test for every potential pollutant, and because carbon dioxide (CO₂) is easy to detect, CO₂ levels serve as a proxy for other indoor pollutants. A number of CO₂ studies suggest that the risk of sick building syndrome symptoms decreases significantly when CO₂ concentrations are less than 800 ppm.^[63] One method for decreasing CO₂ concentration is implementation of CO₂ demand-controlled ventilation, which is displacement ventilation that can enhance air change effectiveness by strategically designing the height of air ventilation.

Impact: Ventilation systems designed primarily for human health are essential to good indoor air quality and play a fundamental role in creating healthy buildings.

Part 1 Increase Outdoor Air Supply (Max: 3 Pt)

For All Spaces:

Mechanically ventilated spaces

The following requirement is met:

- Projects exceed outdoor air supply rates described in ASHRAE 62.1-2010 by the percentages shown in the table below:^[65]

Thresholds	Points
30%	1
60%	2

OR-----

Naturally ventilated spaces

The following requirements are met:

- Projects meet Part 1: Provide Operable Windows in Feature A07: Operable Windows.
- Projects demonstrate that natural ventilation is sufficient to keep CO₂ levels less than the thresholds specified in the table below (measured at 1.2-1.8 m [4-6 ft] above the floor) at maximum intended occupancies in all regularly occupied spaces:^[63,66,67]

Thresholds	Points
900 ppm	1
750 ppm	2
600 ppm	3

Part 2 Implement Demand-Controlled Ventilation (Max: 3 Pt)

For All Spaces:

All regularly occupied spaces meet the following requirements:

- a. A demand-controlled ventilation system regulates the outdoor ventilation rate to keep CO₂ levels at maximum intended occupancy less than the thresholds specified in the table below.^[63,66,67]

Thresholds	Points
900 ppm	1
750 ppm	2
600 ppm	3

- b. Carbon dioxide is measured at the air exhaust diffusers or in occupied space at 1.1-1.7 m [3.6-5.6 ft] above the floor (away from doors, windows, air supply and zones where occupants may exhale directly into the sensor). At least one sensor is used for each major occupancy zone (or per air handling unit if a single zone is served by multiple air handling units). If occupancy density/pattern/usage is different in two adjacent areas, each area must be considered a separate zone.

Part 3 Implement Displacement Ventilation (Max: 1 Pt)

For All Spaces:

Projects implement a displacement ventilation system for heating and/or cooling, with one of the following as a basis for design:

- a. ASHRAE Guidelines RP-949.^[69]
- b. REHVA Guidebook No. 01 (Displacement Ventilation in non-industrial premises).^[70]
- c. ASHRAE's UFAD Guide: Design, Construction and Operations of Underfloor Air Distribution Systems.^[71] Air supply temperature is slightly cooler or warmer than the desired space temperature. Air distribution system is installed at a raised floor height whereby the underfloor area can be cleaned on an annual basis.

Part 4 Implement Advanced Air Distribution (Max: 3 Pt)

For All Spaces except Commercial Kitchen Spaces:

At all workstations, the following requirements are met:

- a. Conditioned air is supplied via an individual diffuser that is positioned no further than 0.8 m [2.6 ft] from an occupant's head.^[72,73]
- b. Occupants are given control over the direction of the supplied airflow and supply air speed (within 0.0-1.2 m/s [0.0-3.9 ft/s] in the head region).^[74]
- c. Supplied air uses one of the strategies specified in the table below:

Requirement	Points
Background mechanical system is used for ventilation	2
Dedicated outdoor air system is used for ventilation	3

A07 OPERABLE WINDOWS | O (MAX: 2 PT)

Intent: Increase the supply of high-quality outdoor air and promote a connection to the outdoor environment by encouraging building users to open windows when outdoor air quality is acceptable.

Summary: This WELL feature requires buildings with operable windows to increase the supply of high-quality outdoor air and promote a connection to the outdoor environment by encouraging building users to open windows when outdoor air quality is acceptable.

Issue: Inhalation of harmful indoor substances is correlated with adverse health outcomes such as infectious diseases, cancer, asthma, allergies and other respiratory infections.^[4,90]

Solutions: Achieving natural ventilation through open windows can provide a positive human experience^[91] but is a challenge to the ability to maintain strict control over interior air quality. Despite often having conditions of temperature and ventilation below recommended standards, studies have shown that naturally ventilated buildings have fewer people reporting sick building syndrome symptoms than mechanically conditioned buildings.^[92] In addition, studies have shown that there is a 7.7% productivity benefit associated with naturally ventilated spaces.^[93] When weather and local outdoor parameters indicate high-quality outdoor air, people should be encouraged to make use of natural ventilation strategies. Therefore, it is necessary to provide information to building users when outdoor conditions are favorable for window opening. Educating building users is an important step, as human behavior is rated as one of the top three components that affect generation and persistence of indoor air pollutants.^[94]

Impact: When outdoor air quality is favorable, opening windows can provide a supply of outdoor air and lower levels of indoor air contaminants, which is supportive of healthy and environmentally conscious buildings.

Part 1 Provide Operable Windows (Max: 1 Pt)

Note:

Projects where the average outdoor PM_{2.5} level is 35 µg/m³ or higher may only achieve Part 1: Provide Operable Windows in conjunction with Part 2: Manage Window Use. The World Health Organization's Global Urban Ambient Air Pollution Database may be consulted to view outdoor air quality levels, available at http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/

For All Spaces:

The following requirements are met:

- a. Project meets one of the below:
 1. At least 75% of regularly occupied spaces have operable windows that provide access to outdoor air.^[95]
 2. The openable window area is equivalent to at least 4% of the net occupiable floor area of that space or floor plate.^[40]
- b. Project does not use radiant cooling systems if situated in climates with an annual relative humidity above 70%.

Part 2 Manage Window Use (Max: 1 Pt)

Note: Projects may only receive points for this part if Part 1: Provide Operable Windows is also achieved.

For All Spaces:

Outdoor air measurement

The following requirements are met:

- a. Outdoor levels of ozone, PM_{2.5} or PM₁₀, and temperature are monitored at intervals of at least once per hour based on a data-gathering station located within 4 km [2.5 mi] of the building.
- b. Data collected are made available to building occupants.

Window operation

Indicator lights at windows and/or online notifications signal to regular building occupants when outdoor air allows for open windows based on when the following thresholds are met:

- a. Ozone less than 51 ppb.
- b. PM_{2.5} less than 15 µg/m³.
- c. PM₁₀ less than 50 µg/m³.
- d. Dry-bulb temperature within 8 °C [15 °F] of indoor air temperature setpoint.

Part 3 Apply Universal Design to Windows (Max: 1 Pt)

For All Spaces:

All operable windows in regularly occupied spaces comply with the following requirements:

- a. Provide enough space to permit occupants to approach and operate them (from both a standing and seated position).^[96]
- b. Are operable with one hand and with a closed fist and do not require tight grasping, pinching or twisting of the wrist.^[96]
- c. Require less than 22 N [5 lbs] of force to open.^[96]

A08 AIR QUALITY MONITORING AND AWARENESS | O

(MAX: 2 PT)

Intent: Monitor indoor air quality issues as well as inform and educate individuals on the quality of the indoor environment.

Summary: This WELL feature requires the ongoing measurement of contaminant data to educate and and empower occupants about their environmental quality.

Issue: Types and concentrations of indoor pollutants continuously fluctuate in any indoor or outdoor environment. For example, cooking in the home can lead to a rapid spike in indoor air pollution.^[87] Urban rush hours and waste-burning cause spikes in air pollution outdoors, which can directly impact indoor air quality. Some indoor air pollutants can be recognized by their immediate impacts on our body such as throat irritation or watery eyes.^[3,4] Others, which often fly under human olfactory radar, are not necessarily benign. According to the U.S. Environmental Protection Agency, some health impacts like respiratory diseases, heart disease and cancer can show up years after exposure.^[88]

Solutions: Due to air quality fluctuations, it is important to install air quality sensors and detectors in every building. Because air quality can fluctuate throughout the day in every building, real-time monitoring is necessary to promptly fix any deviations in indoor quality metrics and minimize occupant exposure to pollutants. In addition to having robust and calibrated sensors, positioning them correctly plays a crucial role in accurate assessment of air quality. Furthermore, educating occupants about the risks associated with elevated air pollutant exposures, along with actions they can take to reduce these risks can encourage them to seek out opportunities to further curb indoor pollution levels on their own.

Impact: Air quality monitoring and education can help individuals be aware of any deviations in indoor air quality metrics and is an important first step toward better air quality.

Part 1 Implement Indoor Air Monitors (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Monitors measure at least four of the following within a regularly occupied or common space in the building:
 1. PM_{2.5} or PM₁₀ (accuracy 2 µg/m³ or finer).
 2. Carbon dioxide (accuracy 25 ppm or finer).
 3. Carbon monoxide (accuracy 1 ppm or finer).
 4. Ozone (accuracy 5 ppb or finer).
 5. Nitrogen dioxide (accuracy 5 ppb or finer).
 6. Total VOCs (accuracy 10 µg/m³ or finer).
 7. Formaldehyde (accuracy 5 ppb or finer).
- b. Monitors are sited at locations compliant with relevant parameters in the Performance Verification Guidebook. Monitor density is minimum one per floor or one every 325 m² [3,500 ft²], whichever is more stringent.
- c. Measurements are taken at intervals of no longer than 10 minutes for particulate matter and carbon dioxide and no longer than one hour for other pollutants.
- d. Data are analyzed for regularly occupied hours (e.g., median, mean, 75th, 95th percentile) and submitted annually through WELL Online.
- e. Monitors are recalibrated or replaced annually, with documentation attesting to their calibration or replacement submitted annually through WELL Online.

Part 2 Promote Air Quality Awareness (Max: 1 Pt)

Note: Projects may only receive points for this part if Part 1: Implement Indoor Air Monitors is also achieved.

Note: Projects may only receive points for this part if 1 is also achieved.

For All Spaces:

Environmental measures display

Real-time display of air pollutants measured in Part 1: Implement Indoor Air Monitors is made available to occupants through one of the following:

- a. At least one monitor screen is prominently positioned at a height of 1.1–1.7 m [3.6–5.6 ft] per 930 m² [10,000 ft²] of regularly occupied space.^[89]
- b. Required data are hosted on a website or phone application accessible to occupants. At least one visible sign is positioned per 930 m² [10,000 ft²] of regularly occupied space indicating where the data may be accessed.

Air quality education

At least two of the following requirements are met:

- a. A digital or physical library is provided to occupants that includes at least two resources outlining the impact of indoor air quality on human health as part of the resource library required through Feature C01: Health and Wellness Awareness.
- b. A labeling system (e.g., colors or symbols) is clearly displayed next to each monitor screen used for air quality monitoring or at the relevant website. Information about health effects is shown in relation to a range of concentrations of air pollutants monitored in Part 1: Implement Indoor Air Monitors. An explanation of the labeling system is provided.
- c. Paper or digital communication that highlights the importance of indoor air quality for human health, including practical tips for how to improve indoor air quality, is issued at least every quarter.
- d. Educational training led by an air quality expert is held at least once per year and covers aspects of health and wellness covered in the WELL Air concept, including interpretation of data collected and practical tips for how to improve indoor air quality.

Note: Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information. If the requirements of Part 2: Air Quality Education are met through the provision of educational materials then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness. Trainings must include culturally appropriate and literacy level appropriate education. Trainings may be provided on-site, off-site or online; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other qualified practitioners.

A09 POLLUTION INFILTRATION MANAGEMENT | O (MAX: 1 PT)

Intent: Minimize the introduction of pollutants into indoor air through the building envelope and at building entrances.

Summary: This WELL feature requires projects to reduce transmission of air and pollutants from outdoors to indoors through the building envelope and entrance.

Issue: Research shows that approximately 65% of outdoor air particle inhalation occurs while indoors.^[111] Exposure to high levels of coarse and fine particulate matter inadvertently introduced into the space can lead to respiratory irritation and has been associated with increases in lung cancer, cardiovascular disease and mortality.^[112] Indoor air quality and thermal comfort can be compromised by leaks and gaps that break the building's air barrier. These weak points are not only wasteful from an energy point of view but can also lead to conditions conducive to mold growth and to the infiltration of pests or polluted air. In addition, building users can introduce particulate matter indoors through their clothes and shoes, including harmful coliforms and *Escherichia coli*, among other toxins.^[113-115]

Solutions: In addition to building envelope commissioning, there is a need for measures that minimize or prevent the introduction of potentially harmful substances into indoor spaces. An example of such interventions is the installation of entryway walk-off systems and/or entryway air seals at all main building entrances.^[116]

Impact: When outdoor air quality is poor, delivery of high-performance building enclosures can improve indoor air quality, which is an important intervention for creating indoor built environments with maximum levels of air quality.

Part 1 Design Healthy Envelope and Entryways (Max: 1 Pt)

For All Spaces:

Building envelope and entry

At least two of the following requirements are met:

- a. The below is performed after substantial completion of construction and prior to occupancy:
 1. Envelope commissioning in accordance with ASHRAE Guideline 0-2013 and the National Institute of Building Sciences (NIBS) Guideline 3-2012 (for new construction or structural renovation).^[117,118]
 2. The commissioning process is performed by an independent professional who is not a member or subcontractor of the building envelope design and construction team.
- b. All regularly used entrances to the building that have pedestrian traffic to the exterior use an entryway system composed of grilles, grates, slots or rollout mats that are at least the width of the entrance and 3 m [10 ft] long in the primary direction of travel (sum of indoor and outdoor length).^[15] These are cleaned as per below:
 1. Walk-off mats, indoor and outdoor, are wet-cleaned at least once every two days and fully dry before use.
 2. Underside of entry mats are cleaned at least once a day.
 3. Entry mats are vacuumed using a vacuum with a beater bar in both directions at least once a day.
- c. One of the below is in place to slow the movement of air from outdoors to indoors:
 1. Building entry vestibule with two typically closed doorways.
 2. Revolving entrance doors.

Outdoor sport areas

The following requirement is met:

- a. All facilities adjacent to an outdoor sports field have a staging area that separates the playing field from other internal areas to capture moisture and debris.^[119]

A10 COMBUSTION MINIMIZATION | O (MAX: 1 PT)

Intent: Reduce human exposure to combustion-related air pollution from heating and transportation sources.

Summary: This WELL feature requires projects to utilize low-emission combustion products or eliminate combustion-based products entirely.

Issue: Combustion-related emissions, mostly from space heating, cooking and nearby transportation, are often a major and overlooked source of indoor air pollution.^[104] Inefficient heating practices, cooking or other combustion activities produce high levels of indoor air pollution that include a range of health-damaging pollutants such as fine particles, nitrogen dioxide and carbon monoxide.^[105] Inhalation of elevated levels of carbon monoxide is linked to headaches, visual impairment, reduced cognitive functioning and ability and reduced ability to perform complex tasks.^[106] Carbon monoxide has 210 times the binding affinity for hemoglobin compared to oxygen and thus prevents oxygen from being delivered to the body, leading to hypoxia, which is a lack of oxygen delivery to body tissues that can cause nausea, loss of consciousness and death.^[107]

Solutions: Opting for non-combustion or low-emission combustion products is an important first step toward the reduction of carbon monoxide, nitrogen dioxide, small particles and other combustion byproducts in the air.^[108]

Impact: Eliminating or reducing indoor sources of pollution is a key step toward achieving high indoor air quality.

Part 1 Manage Combustion (Max: 1 Pt)

For All Spaces except Commercial Kitchen Spaces:

Appliance and heater combustion ban

The following requirement is met:

- a. Combustion-based fireplaces, stoves, space heaters, ranges and ovens are not used in regularly occupied spaces.^[109]

Low-emission combustion sources

The following equipment used in the project for heating, cooling, water heating, process heating or power generation (whether primary or back-up) meet California's South Coast Air Quality Management District rules, or approved equivalent, for pollution:

- a. Internal combustion engines.^[110]
- b. Furnaces.^[110]
- c. Boilers, steam generators and process heaters.^[110]
- d. Water heaters.^[110]

Engine exhaust reduction

The following requirement is met:

- a. Vehicle engine idling for more than 30 seconds is prohibited in all pick-up, drop-off and parking areas. "No idling" signage is present at these locations indicating this rule.

Note:

Projects should consider primary language(s) spoken by the local population when creating signage.

A11 SOURCE SEPARATION | O (MAX: 1 PT)

Intent: Preserve indoor air quality and maximize olfactory comfort in occupied spaces through the isolation and proper ventilation of indoor pollution sources and chemical storage areas.

Summary: This WELL feature requires strategies that isolate key sources of odors, germs, pollution or humidity through doors or dedicated exhaust.

Issue: Air pollution can be created from many indoor sources, including cleaning products, office equipment and humid environments. Chemical storage closets, for example, can be a source of harmful vapors, including Volatile Organic Compounds (VOCs) that are linked to cancer, organ and central nervous system damage.^[128,131] Copy rooms can contribute to the production of ozone, which has been associated with lung inflammation, chest pain, wheezing, coughing, shortness of breath and the exacerbation of respiratory illnesses such as pneumonia and asthma.^[137,138] Bathrooms can encourage the growth of mold and mildew, which have been associated with allergic reactions and aggravate lung diseases such as asthma.^[76] Exposure to air pollutants in kitchens, such as particulate matter, VOCs and polycyclic aromatic hydrocarbons, has been associated with kidney inflammation.^[139]

Solutions: The most effective way to curb air pollution in buildings is to eliminate individual sources or capture emissions at the source before they spread to surroundings.^[140] For air pollution sources that are inevitable, physical separation of such sources combined with direct ventilation exhaust systems is an effective means of protecting individuals.

Impact: Separating individual sources of air pollution helps improve indoor air quality and plays a fundamental role in creating healthier buildings.

Part 1 Manage Pollution and Exhaust (Max: 1 Pt)

For All Spaces:

All bathrooms, kitchens, rooms for cleaning and chemical storage, rooms with high-volume printers and copiers, and high-humidity areas meet one of the following requirements:

- a. Are separated from all adjacent regularly occupied spaces with self-closing doors and/or vestibules.
- b. Utilize exhaust fans so that return air is expelled outdoors rather than recirculated.^[15,119]

For Commercial Kitchen Spaces:

The following requirements are met:

- a. Canopy hoods have side or partial panels when allowable by code.^[141]
- b. Type II hood overhangs and setbacks comply with ASHRAE 154-2011 (Table 3 - Minimum Overhang Requirements for Type II Hoods) on all open sides, measured in the horizontal plane from the inside edge of the hood to the edge of the top horizontal surface of the appliance.^[142]
- c. The vertical distance between the front lower lip of the hood and cooking surface is less than or equal to 1.2 m [4 ft].^[142]
- d. Makeup air velocity near (or directed at) the hood is less than 0.25 m/s [75 fpm].^[141]
- e. Replacement air introduced directly into the exhaust hood cavity does not exceed 10% of the hood exhaust airflow rate.^[143]
- f. At least 50% of the air that replaces the exhaust air is conditioned transfer air rather than makeup air.^[144]
- g. Appliances are grouped under exhaust hoods according to effluent productions and associated ventilation requirements, as specified in ASHRAE 154-2011, per hood type (defined by the classifications used in ASHRAE 154-2011 for light, medium, heavy and extra-heavy appliance duty levels).^[142]
- h. Appliances have a rear seal between the appliance and the wall when allowable by code.^[145]
- i. Appliances located at the end of a cook line requiring exhaust airflow rates greater than 460 L/s/m [300 CFM/ft] have a full side panel or an end wall.^[142]

A12 AIR FILTRATION | O (MAX: 1 PT)

Intent: Remove indoor and outdoor airborne contaminants through air filtration.

Summary: This WELL feature requires projects with mechanically ventilated spaces to implement adequate air filtration and document a maintenance protocol for installed filters. For naturally ventilated spaces, this feature requires that outdoor air quality standards be met.

Issue: Exposure to particulate matter (PM) is associated with a host of negative health outcomes. PM₁₀ can block and inflame airways, causing a range of respiratory-related conditions that can lead to illness or death.^[120] PM_{2.5} poses even greater health risks compared to PM₁₀ because it can penetrate deep into the lungs, enter the bloodstream and as a result, cause a variety of health issues including heart disease and other cardiovascular complications.^[120]

Solutions: Selection and installation of adequate media filters is one of the key mechanisms for minimizing exposure to outdoor and indoor air pollution. Studies have shown that decreased exposure to particulate matter by filtration of recirculated indoor air is associated with reduced risk of cardiovascular disease and is an effective control measure for reducing allergic respiratory disease.^[121,122] In addition, regular filter maintenance is critical to ensure proper air filtration and the efficiency of the air conditioning system. During the operation, filters should be replaced when they become loaded with particles, as they will begin to reduce airflow and increase pressure drop. Overloaded filters not only restrict airflow rate but can also result in a loss of filtration efficiency. Improper operation or maintenance of filtration systems has been associated with symptoms such as dry eyes, skin and throat irritation, fatigue and headache and can lead to more severe implications such as Legionnaires' disease.^[123] Additionally, it is critical for projects to be aware if their building is located in an area with elevated outdoor air pollution, as these projects often need to install a pre-filtration stage in addition to the primary filtration to maintain high quality indoor air.^[124]

Impact: Proper air filtration and the execution of a maintenance protocol over the life of a filter help to improve and maintain indoor air quality over time and play a fundamental role in creating healthier buildings.

Part 1 Implement Particle Filtration (Max: 1 Pt)

For All Spaces:

Mechanically and mixed-mode ventilated spaces

The following requirement is met:

- a. Media filters are used in the ventilation system to filter outdoor air supplied to the space in accordance with thresholds specified in the table below:^[125,126]

Annual Average Outdoor PM _{2.5} Threshold	Minimum Air Filtration Level
16 µg/m ³ or less	MERV 8 or G4
17–18 µg/m ³	MERV 10 or M5
19–23 µg/m ³	MERV 12 or M6
24–39 µg/m ³	MERV 14 or F8
40–59 µg/m ³	MERV 16 or E10
60 µg/m ³ or greater	MERV 16 preceded by MERV 8, or E10 preceded by G4

- b. Filter is equipped with on-board pressure sensors or filter change indicator that signal when filter requires replacement. Evidence that the filter has been replaced according to manufacturer's recommendation is submitted annually through WELL Online.

Note:

The World Health Organization's Global Urban Ambient Air Pollution Database may be consulted to view outdoor air quality

levels, available at http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/

A13 ACTIVE VOC CONTROL | O (MAX: 1 PT)

Intent: Mitigate volatile organic compound (VOC) levels through the implementation of advanced air filtration/purification strategies.

Summary: This WELL feature requires the use of carbon filters to reduce indoor levels of VOCs.

Issue: Building materials, furnishings (e.g., carpets and furniture finishes), fabrics, cleaning products, personal care products, adhesives, solvents and air fresheners can all emit VOCs or semi-volatile organic compounds (SVOCs) into the indoor environment.^[8,127] VOCs include benzene (classified by the U.S. EPA as a known human carcinogen), formaldehyde and other chemical compounds, which at high concentrations can lead to irritation of the nose and pharynx and have been associated with leukemia, childhood asthma and other respiratory disorders.^[128] VOCs found in carpet cleaner, cleaning supplies and pest control mechanisms can be detrimental to children's lungs.^[129,130] Health effects can also include damage to the liver, kidneys and central nervous system.^[131]

Solutions: Carbon filters are designed to absorb these volatile pollutants and remove the largest particles. They can also remove 60% to 70% of ozone from the passing air,^[132] a pollutant that is associated with irregular heartbeat, poor lung function and irritation to the eyes, nose, throat and skin.^[133,134] The use of air-cleaning devices is generally linked to reduced allergic rhinitis and asthma symptoms.^[135] Certain circumstances justify greater investment in air purification strategies. For example, proximity to highly traveled roads or manufacturing plants and seasonal variation can affect outdoor air quality, increasing ozone and VOC content and, in turn, diminishing indoor air quality. Similarly, climates with high humidity levels and inadequate ventilation can foster the development of mold and spores in indoor environments. For optimal performance, air filtration systems need to be maintained according to the manufacturer's instructions.

Impact: The implementation of advanced air filtration/purification strategies is an effective method to reduce levels of VOCs indoors, which is important for decreasing human exposure to harmful contaminants.

Part 1 Implement Carbon Filtration (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Projects utilize one of the below to remove VOCs from indoor air:
 1. Activated carbon filters or a combination of particulate/carbon filters in the main air ducts to filter recirculated air.
 2. A standalone air-cleaning device that utilizes a carbon filter to treat the air (one device per area coverage as specified by the manufacturer).^[136]
- b. Evidence that the filter or device has been replaced or maintained according to manufacturer's recommendation is submitted annually through WELL Online.

A14 MICROBE AND MOLD CONTROL | O (MAX: 2 PT)

Intent: Reduce mold and bacteria growth through condensation management and reduce levels of microbes within occupied spaces.

Summary: This WELL feature requires projects to conduct regular inspections in order to eliminate sources of microbes and mold and to inactivate existing microbes.

Issue: A substantial portion of buildings and homes have some form of mold, mildew or water damage.^[75] Growth of mold spores can trigger asthma, headaches, allergies and other respiratory system disorders.^[76,77] Exposure to mold has also been associated with hypersensitivity pneumonitis, allergic rhinitis, bronchitis, lung tumor development, eczema and toxic mold syndrome.^[78,79] Humidity levels constantly above 60% in the home can easily cause mold growth, which can lead to odors and cause respiratory irritation and allergies in sensitive individuals.^[80]

Solutions: In order to benefit from the known health effects of doing so, it is important to prevent and remediate indoor mold and dampness.^[76] Many studies have reported that eliminating dampness and moisture-related indoor exposures is of major importance for preventing asthma and other respiratory conditions.^[81] Mold often grows on cooling coils in HVAC systems due to moisture condensation and can be introduced into the building's indoor air. It can also occur on or within wall assemblies due to water damage or improper detailing in humid locations, for example in kitchens and bathrooms. Water leaks, poor plumbing and poorly ventilated bathrooms can create standing water in which microorganisms such as bacteria and mold can breed. Such issues can be prevented and mitigated through a combination of regular mold inspections, condensation management plans and microbe inactivation techniques.

Impact: Minimizing exposure to mold and microbes leads to better air quality and reduced health risks.^[76]

Part 1 Implement Ultraviolet Air Treatment (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Project utilizes one of the below:
 1. Projects with a forced-air cooling system use ultraviolet lamps to irradiate the surfaces of the cooling coils and drain pans of the mechanical system supplies.^[82]
 2. Projects without a forced-air cooling system use standalone ultraviolet germicidal irradiation air sanitizers in all spaces with more than 10 regular occupants.
- b. Evidence that the device has been replaced or maintained according to manufacturer's recommendation is submitted annually through WELL Online.

Part 2 Manage Condensation and Mold (Max: 1 Pt)

For All Spaces:

Condensation management

A narrative describes how condensation is addressed for the project, considering the following:

- a. High interior relative humidity levels, particularly in susceptible areas like laundry rooms, below-grade spaces and other high-humidity areas.^[84]
- b. Air leakage that could wet either exposed interior materials or interstitially hidden materials.^[84]
- c. Cold surfaces such as basements, slab-on-grade floors or the inside of exterior walls.^[84]
- d. Oversized air conditioning units.^[84]

Mold inspections

The following requirements are met:

- a. Annual inspections for signs of water damage or pooling, discoloration and mold on ceilings, walls and floors is performed by a professional demonstrated not to have a conflict of interest.^[85] The report is submitted annually

through WELL Online.

b. One of the below is met:

1. Project achieves cooling coil mold reduction as per Part 1: Implement Ultraviolet Air Treatment.
2. All cooling coils (where applicable) are inspected on a quarterly basis for mold growth and cleaned if necessary. Dated photos demonstrating adherence are submitted annually through WELL Online.^[86]

c. For projects with tenants, there is a system in place for notifying building management about mold or water damage and addressing concerns.

REFERENCES

- 1: Klepeis N, Nelson W, Ott W, et al. The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants. *J Expo Anal Environ Epidemiol*. 2001;11(3):231-252. doi:10.1038/sj.jea.7500165.
- 2: McDowell J. *Encyclopedia of Human Body Systems*. Greenwood; 2011.
- 3: Joshi S. The sick building syndrome. *Indian J Occup Environ Med*. 2008;12(2):61. doi:10.4103/0019-5278.43262.
- 4: Selgrade MK, Plopper CG, Gilmour MI, Conolly RB, Foos BSP. Assessing The Health Effects and Risks Associated with Children's Inhalation Exposures—Asthma and Allergy. *J Toxicol Environ Heal Part A*. 2007;71(3):196-207. doi:10.1080/15287390701597897.
- 5: Brook RD, Franklin B, Cascio W, et al. Air Pollution and Cardiovascular Disease. *Circulation*. 2004;109(21). doi:10.1161/01.CIR.0000128587.30041.C8.
- 6: Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet (London, England)*. 2012;380(9859):2224-2260. doi:10.1016/S0140-6736(12)61766-8.
- 7: Meier P, Holloway T, Patz J, et al. Exploring the consequences of climate change for indoor air quality. Indoor particulate matter in developing countries: a case study in Pakistan and potential intervention strategies. *Environ Res Lett*. 2013;8(8). doi:10.1088/1748-9326/8/1/015022.
- 8: Wallace L, Pellizzari E, Leaderer B, Zelon H, Sheldon L. Emissions of volatile organic compounds from building materials and consumer products. *Atmos Environ*. 1987;21(2):385-393. doi:10.1016/0004-6981(87)90017-5.
- 9: World Health Organization. 7 million premature deaths annually linked to air pollution. WHO. [Reference](#). Published 2014. Accessed October 30, 2017.
- 10: World Health Organization. Burden of Disease from Household Air Pollution for 2012: Summary of Results.; 2012. [Reference](#). Accessed October 30, 2017.
- 11: Calderón-Garcidueñas L, Torres-Jardón R, Kulesza RJ, Park S-B, D'Angiulli A. Air pollution and detrimental effects on children's brain. The need for a multidisciplinary approach to the issue complexity and challenges. *Front Hum Neurosci*. 2014;8:613. doi:10.3389/fnhum.2014.00613.
- 12: U.S. Environmental Protection Agency. National Ambient Air Quality Standards (40 CFR Part 50). [Reference](#). Accessed January 25, 2018.
- 13: The European Parliament and of the Council the European Union. Directive 2008/50/EC of the European Parliament and of the council on ambient air quality and cleaner air for Europe. *Off J Eur Union*. 2008;L 152/1. [Reference](#). Accessed March 6, 2018.
- 14: World Health Organization. Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide. 2005. [Reference](#). Accessed January 25, 2018.
- 15: U.S. Green Building Council. LEED BD+C: New Construction | v4 - LEED v4. [Reference](#). Accessed January 25, 2018.
- 16: California Department of Public Health. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, V1.1. 2010. [Reference](#). Accessed January 25, 2018.
- 17: World Health Organization. Guidelines for Indoor Air Quality – Selected Pollutants. Geneva: World Health Organization: 141-142.; 2010. [Reference](#). Accessed January 25, 2018.
- 18: U.S. Environmental Protection Agency. A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon. 2012. [Reference](#). Accessed January 25, 2018.
- 19: Health and Safety Executive. EH40/2005 Workplace Exposure Limits (Second Edition). 2011. [Reference](#). Accessed January 25, 2018.
- 20: Jha P, Ramasundarahettige C, Landsman V, et al. 21st-Century Hazards of Smoking and Benefits of Cessation in the United States. *N Engl J Med*. 2013;368(4):341-350. doi:10.1056/NEJMsa1211128.
- 21: National Cancer Institute. Harms of Cigarette Smoking and Health Benefits of Quitting. [Reference](#). Accessed

November 3, 2017.

- 22: U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress: A Report of the Surgeon General. [Reference](#). Published 2014. Accessed November 3, 2017.
- 23: Vishnevetsky J, Tang D, Chang H-W, et al. Combined effects of prenatal polycyclic aromatic hydrocarbons and material hardship on child IQ. *Neurotoxicol Teratol*. 2015;49:74-80. doi:10.1016/j.ntt.2015.04.002.
- 24: McKenzie J., L. Bhatti and ET d'Espaignet. WHO Tobacco Knowledge Summaries: Tobacco and Dementia. 2014. [Reference](#). Accessed October 31, 2017.
- 25: Matt GE, Quintana PJE, Destailats H, et al. Thirdhand Tobacco Smoke: Emerging Evidence and Arguments for a Multidisciplinary Research Agenda. *Environ Health Perspect*. 2011;119(9):1218-1226. doi:10.1289/ehp.1103500.
- 26: Wang X, Derakhshandeh R, Liu J, et al. One Minute of Marijuana Secondhand Smoke Exposure Substantially Impairs Vascular Endothelial Function. *J Am Heart Assoc*. 2016;5(8):e003858. doi:10.1161/JAHA.116.003858.
- 27: Mello S, Bigman CA, Sanders-Jackson A, Tan ASL. Perceived Harm of Secondhand Electronic Cigarette Vapors and Policy Support to Restrict Public Vaping: Results From a National Survey of US Adults. *Nicotine Tob Res*. 2016;18(5):686-693. doi:10.1093/ntr/ntv232.
- 28: Tinuoye O, Pell JP, Mackay DF. Meta-Analysis of the Association Between Secondhand Smoke Exposure and Physician-Diagnosed Childhood Asthma. *Nicotine Tob Res*. 2013;15(9):1475-1483. doi:10.1093/ntr/ntt033.
- 29: World Health Organization. Global Health Observatory (GHO) data: Second-hand smoke. WHO. [Reference](#). Published 2015. Accessed October 31, 2017.
- 30: New York State Department of Health. NYS Public Health Law, Article 13-E: Regulation of Smoking in Public and Work Places. 2014. [Reference](#). Accessed January 25, 2018.
- 31: Hammond D, Fong GT, McNeill A, Borland R, Cummings KM. Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control*. 2006;15 (suppl 3):iii19-25. doi:10.1136/tc.2005.012294.
- 32: Wargocki P, Wyon DP, Sundell J, Clausen G, Fanger PO. The effects of outdoor air supply rate in an office on perceived air quality, sick building syndrome (SBS) symptoms and productivity. *Indoor Air*. 2000;10(4):222-236. [Reference](#). Accessed November 1, 2017.
- 33: Daisey JM, Angell WJ, Apte MG. Indoor air quality, ventilation and health symptoms in schools: an analysis of existing information. *Indoor Air*. 2003;13(1):53-64. doi:10.1034/j.1600-0668.2003.00153.x.
- 34: Redlich CA, Sparer J, Cullen MR. Sick-building syndrome. *Lancet (London, England)*. 1997;349(9057):1013-1016. doi:10.1016/S0140-6736(96)07220-0.
- 35: Fisk WJ, Rosenfeld AH. Estimates of Improved Productivity and Health from Better Indoor Environments. *Indoor Air*. 1997;7(3):158-172. doi:10.1111/j.1600-0668.1997.t01-1-00002.x.
- 36: Haverinen-Shaughnessy U, Moschandreas DJ, Shaughnessy RJ. Association between substandard classroom ventilation rates and students' academic achievement. *Indoor Air*. 2011;21(2):121-131. doi:10.1111/j.1600-0668.2010.00686.x.
- 37: Chan WR, Parthasarathy S, Fisk WJ, McKone TE. Estimated effect of ventilation and filtration on chronic health risks in U.S. offices, schools, and retail stores. *Indoor Air*. 2016;26(2):331-343. doi:10.1111/ina.12189.
- 38: Milton DK, Glencross PM, Walters MD. Risk of sick leave associated with outdoor air supply rate, humidification, and occupant complaints. *Indoor Air*. 2000;10(4):212-221. [Reference](#). Accessed October 31, 2017.
- 39: Hanssen SO. HVAC— the importance of clean intake section and dry air filter in cold climate. *Indoor Air*. doi:10.1111/j.1600-0668.2004.00288.x.
- 40: American Society of Heating, Refrigerating and Air-Conditioning Engineers. ANSI/ASHRAE Standard 62.1-2010. Ventilation for Acceptable Indoor Air Quality.;2010.
- 41: American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE 62.2: Ventilation and Acceptable Indoor Air Quality in Residential Buildings (ANSI Approved). Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers; 2016.
- 42: European Committee for Standardization. EN 15251 Standard: Indoor Environmental Input Parameters for Design

and Assessment of Energy Performance of Buildings Addressing Indoor Air Quality, Thermal Environment, Lighting and Acoustics. European Committee for Standardization; 2007.

43: British Standards Institution. BS EN 13779: Ventilation for Non-Residential Buildings - Performance Requirements for Ventilation and Room-Conditioning Systems; 2017.

44: Standards Australia. AS 1668.2: The Use of Ventilation and Airconditioning in Buildings); 2002. [Reference](#). Accessed January 26, 2018.

45: Chartered Institution of Building Services Engineers. CIBSE Guide A: Environmental Design. 2007.

46: Chartered Institution of Building Services Engineers. Natural Ventilation in Non-Domestic Buildings, CIBSE Application Manual AM010. 2005.

47: Chartered Institution of Building Services Engineers. Mixed Mode Ventilation : CIBSE Applications Manual AM 13. 2000.

48: American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE Standard 111-2008. Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems. [Reference](#). Accessed March 7, 2018.

49: Porta D, Narduzzi S, Badaloni C, et al. Air pollution and cognitive development at age seven in a prospective Italian birth cohort. *Epidemiology*. 2015;27(2):1. doi:10.1097/EDE.0000000000000405.

50: U.S. Environmental Protection Agency. Highlights from the Clean Air Act 40th Anniversary. [Reference](#). Accessed October 30, 2017.

51: Laumbach RJ, Kipen HM. Respiratory health effects of air pollution: update on biomass smoke and traffic pollution. *J Allergy Clin Immunol*. 2012;129(1):3-11-3. doi:10.1016/j.jaci.2011.11.021.

52: Allen JG, MacNaughton P, Satish U, Santanam S, Vallarino J, Spengler JD. Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments. *Environ Health Perspect*. 2015;124(6). doi:10.1289/ehp.1510037.

53: Dorgan, CE, Dorgan C. Assessment of link between productivity and indoor air quality. In: *Creating the Productive Workplace*. Clements-Croome D. 2nd ed. London: E and FN Spon; 2005: 113-135. 2005. Accessed October 31, 2017. [Reference](#).

54: The Organisation for Economic Co-operation and Development (OECD). *OECD Environmental Outlook to 2050: The Consequences of Inaction*. OECD Publishing; 2012. doi:10.1787/9789264122246-en.

55: Collins JF. *Benzene Reference Exposure Levels: Technical Support Document for the Derivation of Noncancer Reference Exposure Levels Appendix D1*; 2014. [Reference](#).

56: Indoor Air Quality Management Group TG of the HKSAR. *Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places*. 2003. [Reference](#). Accessed January 25, 2018.

57: Molhave L. Volatile Organic Compounds, Indoor Air Quality and Health. *Indoor Air*. 1991;1(4):357-376. doi:10.1111/j.1600-0668.1991.00001.x.

58: World Health Organization RO for E. *Air Quality Guidelines for Europe Second Edition*. 2000. [Reference](#). Accessed January 25, 2018.

59: U.S. Environmental Protection Agency O of R and IA. *EPA Assessment of Risks from Radon in Homes*. 2003. [Reference](#). Accessed January 25, 2018.

60: Harvard T.H. Chan School of Public Health. *The 9 Foundations of a Healthy Building*. Sch Public Heal. 2017. [Reference](#).

61: Parthasarathy S, Fisk WJ, McKone T. Effect Of Ventilation On Chronic Health Risks In Schools And Offices. 2013. [Reference](#). Accessed November 1, 2017.

62: Shendell DG, Winer AM, Weker R, Colome SD. Evidence of inadequate ventilation in portable classrooms: results of a pilot study in Los Angeles County. *Indoor Air*. 2004;14(3):154-158. doi:10.1111/j.1600-0668.2004.00235.x.

63: Seppänen OA, Fisk WJ, Mendell MJ. Association of ventilation rates and CO2 concentrations with health and other responses in commercial and institutional buildings. *Indoor Air*. 1999;9(4):226-252. [Reference](#). Accessed October 31, 2017.

- 64:**
Wyon DP. The effects of indoor air quality on performance and productivity. *Indoor Air*. 2004;14(s7):92-101. [Reference](#)
- 65:** Sundell J, Levin H, Nazaroff WW, et al. Ventilation rates and health: multidisciplinary review of the scientific literature. *Indoor Air*. 2011;21(3):191-204. doi:10.1111/j.1600-0668.2010.00703.x.
- 66:** Illinois Department of Public Health. Guidelines for Indoor Air Quality. [Reference](#). Accessed January 26, 2018.
- 67:** Health and Human Services. Appendix A. Carbon Dioxide and Its Use in Evaluating Adequacy of Ventilation in Buildings.
- 68:** Fisk WJ, Faulkner D, Sullivan DP. Accuracy of CO2 Sensors. 2008. [Reference](#). Accessed March 13, 2018.
- 69:** American Society of Heating, Refrigerating and Air-Conditioning Engineers. Performance Evaluation and Development of Design Guidelines for Displacement Ventilation, RP-949. Atlanta, GA: American Society of Heating, Refrigerating, and Air-Conditioning Engineers. 1998.
- 70:** Federation of European Heating, (REHVA) V and ACA. REHVA Guidebook No.01: Displacement Ventilation in Non-Industrial Premises. 2002.
- 71:** American Society of Heating Refrigerating and Air-Conditioning Engineers. UFAD Guide: Design, Construction and Operation of Underfloor Air Distribution Systems. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2013.
- 72:** Melikov AK. Personalized ventilation. *Indoor Air*. 2004;14(s7):157-167. doi:10.1111/j.1600-0668.2004.00284.x.
- 73:** Pantelic J, Tham KW, Licina D. Effectiveness of a personalized ventilation system in reducing personal exposure against directly released simulated cough droplets. *Indoor Air*. 2015;25(6). doi:10.1111/ina.12187.
- 74:** American Society of Heating Refrigerating and Air-Conditioning Engineers. Thermal Environmental Conditions for Uman Occupancy. Vol 2013. 2013.
- 75:** Cho S-H, Reponen T, LeMasters G, et al. Mold damage in homes and wheezing in infants. *Ann Allergy, Asthma Immunol*. 2006;97(4):539-545. doi:10.1016/S1081-1206(10)60947-7.
- 76:** Mendell MJ, Mirer AG, Cheung K, Tong M, Douwes J. Respiratory and Allergic Health Effects of Dampness, Mold, and Dampness-Related Agents: A Review of the Epidemiologic Evidence. *Environ Health Perspect*. 2011;119(6):748-756. doi:10.1289/ehp.1002410.
- 77:** Zock J-P, Jarvis D, Luczynska C, Sunyer J, Burney P, European Community Respiratory Health Survey. Housing characteristics, reported mold exposure, and asthma in the European Community Respiratory Health Survey. *J Allergy Clin Immunol*. 2002;110(2):285-292. [Reference](#). Accessed November 1, 2017.
- 78:** Pettigrew HD, Selmi CF, Teuber SS, Gershwin ME. Mold and Human Health: Separating the Wheat from the Chaff. *Clin Rev Allergy Immunol*. 2010;38(2-3):148-155. doi:10.1007/s12016-009-8175-5.
- 79:** Fisk WJ, Eliseeva EA, Mendell MJ. Association of residential dampness and mold with respiratory tract infections and bronchitis: a meta-analysis. *Environ Heal*. 2010;9(1):72. doi:10.1186/1476-069x-9-72.
- 80:** Arundel AV, Sterling EM, Biggin JH, Sterling TD. Indirect health effects of relative humidity in indoor environments. *Environ Health Perspect*. 1986;65:351-361. [Reference](#). Accessed November 3, 2017.
- 81:** Kanchongkittiphon W, Mendell MJ, Gaffin JM, Wang G, Phipatanakul W. Indoor Environmental Exposures and Exacerbation of Asthma: An Update to the 2000 Review by the Institute of Medicine. *Environ Health Perspect*. 2014;123(1):6-20. doi:10.1289/ehp.1307922.
- 82:** American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE 185.2: Method of Testing Ultraviolet Lamps for Use in HVAC&R Units or Air Ducts to Inactivate Microorganisms on Irradiated Surfaces (ANSI Approved). Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2014.
- 83:** Lyngby K, Kuehn TH, Burroughs HEB, et al. ASHRAE Position Document on Filtration and Air Cleaning. 2015.
- 84:** U.S. Environmental Protection Agency. Moisture Control Guidance for Building Design, Construction and Maintenance. EPA 402-F-13053. 2013. [Reference](#). Accessed January 26, 2018.
- 85:** National Center for Healthy Housing and American Public Health Association. National Healthy Housing Standard. 2014.

- 86:** National Air Duct Cleaners Association. White Paper on Ultraviolet Lighting Applications in HVAC Systems. [Reference](#). Accessed January 26, 2018.
- 87:** Wallace LA, Emmerich SJ, Howard-Reed C. Source strengths of ultrafine and fine particles due to cooking with a gas stove. *Environ Sci Technol*. 2004;38(8):2304-2311. [Reference](#).
- 88:** U.S. Environmental Protection Agency. Introduction to Indoor Air Quality. [Reference](#). Accessed March 5, 2018.
- 89:** National Disability Authority C for E in UD. Public access terminals - Priority 1: Section 1.2. [Reference](#). Accessed January 25, 2018.
- 90:** Douwes J, Thorne P, Pearce N, Heederik D. Bioaerosol health effects and exposure assessment: progress and prospects. *Ann Occup Hyg*. 2003;47(3):187-200. [Reference](#). Accessed January 12, 2018.
- 91:** Brager GS. Benefits of Improving Occupant Comfort and Well-being in Buildings. In: Proceedings of the 4th International Holcim Forum for Sustainable Construction: The Economy of Sustainable Construction. Mumbai 2013:181-194. [Reference](#). Accessed February 12, 2018.
- 92:** Burge S, Hedge A, Wilson S, Bass J, Robertson A. Sick Building Syndrome: A study of 4373 office workers. *Ann Occup Hyg*. 1987;31(4A):493-504. doi:10.1093/annhyg/31.4A.493.
- 93:** Wargocki P, Wyon DP, Fanger PO. Productivity is affected by the air quality in offices. *Proc Heal Build*. 2000:635-640. [Reference](#). Accessed January 12, 2018.
- 94:** Field RW. Climate Change and Indoor Air Quality. Contractor Report Prepared for: U.S. Environmental Protection Agency, Office of Radiation and Indoor Air. 2010. [Reference](#). Accessed October 31, 2017.
- 95:** International Living Future Institute. Living Building Challenge 3.0. A Visionary Path to a Regenerative Future. 2014. [Reference](#). Accessed January 26, 2018.
- 96:** American National Standards Institute (ANSI). ANSI A117.1: Accessible and Usable Buildings and Facilities, Section 309. 2009. [Reference](#). Accessed February 1, 2018.
- 97:** Bergdahl IA, Torén K, Eriksson K, et al. Increased mortality in COPD among construction workers exposed to inorganic dust. *Eur Respir J*. 2004;23(3):402-406. [Reference](#). Accessed November 3, 2017.
- 98:** Singh R, Ahmad K, Jakhwal DC, Kumar MS. Impact of Air Quality on Human Health In The Vicinity of Construction Sites in Delhi-NCR. *Int J Eng Res Appl* . 2014;4(8):18-26. [Reference](#) 4/C48041826.pdf. Accessed October 31, 2017.
- 99:** Kumar P, Mulheron M, Som C. Release of ultrafine particles from three simulated building processes. *J Nanoparticle Res*. 2012;14(4):771. doi:10.1007/s11051-012-0771-2.
- 100:** Licina D, Bhangar S, Brooks B, et al. Concentrations and sources of airborne particles in a neonatal intensive care unit. *PLoS One*. 2016;11(5). doi:10.1371/journal.pone.0154991.
- 101:** Executive Office of Health and Human Services (EOHHS). Methods Used to Reduce/Prevent Exposure to Construction/Renovation Generated Pollutants in Occupied Buildings. [Reference](#). Accessed February 12, 2018.
- 102:** ANSI/ASHRAE Standard 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. 2017.
- 103:** U.S. Green Building Council. Pilot Credit 75: Clean Construction. 2013. [Reference](#). Accessed January 26, 2018.
- 104:** Liu J, Mauzerall DL, Chen Q, et al. Air pollutant emissions from Chinese households: a major and underappreciated ambient pollution source. *Proc Natl Acad Sci U S A*. 2016;113(28):7756-7761. doi:10.1073/pnas.1604537113.
- 105:** World Health Organization. Household (Indoor) Air Pollution. WHO.
- 106:** Centers for Disease Control and Prevention (CDC). Health Effects Carbon Monoxide Poisoning Exposure and Risk - CDC Tracking Network. [Reference](#). Accessed October 31, 2017.
- 107:** Weaver LK, Hopkins RO, Chan KJ, et al. Hyperbaric Oxygen for Acute Carbon Monoxide Poisoning. *N Engl J Med*. 2002;347(14):1057-1067. doi:10.1056/NEJMoa013121.
- 108:** Bruce N, Pope D, Rehfuess E, Balakrishnan K, Adair-Rohani H, Dora C. WHO indoor air quality guidelines on household fuel combustion: Strategy implications of new evidence on interventions and exposure–risk functions. *Atmos Environ*. 2015;106:451-457. doi:10.1016/J.ATMOSENV.2014.08.064.

- 109:** U.S. Environmental Protection Agency. Protecting your health. [Reference](#). Accessed January 26, 2018.
- 110:** South Coast Air Quality Management District. SCAMD Rules and Regulations, Regulation XI - Source Specific Standards. [Reference](#). Accessed January 26, 2018.
- 111:** Fisk WJ, Chan WR. Effectiveness and cost of reducing particle-related mortality with particle filtration. *Indoor Air*. 2017;27(5):909-920. doi:10.1111/ina.12371.
- 112:** Du Y, Xu X, Chu M, Guo Y, Wang J. Air particulate matter and cardiovascular disease: the epidemiological, biomedical and clinical evidence. *J Thorac Dis*. 2016;8(1):E8-E19. doi:10.3978/j.issn.2072-1439.2015.11.37.
- 113:** Licina D, Tian Y, Nazaroff WW. Emission rates and the personal cloud effect associated with particle release from the perihuman environment. *Indoor Air*. 2017;27(4). doi:10.1111/ina.12365.
- 114:** Lax S, Hampton-Marcell JT, Gibbons SM, et al. Forensic analysis of the microbiome of phones and shoes. *Microbiome*. 2015;3(1):21. doi:10.1186/s40168-015-0082-9.
- 115:** Licina D, Nazaroff WW. Clothing as a transport vector for airborne particles: Chamber study. *Indoor Air*. 2018. doi:10.1111/ina.12452.
- 116:** Younes C, Shdid CA, Bitsuamlak G. Air infiltration through building envelopes: a review. *J Build Phys*. 2012;35(3). doi:10.1177/1744259111423085.
- 117:** American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE Guideline 0: The Commissioning Process. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2013.
- 118:** National Institute of Building Sciences (NIBS). Guideline 3-2012 Building Enclosure Commissioning Process BECx | WBDG Whole Building Design Guide. [Reference](#). Accessed January 26, 2018.
- 119:**
Wenger Corporation. Planning Your Athletic Facility. [Reference](#). Accessed January 26, 2018.
- 120:** World Health Organization RO for E. Health Effects of Particulate Matter. 2013. [Reference](#). Accessed October 31, 2017.
- 121:** Bräuner EV, Forchhammer L, Møller P, et al. Indoor Particles Affect Vascular Function in the Aged. *Am J Respir Crit Care Med*. 2008;177(4):419-425. doi:10.1164/rccm.200704-632OC.
- 122:** Sublett JL. Effectiveness of air filters and air cleaners in allergic respiratory diseases: a review of the recent literature. *Curr Allergy Asthma Rep*. 2011;11(5):395-402. doi:10.1007/s11882-011-0208-5.
- 123:** Mendell MJ, Lei-Gomez Q, Mirer AG, Seppnen O, Brunner G. Risk factors in heating, ventilating, and air-conditioning systems for occupant symptoms in US office buildings: the US EPA BASE study. *Indoor Air*. 2008;18(4):301-316. doi:10.1111/j.1600-0668.2008.00531.x.
- 124:** Centers for Disease Control and Prevention (CDC). Filtration and Air-Cleaning Systems to Protect Building Environments from Airborne Chemical, Biological, or Radiological Attacks. Department of Health and Human Services. 2003. [Reference](#). Accessed May 22, 2018.
- 125:** Stephens B. Selecting Ventilation Air Filters to Reduce PM_{2.5} Of Outdoor Origin. *ASHRAE J*. 2016. [Reference](#). Accessed January 25, 2018.
- 126:** Comparison Chart ASHRAE 52.2, 52.1, EN779, EN1882. [Reference](#) turbines and other power systems/Filter brochures/Filter_class_chart_ASHRAE_EN2012.pdf. Accessed January 25, 2018.
- 127:** Salthammer T. Emissions of Volatile Organic Compounds from Products and Materials in Indoor Environments. *Air Pollut*. 2004;37-71. doi:10.1007/B94830.
- 128:** Nurmatov UB, Tagiyeva N, Semple S, Devereux G, Sheikh A. Volatile organic compounds and risk of asthma and allergy: a systematic review. *Eur Respir Rev*. 2015;24(135):92-101. doi:10.1183/09059180.00000714.
- 129:** Annesi-Maesano I, Baiz N, Banerjee S, Rudnai P, Rive S, the SINPHONIE Group. Indoor Air Quality and Sources in Schools and Related Health Effects. *J Toxicol Environ Heal Part B*. 2013;16(8):491-550. doi:10.1080/10937404.2013.853609.
- 130:** de Gennaro G, Farella G, Marzocca A, Mazzone A, Tutino M. Indoor and outdoor monitoring of volatile organic compounds in school buildings: indicators based on health risk assessment to single out critical issues. *Int J Environ*

Res Public Health. 2013;10(12):6273-6291. doi:10.3390/ijerph10126273.

131: U.S. Environmental Protection Agency. Volatile Organic Compounds' Impact on Indoor Air Quality. [Reference](#). Accessed October 31, 2017.

132: Fisk W, Spears M, Sullivan D, Mendell M. Ozone Removal by Filters Containing Activated Carbon: A Pilot Study. 2012. [Reference](#). Accessed November 1, 2017.

133: Song X, Liu Y, Hu Y, et al. Short-Term Exposure to Air Pollution and Cardiac Arrhythmia: A Meta-Analysis and Systematic Review. *Int J Environ Res Public Health*. 2016;13(7):642. doi:10.3390/ijerph13070642.

134: Glas B, Stenberg B, Stenlund H, Sunesson AL. Exposure to formaldehyde, nitrogen dioxide, ozone, and terpenes among office workers and associations with reported symptoms. *Int Arch Occup Environ Health*. 2015;88(5):613-622. doi:10.1007/s00420-014-0985-y.

135: Hacker DW, Sparrow EM. Use of air-cleaning devices to create airborne particle-free spaces intended to alleviate allergic rhinitis and asthma during sleep. *Indoor Air*. 2005;15(6):420-431. doi:10.1111/j.1600-0668.2005.00387.x.

136: U.S. Environmental Protection Agency. Residential Air Cleaners (Second Edition): A Summary of Available Information. [Reference](#). Accessed January 26, 2018.

137: U.S. Environmental Protection Agency. Health Effects of Ozone in Patients with Asthma and Other Chronic Respiratory Disease. [Reference](#). Accessed October 31, 2017.

138: The National Institute of Environmental Health Sciences, National Institutes of Health. NIH Publication # 99-4671: Ozone Alert. [Reference](#). Accessed October 31, 2017.

139: Singh A, Kamal R, Mudiam MKR, et al. Heat and PAHs Emissions in Indoor Kitchen Air and Its Impact on Kidney Dysfunctions among Kitchen Workers in Lucknow, North India. Jia Z, ed. *PLoS One*. 2016;11(2):e0148641. doi:10.1371/journal.pone.0148641.

140: U.S. Environmental Protection Agency. Improving Indoor Air Quality. [Reference](#). Accessed February 12, 2018.

141: California Energy Commission. Design Guide Improving Commercial Kitchen Ventilation System Performance. 2003. [Reference](#). Accessed January 26, 2018.

142: Minnesota Department of Labor & Industry. Minnesota Mechanical and Fuel Gas Code - with ANSI/ASHRAE Standard 154-2011. 2015. [Reference](#). Accessed January 26, 2018.

143: American Society of Heating, Refrigerating and Air-Conditioning Engineers. ANSI/ASHRAE/IES Standard 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2010.

144: American Society of Heating, Refrigerating and Air-Conditioning Engineers. ANSI/ASHRAE/USGBC/IES Standard 189.1: Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings (ASHRAE 189.1). Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2011. [Reference](#). Accessed January 26, 2018.

145: Swierczyna R, Sobiski P, Fisher D, Cole T. Supplemental Research to ASHRAE 1202-RP: Effects of Range Top Diversity, Range Accessories, and Hood Dimensions on Commercial Kitchen Hood Performance. 2006. [Reference](#). Accessed January 26, 2018.

WATER

The WELL Water concept covers aspects of the quality, distribution and control of liquid water in a building. It includes features that address the availability and contaminant thresholds of drinking water, as well as features targeting the management of water to avoid damage to building materials and environmental conditions.

Nearly two-thirds of the human body is composed of water; it is a major component of cells and the dominant component of fluid between the cells.^[1] Water is the medium for the transport of nutrients and waste throughout the body and helps to regulate the internal body temperature.^[1] The U.S. Institute of Medicine recommends that women consume approximately 2.7 L [91 oz] and men 3.7 L [125 oz] of water per day,^[1] while the European Food Safety Authority's Adequate Intake recommendation is 2 L [49 oz] and 2.5 L [61], respectively.^[2] (These values include water from all sources including drinking water, other beverages and food.) These amounts are appropriate to offset what leaves the body through respiration, perspiration and excretion, aiding in the removal of toxins, byproducts and other waste.^[1] However, many people are inadequately hydrated, which is associated with higher rates of obesity.^[3,4,5,6] One contributing factor to this is the real or perceived quality of drinking water, as people who mistrust the safety of their water can be more likely to have lower intake of water and higher intake of sugar-sweetened beverages.^[7]

Over the last hundred years, many parts of the world saw dramatic improvements in drinking water quality, especially related to infectious diseases. The U.S. Centers for Disease Control and Prevention recognize this as one of the ten greatest public health achievements of the 20th century.^[8,9] However, the treatment and distribution systems that have made this improvement possible are also potential sources of contamination. For example, chlorine and chloramine are commonly added to water to kill pathogenic organisms, but can lead to the formation of disinfectant byproducts such as trihalomethanes (THMs) and haloacetic acids (HAAs); these are risk factors for cancer and other adverse health effects when exposure occurs at elevated levels.^[10,11]

While developed countries have experienced improvements in reducing pathogens related to infectious diseases, there has been increasing risk from industrial, agricultural and pharmaceutical sources. For example, water with high levels of nitrate can impair oxygen transport in infants and lead exposure can impair neurodevelopment in children.^[12] As a result, the U.S. Environmental Protection Agency has warned that threats to drinking water are increasing and we can no longer take our drinking water for granted.^[13] Due to widely varying water quality across the globe, it is important to identify which (if any) contaminants are of concern on the local scale.^[12] Only then is it possible to design water treatment systems which address the necessary contaminants without adding undue complexity and wastewater.

In addition to providing hydration for building users, water plays a large role in other aspects of building design and operation. It is frequently used in heating and cooling systems, irrigation, pools and baths and general appliances. These instances are associated with various concerns for contamination, such as the need to control *Legionella* in cooling systems and hot tubs.^[14] Additionally, if water from any source wets building materials that are not intended to come into contact with water, it sets up prime conditions for mold growth.^[15] Careful building design and an operations team responsive to inspections and sensors can mitigate the risks from water in these other aspects of buildings.

WELL aims to increase the rate of adequate hydration in building users and reduce health risks due to contaminated water and excessive moisture within buildings through better awareness and maintenance of water quality and management.

Note: All projects must have at least one drinking water dispenser within the project boundary for drinking water, which will be sampled during performance testing.

W01 FUNDAMENTAL WATER QUALITY | P

Intent: Limit the presence of sediment and water-borne bacteria levels in water for human contact.

Summary: This WELL feature requires the provision of water that meets thresholds for turbidity and coliforms for drinking and other uses likely to come in contact with building occupants and verifies performance using on-site tests.

Issue: The water supplies of most cities use an extensive treatment system to maintain the integrity and safety of the water. Two properties of water—total coliforms and turbidity—commonly serve as indicators for the effectiveness of these systems and for the possible presence of other, more concerning contaminants. Coliform bacteria are naturally present in the environment and are generally considered harmless. However, total coliform presence in water suggests that water may contain more dangerous pathogens, such as the specific coliform, *E. coli*.^[16] In addition to indicating possible problems with filtration (and possibly causing aesthetic concerns), high turbidity can provide food and shelter for microbes.^[16,17] High turbidity water also can foul or reduce the efficacy of water treatment technologies intended to remove health-related contaminants.^[18,19]

Solutions: Sediment filters can reduce the turbidity of water by removing suspended solids. This can solve appearance-based concerns of water quality and prepare the water for later stages of treatment.^[20] Once the water is of a low turbidity, UV disinfection systems are effective at destroying coliforms and other microbes.^[19]

Impact: Managing contaminants that serve as indicators can prepare the water for further treatment and demonstrate that treatment methods are properly functioning.

Part 1 Meet Sediment Thresholds

For All Spaces:

Water delivered to the project for human consumption, handwashing and showers/baths meets the following threshold:

- a. Turbidity less than or equal to 1.0 NTU.^[21]

Part 2 Meet Microorganisms Thresholds

For All Spaces:

Water delivered to the project for human consumption, handwashing and showers/baths meets the following requirement:

- a. Contains 0 CFU / 100 mL total coliforms (including *E. coli*).^[21]

Part 3 Monitor Fundamental Water Parameters

For All Spaces:

One of the following requirements is met:

- a. The water contaminants listed in this feature are monitored at intervals of no less than once per year and results are submitted annually through WELL Online. The number and location of sampling points for on-going monitoring complies with the requirements outlined in the Performance Verification Guidebook.
- b. The threshold levels of the water contaminants listed in this feature, as reported in a local municipal water quality report, are submitted annually through WELL Online.
- c. Project achieves at least one point in Feature W05: Water Quality Consistency (this point is still added to the project's score, but any points earned in Feature W05: Water Quality Consistency do not count toward the required 2-point minimum for this concept).

Note:

For on-going monitoring, projects are not required to use devices or methods that comply with the requirements described in the Performance Verification Guidebook. However, if measurements are undertaken by a performance testing agent in compliance with the Performance Verification Guidebook, results from each year may be aggregated together and utilized for recertification purposes

W02 WATER CONTAMINANTS | P

Intent: Provide access to drinking water that complies with health-based limits on contaminants.

Summary: This WELL feature requires projects provide drinking water that meets thresholds on contaminants based on thresholds published by national and international research and regulatory groups and verifies performance using on-site tests.

Issue: Rivers, lakes and other sources of drinking water can accumulate pollution through natural geologic conditions or from industry and agriculture. For example, natural deposits have caused high arsenic levels in drinking water for 140 million people in 70 countries.^[22] Pesticides and herbicides used in agriculture enter the water supply through rain runoff and in the U.S. have been detected in virtually every stream in agricultural, urban and mixed-use areas, as well as in 30-60% of groundwater.^[16,23] Many of the metals and organic pollutants found in water, such as vinyl chloride and mercury, arise from discharge from industrial facilities.^[16] As water travels from its source through municipal distribution systems and building pipes, it also encounters many opportunities to pick up contaminants. Water districts often add chlorine for valuable disinfection purposes. However, disinfectant byproducts (DBPs) such as trihalomethanes (THMs) and haloacetic acids (HAAs) can be created when the chlorine reacts with organic material in the water. Exposure to these through ingestion and inhalation has been linked to cancer, kidney damage and central nervous system birth defects.^[10,11] Finally, corrosion from municipal or building pipes is the primary source for other drinking water contaminants, such as lead, which is associated with impaired neurodevelopment in children and increased systolic blood pressure in adults.^[12]

Solutions: There are many building-scale interventions that can improve water quality. Their effectiveness depends on the contaminants being removed, so it is important for projects to understand the baseline water quality. Activated carbon filters are made from highly porous material that collects chlorine and disinfectant byproducts, many pesticides and some pharmaceuticals and personal care products.^[24] Reverse osmosis (RO) systems operate by forcing pressurized water through a microscopic mesh to remove suspended solids and some microorganisms and dissolved contaminants.^[18]

Impact: Identifying and controlling the contaminants in drinking water can reduce exposure (through ingestion) to harmful substances.

Part 1 Meet Dissolved Metal Thresholds

For All Spaces:

Water delivered to the project for human consumption meets the following thresholds:

- a. Lead less than 0.01 mg/L.^[12]
- b. Arsenic less than 0.01 mg/L.^[12,21]
- c. Antimony less than 0.006 mg/L.^[21]
- d. Mercury less than 0.002 mg/L.^[21]
- e. Nickel less than 0.07 mg/L.^[12]
- f. Copper less than 1.0 mg/L.^[21]
- g. Cadmium less than 0.005 mg/L.^[21]
- h. Chromium (total) less than 0.1 mg/L.^[21]

Part 2 Meet Organic Pollutant Thresholds

For All Spaces:

Water delivered to the project for human consumption meets the following thresholds:

- a. Styrene less than 0.02 mg/L.^[12]
- b. Benzene less than 0.005 mg/L.^[21]
- c. Ethylbenzene less than 0.3 mg/L.^[12]

- d. Vinyl chloride less than 0.002 mg/L.^[21]
- e. Toluene less than 0.7 mg/L.^[12]
- f. Xylenes (total: m, p and o) less than 0.5 mg/L.^[12]
- g. Tetrachloroethylene less than 0.005 mg/L.^[21]

Part 3 Meet Disinfectant Byproducts Thresholds

For All Spaces:

Water delivered to the project for human consumption meets the following thresholds:

- a. Total trihalomethanes (sum of dibromochloromethane, bromodichloromethane, chloroform and bromoform) less than 0.08 mg/L.^[21]
- b. Total haloacetic acids (sum of chloroacetic, dichloroacetic, trichloroacetic, bromoacetic and dibromoacetic acids) less than 0.06 mg/L.^[21]

Part 4 Meet Herbicide and Pesticide Thresholds

For All Spaces:

Water delivered to the project for human consumption meets the following thresholds:

- a. Atrazine less than 0.003 mg/L.^[21]
- b. Simazine less than 0.002 mg/L.^[12]
- c. 2,4-Dichlorophenoxyacetic acid less than 0.07 mg/L.^[21]

Part 5 Meet Fertilizer Thresholds

For All Spaces:

Water delivered to the project for human consumption meets the following threshold:

- a. Nitrate less than 50 mg/L (11 mg/L as nitrogen).^[12]

Part 6 Meet Public Water Additive Thresholds

For All Spaces:

Water delivered to the project for human consumption meets the following thresholds:

- a. Fluoride less than 4 mg/L.^[21]
- b. Chlorine less than 4 mg/L.^[21]
- c. Chloramine less than 4 mg/L.^[21]

Part 7 Monitor Water Contaminant Parameters

For All Spaces:

On-site testing

One of the following requirements is met:

- a. The water contaminants listed in this feature are monitored at intervals of no less than once per year and results are submitted annually through WELL Online. The number and location of sampling points complies with the requirements outlined in the Performance Verification Guidebook.
- b. The levels of the water contaminants listed in this feature, as reported in a local municipal water quality report, are submitted annually through WELL Online.
- c. Project achieves at least one point in Feature W05: Water Quality Consistency (this point is still added to the project's score, but any points earned in Feature W05: Water Quality Consistency do not count toward the required 2-point minimum for this concept).

Note:

For requirement a), projects are not required to use devices or methods that comply with the requirements described in the Performance Verification Guidebook. However, if measurements **are** undertaken by a performance testing agent in compliance with the Performance Verification Guidebook, results from each year may be aggregated together and utilized for recertification purposes

W03 LEGIONELLA CONTROL | P

Intent: Establish an effective management program that prevents or adequately controls the risk of exposure to *Legionella* bacteria.

Summary: This WELL feature requires projects to analyze their facilities for risk of *Legionella* and set up teams and response processes to manage concerns.

Issue: *Legionella* is a species of bacteria naturally present in many bodies of water that, if inhaled, can lead to legionellosis (commonly called Legionnaires' Disease), a type of pneumonia. It can cause coughs and shortness of breath and also muscle aches and headaches.^[14,34] If untreated, it can lead to lung failure and death, especially for those at higher risk, such as individuals who smoke, are over 50 or have a weakened immune system.^[14,34] The *Legionella* bacterium was first identified in 1976 following an outbreak in Philadelphia, Pennsylvania. Each year in the U.S., *Legionella* results in roughly 8,000 to 18,000 hospitalizations; in France, there are roughly 1,300 cases each year, and in Australia, 300 to 500 cases are identified annually.^[14,34,35,36] This represents a rate of 1.8 to 2 cases per 100,000 population, a number that has been increasing in recent years in many locations.^[14,35,36]

Solutions: *Legionella* is dangerous when suspended in mists or sprays that can be inhaled. This occurs most often when inappropriately treated and managed water is used in hot tubs, showers, fountains and large building refrigeration systems and forms a mist of contaminated water.^[14] Controlling *Legionella* risk is a complex process, but several organizations have published standards and guidelines outlining best practices and proven methods of prevention; for example, ASHRAE Standard 188, Legionellosis: Risk Management for Building Water Systems and the European Centre for Disease Prevention and Control.^[37,38]

Impact: By carefully cataloging water assets and hazards and preemptively developing plans and responses, projects can control a common building-related illness.

Part 1 Implement Legionella Management Plan

For All Spaces:

A narrative describes how the building addresses *Legionella*, and includes the following:

- a. Formation of a team for *Legionella* management in the building.^[37]
- b. Water system inventory and production of process flow diagrams.^[37]
- c. Hazard analysis of water assets.^[37]
- d. Identification of critical control points.^[37]
- e. Maintenance and control measures, monitoring, establishment of performance limits and corrective actions.^[37]
- f. Documentation, verification and validation procedures.^[37]

W04 ENHANCED WATER QUALITY | O (MAX: 1 PT)

Intent: Provide access to drinking water without unpleasant taste, odor and appearance.

Summary: This WELL feature requires projects provide drinking water that meets thresholds on contaminants that address aesthetics and taste and verifies performance using on-site tests.

Issue: Even when health-based thresholds for water quality are met, water can be unappealing to drink because of contaminants that affect taste, odor and appearance, sometimes referred to as nuisance chemicals.^[12,25] For example, high levels of chloride contribute to a salty taste and iron can give the water a reddish appearance.^[12] Therefore, many regulatory bodies set non-enforceable limits, such as the Canadian Aesthetic Objectives and the U.S. National Secondary Drinking Water Regulations, based on human detectability and acceptability for these substances.^[25,26]

Solutions: Like pollutants with health-based concerns, the treatment system to address nuisance chemicals depends on the contaminant of interest. Assuming the turbidity and chlorine levels are managed, reverse osmosis can remove most of the aesthetic contaminants from the water.^[27]

Impact: By managing nuisance chemicals, projects can provide more appealing and palatable drinking water.

Part 1 Meet Drinking Water Taste Properties (Max: 1 Pt)

For All Spaces:

Water delivered to the project for human consumption meets the following thresholds:

- a. Aluminum between 0.05 and 0.2 mg/L.^[25]
- b. Chloride less than 250 mg/L.^[25]
- c. Fluoride less than 2 mg/L.^[25]
- d. Manganese less than 0.05 mg/L.^[25]
- e. Sodium less than 270 mg/L.^[28]
- f. Sulfate less than 250 mg/L.^[25]
- g. Iron less than 0.3 mg/L.^[25]
- h. Zinc less than 5 mg/L.^[25]
- i. Total Dissolved Solids less than 500 mg/L.^[25]

W05 WATER QUALITY CONSISTENCY | O (MAX: 2 PT)

Intent: Maintain consistent high quality of drinking water.

Summary: This WELL feature requires use of filters on drinking water dispensers or testing of key water quality parameters at a more frequent interval.

Issue: The quality of water is not a constant parameter; it can fluctuate based on weather and other factors. For example, where the soil in watersheds contains large amounts of silt and clay, the water's turbidity levels rise during periods of snowmelt and heavy rain.^[28] Water quality can also vary because of changes to infrastructure, particularly for contaminants introduced downstream of municipal water treatment. For example, lead and copper in older pipes can dissolve into the drinking water if anticorrosion additives are not maintained, and are a particular risk when the source of a water supply changes.^[29] Variability in the disinfectant level can allow microbes to flourish, sometimes causing water suppliers to issue boil alerts to water users.^[29]

Solutions: To help detect fluctuations in water quality, projects can undertake their own water sampling operations on a regular basis. Or, by installing treatment techniques such as sediment filters, UV disinfection systems, and reverse osmosis, projects can better accommodate water quality variations.^[18,19,20]

Impact: By treating or undertaking regular assessment of drinking water, buildings can proactively manage their water quality on an ongoing basis.

Part 1 Test and Display Water Quality (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. All water delivered to the project for human consumption is tested quarterly (with results submitted annually through WELL Online) for the below:
 1. Lead.
 2. Copper.
 3. Turbidity.
 4. Coliforms.
- b. Most recent water quality results are made available to occupants through one of the below:
 1. Visual display prominently located near sources of drinking water.
 2. Hosting the required data on a website accessible to occupants. A visible sign should be positioned near sources of drinking water indicating the website where the data may be accessed.

Note: Project teams should consider primary language(s) spoken by the local population when creating signage.

Part 2 Filter Drinking Water (Max: 1 Pt)

For All Spaces:

Treatment Devices

All water from drinking water dispensers is treated within the building with the following:

- a. A filter designed to remove suspended solids with pore size 1.5 µm or less.
- b. A UV disinfection system rated by NSF/ANSI Standard 55 (Class A or B) or a device rated by NSF/ANSI Standard Standard 53 or 58 for cyst removal or reduction.
- c. A device rated by NSF/ANSI Standard 53 or 58 for copper and lead reduction.

Device Maintenance

The following requirement is met:

- a. Projects submit annually through WELL Online evidence that water treatment devices have been properly

maintained as per the manufacturer's recommendation.

W06 DRINKING WATER PROMOTION | O (MAX: 1 PT)

Intent: Promote proper hydration through the consumption of drinking water over less healthy alternatives by promoting high quality drinking water accessibility.

Summary: This WELL feature requires readily-available and maintained dispensers for drinking water.

Issue: People in many parts of the world are inadequately hydrated. For example, nearly a quarter of American adults and children do not drink plain water on a given day.^[3,30] This contributes to the fact that roughly a third of American adults and half of children are inadequately hydrated.^[3,4] Similarly, in Italy, 75% of women and 90% of men consume less than the European Food Safety Authority's Adequate Intake, and the average consumption of plain water in Australia is just one liter per day.^[5,6] Inadequate hydration is associated with higher BMI and nearly 60% greater odds of being obese.^[3] Individuals who remain hydrated by swapping plain water for sugar-sweetened beverages face their own set of risks, covered in greater detail in the WELL Nourishment concept.

Solutions: The first step toward increasing consumption of plain water is to make it easily available. This includes removing barriers to accessibility. For example, 40% of California school districts do not offer free drinking water in their cafeterias.^[31] When the addition of drinking fountains is combined with information sessions, consumption of plain water increases.^[32] Finally, since poor maintenance of drinking water facilities discourages consumption, it is important to keep water dispensers in a state of good repair.^[33]

Impact: By providing free and easily available drinking water in well maintained dispensers, projects can further encourage consumption of plain water.

Part 1 Ensure Drinking Water Access (Max: 1 Pt)

For All Spaces except Dwelling Units:

The following requirements are met:

- a. At least one drinking water dispenser (minimum one per floor) is located within 30 m [100 ft] walk distance of all regularly occupied floor area and in all dining areas.
- b. All newly installed drinking water fountains are designed for water bottle-refilling.
- c. The mouthpieces/outlets, protective guards and basins of drinking water fountains and dispensers is cleaned on a daily basis.

W07 MOISTURE MANAGEMENT | O (MAX: 3 PT)

Intent: Limit the potential for bacteria and mold growth within buildings from water infiltration and condensation.

Summary: This WELL feature requires projects to implement techniques to minimize the presence of unintentional water and, when unavoidable, to manage it through material selection.

Issue: Excess moisture and dampness is a common problem in buildings, affecting about 20% of buildings in Europe, Canada and the U.S.^[15] It creates conditions conducive to the growth of mold and other biological pests, which can increase the risk of developing respiratory infections and asthma for those within the building.^[15] It is estimated that one fifth of asthma cases in the U.S. are caused by excess moisture and dampness in buildings, contributing to some \$3.5 billion in asthma-related medical expenses.^[39] Furthermore, moisture can damage the building itself by creating an environment hospitable to insects and other destructive pests, corroding metal components and degrading wood and porous building materials.^[40] These problems can arise when water unintentionally penetrates the building envelope or leaks from indoor uses of water, or when moisture-heavy air condenses on building materials.

Solutions: Mold can find sufficient food and shelter on naturally present dust, so the best tactic to combat mold is to control the dampness of building materials.^[15] To minimize the negative effects of bulk liquid water, exterior sources of water (including precipitation and groundwater) should drain away from the building and the exterior cladding should block rainwater from traversing the building walls.^[40] In addition, the walls should contain capillary breaks to prevent water from wicking from outdoors to indoors; areas where condensation is likely to occur should use moisture-tolerant materials that dry quickly.^[40]

Impact: Through effective design of the building's curtain wall, plumbing assemblies and ventilation system, projects can make conditions inhospitable to mold, microbes and pests, reducing the risk to respiratory health.^[15,40]

Part 1 Manage Exterior Liquid Water (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. A continuous drainage plane (e.g., a weather-resistant barrier integrated with flashing systems at penetrations) is constructed interior to the exterior cladding.
- b. To prevent the wicking of porous building materials, one of the below capillary break methods is used:
 1. Free-draining spaces (e.g., between exterior cladding, weather-resistant barriers in wall assemblies).
 2. Non-porous materials (e.g., closed-cell foams, waterproofing membranes, metal) between porous materials.

Part 2 Isolate Moisture-sensitive Materials (Max: 1 Pt)

For All Spaces:

A narrative describes how moisture-tolerant materials have been selected and/or moisture-sensitive materials are being protected, considering the following:

- a. Exposed entryways and glazing.^[40]
- b. Porous cladding materials.^[40]
- c. Finished floors and interior sheathing in basements, bathrooms, kitchens and high-humidity spaces.^[40]

Part 3 Manage Interior Liquid Water (Max: 1 Pt)

For All Spaces:

To prevent leaks and water damage, one of the following is installed:

- a. Readily accessible, single-throw manual shut-off (governed or activated per use) or automatic shut-off at point-of-connection for all hard-piped fixtures (such as dishwashers, icemakers and clothes washers).
- b. Building-wide plumbing leak detection system.

W08 HANDWASHING | O (MAX: 2 PT)

Intent: Reduce pathogen transmission associated with washing and drying hands.

Summary: This WELL feature requires sufficiently large sinks, disposable soap containers and hand drying towels.

Issue: Washing hands with soap is a recommended and effective way of removing dirt and bacteria and can greatly reduce transmission and incidence of gastrointestinal disease, including diarrhea, and respiratory disease.^[41,42]

However, the hands will only become as clean as the surrounding environment. Sinks, which often have standing water and relatively infrequent cleaning, can house pathogenic bacteria that can migrate onto hands if touched.^[43]

Liquid soap dispensers are another place that frequently become homes for bacteria; even when cleaned, the soap and inside of the container often remain contaminated, indicating that the dispensers should not be topped off or refilled.^[44,45,46] Once an individual's hands are cleaned, they can more easily become re-infected when wet compared to when dry.^[47]

Solutions: Sinks and faucets should be designed in such a way as to avoid unnecessary contact with the hands.

Bathrooms should include paper towels for hand drying, as there is stronger evidence about the ability of paper towels to dry hands and remove bacteria, as compared to air dryers.^[47,48]

Impact: By encouraging handwashing and drying and limiting places that harbor germs, projects can help reduce infectious disease transmission.

Part 1 Provide Adequate Sink (Max: 1 Pt)

For All Spaces:

Bathroom and kitchen sinks meet the following requirements:

- The sink column of water is at least 25 cm [10 in] in length (measured along flow of water, even if at an angle).
- The sink column of water is at least 8 cm [3 in] away from any edge of the sink.
- The sink basin is at least 23 cm [9 in] in width and length.

Part 2 Provide Handwashing Support (Max: 1 Pt)

For All Spaces:

At all sink locations, the following are provided:

- Fragrance-free hand soap placed in dispensers with disposable and sealed soap cartridges.
- Paper towels for hand drying.

For Commercial Kitchen Spaces:

The following requirement is met:

- Clear signage directing toward the nearest handwashing location is present at the entrance to all areas intended for food preparation.

Note: Projects should consider primary language(s) spoken by the local population when creating signage.

REFERENCES

- 1: Institute of Medicine of the National Academies. Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington: The National Academies Press; 2005.
- 2: European Food Safety Authority. *Overview on Dietary Reference Values for the EU Population as Derived by the EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA)*. Vol 4.; 2017. [Reference](#).
- 3: Chang T, Ravi N. Inadequate Hydration, BMI, and Obesity Among US Adults: NHANES 2009-2012. *Ann Fam Med*. 2016;320-324. doi:10.1370/afm.1951.
- 4: Kenney EL, Long MW, Craddock AL, Gortmaker SL. Prevalence of Inadequate Hydration Among US Children and Disparities by Gender and Race / Ethnicity?: National Health and Nutrition Examination Survey , 2009 - 2012. *Am J Public Health*. 2015;105(8):2009-2012. doi:10.2105/AJPH.2015.302572
- 5: Australian Bureau of Statistics. Australian Health Survey: Consumption of Food Groups from the Australian Dietary Guidelines, 2011-12. doi:4364.0.55.012
- 6: Mistura L, D'Addezio L, Turrini A. Beverage Consumption Habits in Italian Population: Association with Total Water Intake and Energy Intake. *Nutrients*. 2016;8(11). doi:10.3390/nu8110674
- 7: Onufrak SJ, Park S, Sharkey JR. The Relationship of Perceptions of Tap Water Safety with Intake of Sugar Sweetened Beverages and Plain Water among U.S. Adults. *Public Heal Nutr*. 2015;17(1):179-185. doi:10.1017/S1368980012004600.
- 8: Centers for Disease Control and Prevention. History of Drinking Water Treatment. [Reference](#). Published 2012. Accessed January 10, 2018.
- 9: Centers for Disease Control and Prevention. Ten great public health achievements--worldwide, 2001-2010. *Morb Mortal Wkly Rep*. 2011;60(24):814-818. doi:10.1001/jama.281.16.1481
- 10: World Health Organization. Trihalomethanes in Drinking-Water.; 2005.
- 11: Nieuwenhuijsen MJ, Martinez D, Grellier J, et al. Chlorination disinfection by-products in drinking water and congenital anomalies: Review and meta-analyses. *Environ Health Perspect*. 2009;117(10):1486-1493. doi:10.1289/ehp.0900677
- 12: World Health Organization. WHO Guidelines for Drinking-Water Quality. 4th ed. Geneva: WHO Press; 2011. doi:10.1016/S1462-0758(00)00006-6
- 13: U.S. Environmental Protection Agency. Water on Tap: What You Need to Know. Washington, DC; 2009.
- 14: Centers for Disease Control and Prevention. Legionnaires' Disease. Atlanta; 2016.
- 15: WHO Regional Office for Europe. WHO Guidelines for Indoor Air Quality: Dampness and Mould. Copenhagen; 2009.
- 16: U.S. Environmental Protection Agency. National Primary Drinking Water Regulations.; 2009.
- 17: U.S. Geological Survey. Turbidity. [Reference](#). Published 2016. Accessed December 20, 2017.
- 18: Dvorak B. Drinking Water Treatment?: Reverse Osmosis. Lincoln, NE; 2014.
- 19: Lahlou M. Tech Brief - Ultraviolet Disinfection. Tap. 2000;15.
- 20: Dvorak B, Skipton S. Drinking Water Treatment: Sediment Filtration. Lincoln, NE; 2013.
- 21: U.S. Environmental Protection Agency. 2012 Edition of the Drinking Water Standards and Health Advisories.; 2012. doi:EPA 822-S-12-001
- 22: Bagchi S. Arsenic threat reaching global dimensions. *Can Med Assoc J*. 2007;177(11):1344-1345. doi:10.1503/cmaj.071456
- 23: Gilliom RJ, Hamilton PA. Pesticides in the Nation's Streams and Ground Water, 1992 - 2001. Sacramento; 2006.
- 24: Montana Department of Environmental Quality. FAQs About PPCPs?: Montana Focus. [Reference](#). Published 2008. Accessed January 4, 2018.

- 25: U.S. Environmental Protection Agency. National Secondary Drinking Water Regulations. [Reference](#). Published 2017. Accessed January 4, 2018.
- 26: Health Canada. Guidelines for Canadian Drinking Water Quality Summary Table Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment February 2017. Ottawa; 2017.
- 27: Ohio Department of Health. Reverse Osmosis (RO). [Reference](#). Published 2015. Accessed January 4, 2018.
- 28: NYC Environmental Protection. New York City 2016 Drinking Water Supply and Quality Report. New York; 2016.
- 29: Torrice M. How Lead Ended Up In Flint's Tap Water. *Chem Eng News*. 2016;94(7).
- 30: Sebastian RS, Enns CW, Goldman JD. Drinking Water Intake in the U.S.: What We Eat In America, NHANES 2005-2008.; 2011.
- 31: Huppert G. Water, water everywhere, nor any drop to drink: overcoming barriers to student consumption of free water. In: School Wellness Conference. Anaheim, CA; 2009.
- 32: Muckelbauer R, Libuda L, Clausen K, Toschke AM, Reinehr T, Kersting M. Promotion and provision of drinking water in schools for overweight prevention: randomized, controlled cluster trial. *Pediatrics*. 2009;123(4):e661-7. doi:10.1542/peds.2008-2186
- 33: Northcoast Nutrition and Fitness Collaborative. Water Woes.; 2010.
- 34: Centers for Disease Control and Prevention. Facts About Legionella and Hot Tubs / Spas. Atlanta; 2013.
- 35: European Legionnaires' Disease Surveillance Network. Legionnaires' Disease in Europe , 2011 to 2015. Vol 22.; 2017.
- 36: Corvisy R, Trungove M, Bright A, et al. Australia's notifiable disease status, 2014: Annual report of the National notifiable diseases surveillance system SYSTEM. *Commun Dis Intell*. 2015;39(1):E46-E136.
- 37: ASHRAE Standing Standard Project Committee 188. Legionellosis: Risk Management for Building Water Systems. Atlanta; 2015.
- 38: European Centre for Disease Prevention and Control (ECDC). European Technical Guidelines for the Prevention, Control and Investigation, of Infections Caused by Legionella Species.; 2017. [Reference](#).
- 39: Mudarri D, Fisk WJ. Public health and economic impact of dampness and mold. *Indoor Air*. 2007;17(3):226-235. doi:10.1111/j.1600-0668.2007.00474.x
- 40: U.S. Environmental Protection Agency. Moisture Control Guidance for Building Design, Construction and Maintenance. Washington, DC; 2013.
- 41: Curtis V, Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: A systematic review. *Lancet Infect Dis*. 2003;3(5):275-281. doi:10.1016/S1473-3099(03)00606-6
- 42: Aiello AE, Coulborn RM, Perez V, Larson EL. Effect of Hand Hygiene on Infectious Disease Risk in the Community Setting: A Meta-Analysis. *Am J Public Health*. 2008;98(8):1372-1381. doi:10.2105/AJPH.2007.124610.
- 43: Jumaa P. Hand hygiene: Simple and complex. *Int J Infect Dis*. 2005;9(1):3-14. doi:10.1016/j.ijid.2004.05.005
- 44: Chattman M. Occurrence of heterotrophic and coliform bacteria in liquid hand soaps from bulk refillable dispensers in public facilities. *J Environ Health*. 2011;73(7):26-29. [Reference](#).
- 45: Lorenz LA, Ramsay BD, Goeres DM, Fields MW, Zapka C, Macinga DR. Evaluation and remediation of bulk soap dispensers for biofilm. *Biofouling*. 2012;28(1):99-109. doi:10.1080/08927014.2011.653637.
- 46: Momeni S, Tomlin N, Ruby J. Isolation of *Raoultella planticola* from refillable antimicrobial liquid soap dispensers in a dental setting. *J Am Dent Assoc*. 2015;14(11):871-882. doi:10.1016/j.adaj.2014.12.013.
- 47: Huang C, Ma W, Stack S. The hygienic efficacy of different hand-drying methods: A review of the evidence. *Mayo Clin Proc*. 2012;87(8):791-798. doi:10.1016/j.mayocp.2012.02.019
- 48: Carmen Huesca-Espitia L del, Aslanzadeh J, Feinn R, Joseph G, Murray TS, Setlow P. Deposition of Bacteria and Bacterial Spores by Bathroom Hot Air Hand Dryers. *Appl Environ Microbiol*. 2018;84(9). doi:10.1128/AEM.00044-18

NOURISHMENT

The WELL Nourishment concept requires the availability of fruits and vegetables and nutritional transparency and encourages the creation of food environments where the healthiest choice is the easiest choice.

Nutrition and health are closely related. Poor nutrition is a top contributor to the global burden of noncommunicable diseases and a modifiable risk factor for numerous preventable chronic diseases.^[1] While fruits and vegetables are critical components of a healthy eating pattern, most individuals around the world do not consume the daily recommended five servings (400 g).^[1] Worldwide, diets are generally low in fruits, vegetables, whole grains and nuts and seeds, and 14% of gastrointestinal cancer deaths, 11% of ischemic heart disease deaths and 9% of stroke deaths are attributable to this insufficient fruit and vegetable intake.^[2] Diets around the world are characterized by an increasing consumption of highly refined and packaged foods and higher intakes of sodium, sugar and refined fats.^[3] These dietary patterns contribute to poor diets and poor health outcomes, including an increased risk of diet-related diseases. Diet-related health problems, which include cardiovascular disease, high blood pressure, type 2 diabetes and some cancers, continue to persist at high levels, alongside the increasing global prevalence of overweight and obesity.^[1] In 2010, nutritional deficiencies contributed more than 1.2 billion disability adjusted life years (DALYs) to the global burden of disease, while overweight and obesity were estimated to cause over 3 million deaths worldwide.^[4] Fortunately, food purchase and consumption decisions, dietary patterns and food preparation practices all represent avenues for health improvement. From restaurants and supermarkets to cafeterias and vending machines, a variety of interventions and strategies exist that can positively affect individual food choices and global dietary patterns.

Dietary patterns around the world are influenced by a complex mixture of personal, cultural and environmental factors, including the buildings and communities where we spend our time. The way our food environment is designed and operated as well as the availability and access to foods and beverages in this environment plays a role in supporting healthy choices and promoting healthy eating behaviors.^[5] The variety of settings in which we make our daily food choices, including our homes, workplaces, schools and communities, should empower healthy choices. Research shows that individual change is more likely to occur when environmental conditions and influences are aligned to support individual behaviors.^[6,7] Thus, improving nutrition and eating behaviors requires complementary efforts that span both policy and environmental change. This includes organizational policies to improve the availability, accessibility and consumption of healthy food choices for everyone, including individuals with dietary restrictions and food allergies. It also includes food advertising and marketing policies to support healthy eating and help normalize minimally processed, nutrient-dense foods. Environmental interventions include designated eating spaces that allow for social and mindful eating as well as food production and agriculture spaces that reconnect individuals to food and increase access to produce. Finally, strategies to increase nutritional knowledge and health literacy can complement existing environmental and policy interventions.

WELL supports healthy eating patterns by increasing access to healthier food and beverage choices, limiting access to highly processed foods and ingredients and designing environments that nudge individuals toward healthier choices.

Note: For more information on the maximum points available per feature by food and beverage offering see Appendix N1.

N01 FRUITS AND VEGETABLES | P

Intent: Promote the consumption of fruits and vegetables by making fruits and vegetables easily accessible.

Summary: This WELL feature requires the provision and promotion of fruits and vegetables if food is sold or provided.

Issue: Consumption of fruits and vegetables is a key component of a healthy dietary pattern for the prevention of chronic disease.^[1] However, most individuals around the world do not meet the daily recommended five servings (400 g).^[1] The World Health Organization estimated that 5.2 million deaths worldwide were attributable to low fruit and vegetable consumption in 2013.^[2] 14% of gastrointestinal cancer deaths, 11% of ischemic heart disease deaths and 9% of stroke deaths globally are also attributable to insufficient fruit and vegetable intake.^[2] Greater consumption of fruits and vegetables is associated with a reduced risk of cardiovascular disease, obesity, type 2 diabetes, stroke and certain types of cancers as well as improved weight management.^[1,8,9,10] Additionally, eating a variety of fruits and vegetables helps ensure adequate nutrient, micronutrient and dietary fiber intake.^[11]

Solutions: Subsidies to reduce the price of fruits and vegetables have been shown to be effective interventions to increase their consumption.^[12,13] Increased availability of fresh fruit at worksites has been shown to improve fruit and vegetable consumption at work and at home, showing that individuals take these healthier habits home.^[14] Strategies to increase fruit and vegetable consumption include behavioral interventions such as increased availability and visibility of fruits and vegetables, pricing incentives to lower the cost of fruits and vegetables and promotion and support of community gardens and urban agriculture initiatives.^[15]

Impact: Increasing the availability and access of fruits and vegetables can support fruit and vegetable consumption.

Part 1 Ensure Fruit and Vegetable Availability

For All Spaces:

Fruit and vegetable variety

If the following types of food are sold or provided on a daily basis within the project boundary, the selection includes a variety of fruits and vegetables as specified below per food offering:

- a. Packaged foods: at least two varieties of fruits and at least two varieties of vegetables.^[16]
- b. Foods prepared on-site: at least four varieties of fruits and at least four varieties of vegetables.^[17]

Note: Fruits and vegetables may be fresh, frozen, cooked, canned or dried/dehydrated. 100% fruit juices, 100% vegetable juices, fruits with added sugars, fried vegetables, nuts and seeds and starchy vegetables (e.g., potatoes, corn) do not count toward meeting the requirements.

OR-----

Fruit and vegetable options

If foods are sold or provided on a daily basis within the project boundary, the selection meets the following requirement:

- a. At least 50% of available options, including beverages, are fruits and/or vegetables.

Part 2 Promote Fruit and Vegetable Visibility

For All Spaces:

If foods are sold or provided on a daily basis within the project boundary, fruits and vegetables meet one of the following requirements:

- a. Placed at eye level or just below eye level.^[16,18,19]
- b. Placed next to cash registers.^[16,18,19]
- c. Placed at the end of aisles.^[16,18,19]
- d. Placed at the beginning of food service lines.^[16,18,19]
- e. Visible from the main building entrance.^[20,21]

N02 NUTRITIONAL TRANSPARENCY | P

Intent: Help individuals make informed food consumption choices through nutritional labeling and information.

Summary: This WELL feature requires the provision of detailed nutritional information, ingredient disclosure and food allergen and refined ingredient labeling for all foods sold or provided.

Issue: Nutritional information panels and nutrition facts labels are often found on prepackaged foods and beverages. These provide consumers with useful nutrient, ingredient and allergen information that can be used to guide food choices and daily intake. However, the same level of nutritional transparency does not exist for foods at restaurants, vending machine items and a variety of food retail establishments. Transparency is especially important for the millions of individuals with food allergies who must navigate many issues when dining away from home.

Solutions: Evidence is inconsistent as to whether calorie labeling reduces calories purchased or calories consumed, but the increased transparency has led to the introduction of lower-calorie items in restaurants and other establishments.^[22,23,24] Research also suggests that calorie labeling and similar health labeling interventions may serve as important sources of nutritional information for consumers and are associated with healthier food choices and increased calorie information awareness.^[25,26,27] Interventions that use color-coded labeling such as traffic light labeling (green = healthy; yellow = less healthy; red = unhealthy) have been shown to increase sale and selection of healthy items and decrease sale and selection of unhealthy items.^[28,29] For prepared or non-packaged foods, ingredient transparency through ingredient disclosure or labeling can help individuals identify and avoid potential allergens. As there is no cure for food allergies, avoidance of food allergens is a recommended strategy for preventing serious allergic reactions such as anaphylaxis.

Impact: Nutritional transparency can help individuals make informed food choices that support a healthy diet and increase nutrition awareness.

Part 1 Provide Nutritional Information

For All Spaces:

The following nutritional information is clearly displayed (per meal or item) at point-of-decision on packaging, menus or signage for all packaged foods and beverages sold or provided on a daily basis within the project boundary:

- a. Total calories.
- b. Macronutrient content (total protein, total fat and total carbohydrate) in weight and as a percent of the estimated daily requirements (daily values).
- c. Total sugar content.

Part 2 Implement Ingredient Labeling

For All Spaces:

The following requirements are met for all non-packaged foods and beverages sold or provided on a daily basis within the project boundary and foods prepared on-site:

- a. A list of ingredients is clearly displayed (per meal or item) at point-of-decision on packaging, menus or signage. If information is displayed on a digital resource, signage is present at point-of-decision to direct individuals to the digital resource.
- b. Common food allergens, as mandated by federal regulation, are clearly labeled at point-of-decision on packaging, menus or signage.

Part 3 Implement Refined Ingredient Labeling

For All Spaces:

All foods and beverages sold or provided on a daily basis within the project boundary that meet the following conditions are prominently labeled at point-of-decision to indicate high sugar content or partially hydrogenated oils:

- a. Beverages that contain more than 25 g of sugar per container.

- b. Non-beverage food items (except whole fruits) that contain more than 25 g of sugar per serving.
- c. Foods and beverages that contain partially hydrogenated oils.

N03 REFINED INGREDIENTS | O (MAX: 3 PT)

Intent: Help individuals avoid highly processed foods and ingredients.

Summary: This WELL feature requires that all foods and beverages comply with sugar, refined grain and artificial *trans* fat limitations and requires maintenance of frying oil quality.

Issue: Poor diets are the leading risk factor for mortality and morbidity globally, with an estimated 9% of the global burden of disease attributable to diets of poor nutritional content.^[30] Highly processed or refined foods contain many artificial ingredients, including added sugars, refined grains and artificial *trans* fats.^[31] Refining grains removes most of the vitamins, minerals and dietary fiber that are originally present. Dietary fiber is beneficial as it may lower the risk of heart disease, stroke, hypertension, diabetes and obesity and is associated with improved digestive health.^[32] However, high intake of sugar and added sugars is associated with poor diet quality, an increased risk of heart disease, weight gain, obesity and tooth decay.^[33,34,35] *Trans* fats have no known health benefits and increased intake of *trans* fats is associated with an increased risk of heart disease, stroke and type 2 diabetes.^[1,31,36] While low levels of *trans* fats exist naturally in meat and dairy products, the World Health Organization (WHO) has called for the global elimination of industrially-produced *trans* fats in an effort to reduce global *trans* fat intake.^[37]

Solutions: Increasing access to healthier food items includes increasing the availability of healthier alternatives as well as limiting the availability of highly processed foods. The WHO recommends that children and adults reduce intake of added sugars throughout their lifetime and further suggests reducing the intake of added sugars to less than 5% of total energy intake.^[33] Based on average adult daily energy requirements, this generally translates to consuming no more than 25 grams of added sugar per day. Limiting intake of sugar-sweetened beverages and sugary foods can help individuals meet WHO sugar recommendations and reduce daily sugar intake. Promoting the consumption of whole grains by increasing whole grain options can help individuals make at least half of their grains whole grains.^[1,36] Partially hydrogenated oils (or *trans* fats) are not part of a healthy diet and their intake should be strictly limited.^[1,38] Since frying oils can oxidize and degrade as they are used, they should be discarded before the level of degradation becomes hazardous to human health.^[39]

Impact: Poor diet is a top contributor to the global burden of non-communicable disease.^[30] Fortunately, the environments where individuals spend most their time can be an important point of intervention for the promotion of healthy diets.

Part 1 Limit Total Sugars (Max: 1 Pt)

For All Spaces:

All foods and beverages sold or provided on a daily basis within the project boundary meet the following requirements:

- Beverages do not contain more than 25 g of sugar per container.^[24] Bulk containers of 1 L [1 qt] or larger do not contain more than 25 g of sugar per serving.^[24]
- At least 25% of beverages contain no sugar per container or serving, or drinking water is available at no cost.
- No non-beverage food item (except whole fruit) contains more than 25 g of sugar per serving.^[24]

Part 2 Promote Whole Grains (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- In at least 50% of food offerings where a grain flour is the primary ingredient by weight, a whole grain is the primary ingredient.^[19]
- If both whole grain and refined grain options are available, whole grain options do not cost more than their refined grain counterparts (i.e., brown rice does not cost more than white rice).

Part 3 Manage Oils (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. All foods and beverages sold or provided on a daily basis within the project boundary do not contain partially hydrogenated oils.
- b. Frying oils used on-site are discarded before the level of total polar materials (TPM) becomes greater than 24% during operation.^[39]

N04 FOOD ADVERTISING | O (MAX: 2 PT)

Intent: Encourage the selection and consumption of healthier food choices through strategic placement and advertising.

Summary: This WELL feature requires healthy food advertising and nutritional messaging and strategic menu design to guide healthy food choices.

Issue: Billions of dollars are spent annually on food marketing and advertising around the world to overwhelmingly promote highly processed products including sugar-sweetened beverages, breakfast cereals and fast foods.^[40] In addition to advertisements, the availability, placement and visibility of foods and beverages in the immediate food environment have the power to influence our food choices and ultimately our health.^[41] Fortunately, food environment interventions can guide the selection of healthier items without limiting perceived freedom of choice through nudging strategies and other invisible modifications.^[41,42]

Solutions: Strategies that increase the visibility and convenience of healthy foods have been shown to promote healthier choices through increased sale and selection of healthier items and may encourage long-term changes in eating behaviors.^[28,43] Healthy food advertising has also been shown to increase the selection of healthier items and may have a stronger impact than anti-obesity advertising on shaping eating behaviors.^[44] These interventions have been effective in a variety of food settings including cafeterias, grocery stores and supermarkets.^[28,45,46]

Impact: Creating food environments where the healthiest food choice is the easiest food choice can help improve the diet quality and health of individuals.

Part 1 Promote Healthy Nutritional Messaging (Max: 1 Pt)

For All Spaces:

Healthy food advertising

Advertisements for foods and beverages within the project boundary meet the following requirements:

- a. Sugar-sweetened beverages are not marketed or promoted.^[47]
- b. Deep-fried food options are not marketed or promoted.^[48]

Nutritional messaging

Designated eating areas or common areas contain at least three different instances of messaging per project that communicate at least one of the following:

- a. Encouragement of the consumption of whole, natural foods.
- b. Encouragement of the consumption of drinking water.^[49,50]

Note: Nutritional messaging can take the form of prominent displays such as educational posters, brochures or other visual media.

Part 2 Implement Healthy Menu Design (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. A description of the nutritional criteria used to identify healthy menu items is submitted through WELL Online. Nutritional criteria should be based on dietary, scientific or medical evidence or guidelines.
- b. On menus and menu boards, healthy menu items are presented according to at least three of the following promotion strategies:
 1. Included as the default options throughout the menu (e.g., a salad is the default side instead of fries or chips).^[18]
 2. Listed using appealing descriptions.^[51,52]
 3. Visually highlighted through icons, different colors or bolding.^[53]

4. Listed first in each menu section.^[53]
5. Listed in prominent areas of the menu (e.g., the top, bottom, corners).^[53]

N05 ARTIFICIAL INGREDIENTS | O (MAX: 1 PT)

Intent: Help individuals avoid artificial colors, flavors, sweeteners and preservatives in foods and beverages.

Summary: This WELL feature requires projects to label and phase out or restrict artificial ingredients.

Issue: Numerous artificial ingredients are typically added to highly processed foods to improve taste and extend shelf life.^[54] However, since these additives do not add nutritional value to a food and tend to appear in foods with low nutritional quality, they should be avoided as often as possible. While some artificial ingredients do not carry immediate health risks, they may become toxic when consumed in large quantities and many have not been evaluated for their effects on metabolic regulation or potential contributions to obesity.^[55] Additionally, certain artificial dyes that are approved for use in the U.S. may be carcinogenic, cause hypersensitivity reactions and behavioral problems or be inadequately tested.^[56] In the EU, for example, foods that contain artificial dyes are required to carry label warnings that they may cause hyperactivity in children.^[57,58]

Solutions: Sourcing packaged foods and beverages without harmful artificial colors, flavors, sweeteners and preservatives can help limit artificial ingredient consumption as well as promote a diet of whole, natural foods. Labeling and phasing out the use of artificial ingredients that have been deemed ingredients of concern is an additional way to help individuals avoid consumption of potentially harmful additives. Fortunately, many food companies are phasing out artificial ingredients or reformulating recipes to remove them, a trend partly driven by growing consumer demand and an increased desire for nutritional transparency.^[59]

Impact: Reducing or restricting artificial ingredients can help individuals avoid potentially harmful ingredients.

Part 1 Restrict Artificial Ingredients (Max: 1 Pt)

For All Spaces:

One of the following requirements is met:

- a. A policy is in place to phase out (over a maximum of three years) the use, sale and provision of foods and beverages containing artificial ingredients listed in the table below. Additionally, all foods and beverages sold or provided within the project boundary are clearly labeled on packaging, nearby menus or signage to indicate whether they contain artificial ingredients listed in the table below.
- b. All foods and beverages sold or provided on a daily basis within the project boundary do not contain artificial ingredients listed in the table below:

Colorings ^[60]	Blue 1 (E133), Blue 2 (E132), Green 3, Orange B, Citrus Red 2, Red 3 (E127), Red 40 (E129), Yellow 5 (E102), Yellow 6 (E110), carmine, cochineal extract, caramel coloring
Sweeteners ^[60]	acesulfame-potassium (acesulfame-k), aspartame, saccharin, sucralose, cyclamate
Preservatives ^[60]	sodium nitrate, sodium nitrite, potassium bromate, potassium iodate, propyl gallate, BHA (butylated hydroxyanisole), BHT (butylated hydroxytoluene), BVO (brominated vegetable oil)

Note: These artificial ingredients and additives have been deemed “unsafe in amounts consumed or very poorly tested and not worth any risk” by the Center for Science in the Public Interest.^[60]

N06 PORTION SIZES | O (MAX: 1 PT)

Intent: Promote healthy portion sizes and reduce unintended overconsumption.

Summary: This WELL feature requires reduced-size food options when food is sold or provided and limits dishware sizes when food is self-serve.

Issue: The portion and packaging sizes of many foods have increased significantly over the last 30 years alongside rising global obesity rates.^[61,62] Larger packaging, meal sizes and dishware sizes are possible contributors to growing portion sizes, especially when portion and serving sizes do not align. Research suggests that individuals consistently consume more food and drink when offered larger-sized portions, packages or tableware than when offered smaller-sized versions.^[63]

Solutions: Smaller (half-size or reduced-size) portion size options for meals and individual food items can encourage reasonable portions without infringing on individual choice.^[16,19,48] Reducing the portion size of foods and beverages that are not nutrient dense, such as processed foods, can help individuals maintain calorie balance and reduce added sugar consumption.^[11] Dishware sizes can also be adjusted to promote healthier portion sizes. Larger dishware is associated with larger self-served portions and greater energy intake in both adults and children.^[63,64,65] Individuals also tend to underestimate the quantity of food when it is presented on a larger plate and overestimate the quantity when it is presented on a smaller plate.^[66,67,68] Though the effect of plate size may vary based on an individual's body weight or gender, it may have more influence when purposely used to guide appropriate portions.^[64,69,70]

Impact: Optimizing meal and dishware sizes can help guide appropriate portion sizes.

Part 1 Promote Healthy Portions (Max: 1 Pt)

For All Spaces:

Employee dining areas

Where food is sold or provided on a daily basis within the project boundary, the following requirements are met (as applicable):

- a. Where food is sold or provided for employees or visitors, at least one of the following is available for at least half of all offerings:
 1. Individual items offered in reduced-size or half-size portions (e.g., half-sandwich) and at a lower cost compared to the larger, regular version.^[16,19]
 2. A version of the main course offered in a reduced-size or half-size portion and at a lower cost compared to the larger, regular version.^[16,19]
- b. Where food sold or provided for employees or visitors is self-serve and requires the use of a serving plate, bowl or cup, each of the following is met (as applicable):
 1. Circular plates: the diameter of a plate is no larger than 25 cm [10 in].
 2. Non-circular plates: the total surface area of a plate does not exceed 507 cm² [79 in²].
 3. Bowls (except at salad stations) are no larger than 473 mL [16 oz].
 4. Cups (except for water) are no larger than 473 mL [16 oz].

Student dining areas

Where food sold or provided for primary or secondary school students is self-serve and requires the use of a serving plate, bowl or cup, each of the following is met (as applicable):

- a. Circular plates: the diameter of a plate is no larger than 20 cm [8 in] for primary and 25 cm [10 in] for secondary school students.^[65]
- b. Non-circular plates: the total surface area of a plate does not exceed 314 cm² [49 in²] for primary and 507 cm² [79 in²] for secondary school students.^[65]
- c. Bowls (except at salad stations) are no larger than 240 mL [8 oz] for primary and 355 mL [12 oz] for secondary school students.^[65]

- d. Cups (except for water) are no larger than 240 mL [8 oz] for primary and 355 mL [12 oz] for secondary school students.

N07 NUTRITION EDUCATION | O (MAX: 1 PT)

Intent: Improve dietary habits and eating behaviors and increase nutritional knowledge.

Summary: This WELL feature requires the provision of nutrition education.

Issue: Combined with access to nutritious foods, nutrition education is an effective strategy to encourage healthy eating behaviors and well-designed nutrition education programs can lead to healthier food choices. Participation in nutrition education programs was associated with increased fruit and vegetable intake in both children and adults.^[71,72,73] In children, school-based nutrition education was associated with decreased BMI and weight gain and increased fruit and vegetable consumption.^[74,75] It has also been shown to increase positive attitudes toward fruits and vegetables and may also improve academic performance in primary and middle school children.^[76,77,78,79] In adults, nutrition education programs that included cooking demonstrations were associated with increased fruit and vegetable consumption, knowledge of a healthy diet and skill in food preparation.^[80] Cooking demonstrations also increased frequency of home cooking and self-efficacy for following recipe instructions.^[80] At workplaces, nutrition education in combination with modifications to the food environment was associated with reductions in salt and saturated fat intake, lower BMI and higher nutrition knowledge.^[81] Overall, nutrition education initiatives have been successful in improving awareness, skills and motivation at home, school and work settings.

Solutions: Effective nutrition education can be delivered through multiple types of interventions and cover a variety of topics. Nutrition education has been shown to be more effective when focused on changing specific behaviors rather than only increasing knowledge.^[82,83] Additionally, nutrition education is more effective when combined with environmental dietary modifications such as strategic placement of healthier alternatives, portion size control and menu modifications.^[81] Educational programming that includes multiple types of interventions (mixed-method programming) and that is on-going or longer term has a greater impact than short-term, single-method interventions.^[72,81,83] The scope of nutrition education may also be broader than personal nutrition and health. For example, education can cover topics such as safe food handling practices, gardening and food production techniques as well as food preparation skills.

Impact: Nutrition education strategies can positively impact individual nutrition and health behaviors.

Part 1 Provide Nutrition Education (Max: 1 Pt)

For All Spaces:

At least one of the following is offered at no cost:

- a. Cooking demonstrations on a quarterly basis, at minimum.
- b. Nutrition or dietary education workshops on a quarterly basis, at minimum.
- c. Individual nutrition consultations by registered dietitians or certified nutrition professionals on a quarterly basis, at minimum.
- d. Educational materials including cookbooks, magazines or other literature that promotes healthy eating and nutrition, with at least three different resources available for every 100 regular building occupants or students.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 1: Provide Nutrition Education are met through the provision of educational materials then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

N08 MINDFUL EATING | O (MAX: 2 PT)

Intent: Encourage mindful eating behaviors and communal dining opportunities.

Summary: This WELL feature requires designated eating spaces that contain tables and chairs and the provision of daily meal breaks.

Issue: Eating behaviors are influenced by a variety of factors, including physiological and environmental. Eating alone and distracted eating have become emerging social concerns in modern life and are associated with a variety of social and health outcomes. Studies have found that people who tend to eat alone may be more likely to choose unhealthier foods, eat fewer fruits and vegetables and eat at irregular times.^[84] Eating alone may also be a potential risk factor for metabolic syndrome, a group of risk factors that increase the risk of heart disease, stroke and diabetes.^[85] There is also some evidence to indicate that distracted eating while working, reading, watching television or listening to music is associated with higher food intake.^[86] Fortunately, eating attentively and placing focus on the process of eating may lead to better control of food intake, and a positive relationship exists between mindful eating and mental well-being.^[87]

Solutions: The provision of designated eating spaces can encourage individuals to enjoy meals together, prevent distracted eating at workstations and lead to better eating habits. Psychological detachment from work (mentally and physically distancing oneself from work) during a break is associated with increased positive mood and life satisfaction and decreased burnout.^[88] In addition to eating spaces, having designated meal periods can help ensure individuals have and take time to eat meals mindfully.

Impact: Providing dedicated eating spaces and dedicated meal breaks can allow individuals to consume meals together and away from their workstations and encourage mindful eating.

Part 1 Include Designated Eating Space (Max: 1 Pt)

For All Spaces:

The project has a designated eating space for regular building occupants that meets the following requirements:

- a. Contains tables and chairs to accommodate at least 25% of regular building occupants at peak occupancy. If multiple designated eating spaces are present, the combined seating space must accommodate at least 25% of regular building occupants at peak occupancy.
- b. Provides protection from environmental elements (e.g., direct sunlight, rain, wind) or is in a climate-controlled space.

Part 2 Provide Daily Meal Breaks (Max: 1 Pt)

For All Spaces:

The following requirement is met:

- a. Employees and students (as applicable) have a daily meal or lunch period of at least 30 minutes and the opportunity to eat away from their workstation.

N09 SPECIAL DIETS | O (MAX: 2 PT)

Intent: Provide alternative food choices to individuals with dietary restrictions or food allergies.

Summary: This WELL feature requires the provision of meal alternatives and enhanced nutritional transparency when meals or catering are provided.

Issue: Individuals with food allergies, intolerances or dietary restrictions may encounter difficulty in finding suitable meal options outside of the home setting. The World Allergy Organization reports that the prevalence of food allergies is increasing in countries around the world.^[89] Additionally, a growing number of individuals are omitting certain ingredients or following special diets for a variety of personal, health, social and environmental reasons.^[59] Such dietary exclusion or restriction may have nutritional consequences and lead to a nutritionally deficient diet.^[90,91] Dietary guidelines increasingly recognize a variety of healthy eating patterns, such as the Mediterranean-style and vegetarian eating patterns, that can help ensure an individual's diet is both nutritionally adequate and enjoyable.^[11]

Solutions: Meal alternatives for common food allergies or intolerances and dietary restrictions can help accommodate individual dietary preferences and ensure the availability of meal options and balanced meals for everyone. Alternatives can minimize the stress and worry associated with food and dietary restrictions and allow individuals to focus on their work and tasks at hand. Suitable meal options can also minimize the risk of individuals consuming potentially harmful foods. To further reduce barriers to special dietary needs, alternative food items can be offered at the same or similar price as standard items. On-site registered dietitians and nutritionists can also help with day-to-day dietary management and help guide safe food choices. For prepared foods, ingredient transparency through ingredient disclosure and food allergen labeling can help individuals identify and avoid potential allergens.

Impact: Accommodating special dietary needs can help ensure equitable food access and support healthy eating patterns for everyone.

Part 1 Manage Allergies and Alternatives (Max: 1 Pt)

For All Spaces except Commercial Kitchen Spaces:

Meals, including catered meals, include at least one main course option for each of the following criteria upon request:

- a. Peanut-free.
- b. Gluten-free.
- c. Lactose-free.
- d. Egg-free.
- e. Containing no animal, seafood or dairy products.
- f. Containing no animal or seafood products, except for eggs and dairy.

For Commercial Kitchen Spaces:

A protocol is in place to confirm that the following requirements are met to prevent cross-contact during the preparation of meals:

- a. Hands are washed and gloves changed between preparing different menu items.^[92]
- b. All surfaces are cleaned (with warm water and soap) or sanitized between preparing different menu items.^[92]
- c. Clean kitchen tools and appliances (washed with warm water and soap) are used for food preparation.^[92]
- d. Meals are prepared on top of barriers (e.g., cutting boards, foil, parchment paper).^[92]

Part 2 Implement Enhanced Ingredient Labeling (Max: 1 Pt)

For All Spaces:

Projects have in place a protocol that requires all foods and beverages provided by catering within the project boundary to meet the following requirements:

- a. A list of ingredients is clearly displayed (per meal or item) at point-of-decision on packaging, menus or signage.
- b. Common food allergens, as mandated by federal regulation, are clearly labeled at point-of-decision on packaging, menus or signage.

N10 FOOD PREPARATION | O (MAX: 1 PT)

Intent: Provide space and supportive amenities for the preparation of meals on-site.

Summary: This WELL feature requires a food preparation area, storage space and other amenities to support the reassembly or reheating of meals on-site.

Issue: Consumption of foods away from home has steadily increased since the 1970s.^[59,93] This is a concerning trend since meals consumed away from home are often higher in calories, lower in nutrients and larger in portion size.^[94] Emerging research has found an association between eating away from home and a higher BMI and lower fruit and vegetable consumption in adults.^[95] Analysis of dietary intake data also shows that individuals who bring food from home tend to have a better diet quality than individuals who purchase food away from home.^[94]

Solutions: Spaces that allow individuals to reheat or assemble food prepared at home can support healthy eating habits and cooking skills. Sufficient cold storage space can ensure safe food storage to accommodate the storage needs of individuals who bring meals from home. Other supportive amenities including eating utensils and devices for reheating food can make it even easier for individuals to consume homemade meals and encourage healthy eating patterns.

Impact: Food preparation and storage space and supportive meal amenities can encourage individuals to bring healthier food options from home.

Part 1 Provide Meal Support (Max: 1 Pt)

For All Spaces except Dwelling Units:

Employee dining areas

At least one dining space contains the following supportive amenities that meet employee demand:

- a. Cold storage.
- b. Countertop surface.
- c. Sink and amenities for dish and hand washing.
- d. Device for reheating food (e.g., microwave, toaster oven).^[50]
- e. Dedicated cabinets or storage units available for employee use.
- f. Reusable eating utensils, including spoons, forks, knives and microwave-safe plates and cups.

Student dining areas

At least one dining space for primary and secondary school students meets the following requirements:

- a. Provides students with access to cabinets or storage units for food storage.^[50]
- b. Provides students with access to a device for reheating food (e.g., microwave, toaster oven).^[50]
- c. Provides reusable eating utensils, including spoons, forks and microwave-safe plates and cups.^[50]

For Dwelling Units:

Dining spaces in dwelling units provide the following supportive amenities:

- a. Countertop surface.
- b. Sink.
- c. Refrigerator.
- d. Cabinets.
- e. Stove with hood.

N11 RESPONSIBLE FOOD SOURCING | O (MAX: 1 PT)

Intent: Reduce dietary exposure to pesticides, hormones and antibiotics.

Summary: This WELL feature requires sourcing certified organic produce and Certified Humane[®] meat, egg or dairy products.

Issue: The use of antibiotics and hormones on animals and pesticides on produce is a global threat to public health and the ability to treat infectious diseases. Studies have confirmed that the use of antibiotics in agriculture and animals contributes to the development of antibiotic resistance in humans, and dietary pesticide exposure has been associated with adverse reproductive consequences in women and men.^[96,97,98,99] Additionally, consumption of certain pesticides has been linked to an increased risk for some types of cancer, and pregnant women exposed to higher amounts of pesticides have given birth to children with lower IQ points.^[100,101,102]

Solutions: Responsible sourcing practices and policies can help promote sustainable, ethical and socially responsible food purchases and promote animal welfare. While organically grown foods may not be significantly more nutritious than conventionally grown foods, organic produce has been shown to have lower levels of pesticide residue and organic chicken and pork are less likely to contain antibiotic-resistant bacteria than conventional food.^[103] Animal welfare standards serve to ensure animals are raised in humane conditions and address topics such as space allowance, transportation, feed and outdoor access provided for farm animals.^[104] Humane practices also limit the use of antibiotics and hormones on animals. Labeling organic and humanely raised foods can help individuals quickly identify these products as well as promote local farms and organizations.

Impact: Organic farming and humane animal practices limit the use of antibiotics, pesticides, hormones and additives during food production. Greater consumption of organic produce can help limit dietary exposure to harmful pesticides and hormones.^[103,105]

Part 1 Implement Responsible Sourcing (Max: 1 Pt)

For All Spaces:

Sustainable sourcing

The total product line (including products that are purchased, used and sold) meets the following criteria:

- a. At least 50% of the total produce line (fruits and vegetables) is certified organic.^[106]
- b. At least 25% of the total animal product line (meat, seafood, egg and dairy products) is certified organic or Certified Humane[®].^[104,106]

Sustainable labeling

Sustainable and humane agriculture is promoted through the following (as applicable):

- a. Certified organic and Certified Humane[®] products are labeled at point-of-decision.
- b. Local farms or sources are advertised at point-of-decision for locally sourced foods.

N12 FOOD PRODUCTION | O (MAX: 2 PT)

Intent: Improve access to fresh produce and provide opportunities for on-site food production.

Summary: This WELL feature requires the provision of space, infrastructure and tools for on-site food production.

Issue: As the urban population continues to grow, changing economic and environmental conditions have led to a disconnect between city dwellers and food production. Most food is produced hundreds of miles from where it is consumed, often threatening local food systems. However, consumers have an increasing desire to know how their food is made, raised or grown.^[59] This had led to the growth of a global movement committed to reconnecting individuals, communities and local food systems.

Solutions: Increasing access to locally grown food is important for many reasons, including food access and sustainability as well as community building efforts. Individuals who participate in communal gardening projects have increased fruit and vegetable intake, higher social engagement and a lower likelihood of consuming less nutritious foods such as sugar-sweetened beverages or processed sweets.^[107] These benefits have been shown to extend beyond the individual gardener, with participation in community agriculture associated with increased household fruit and vegetable intake as well.^[108] Beyond the nutritional benefits, gardens can also help fortify social cohesion, increase physical activity, provide on-site educational opportunities and increase perceptions of community safety.^[109]

Impact: Local food production cultivates equitable access to healthy, sustainably grown food and raises awareness around health and nutrition.

Part 1 Provide Gardening Space (Max: 1 Pt)

For All Spaces except Dwelling Units:

The project provides a permanent and accessible space for food production within 800 m [0.5 mi] of the project boundary that meets the following requirements:

- a. The space includes at least one of the following:
 1. Garden or greenhouse with food-bearing plants.^[110]
 2. Edible landscaping (e.g., fruit trees, herbs).^[110]
 3. Hydroponic farming system.^[110]
- b. The space is open to regular building occupants during regular building hours and foods grown are made available to regular building occupants.
- c. The space is at least 0.09 m² [1 ft²] per eligible employee or 0.05 m² [0.5 ft²] per student, whichever area is greater (up to a maximum of 70 m² [750 ft²]). The area calculated is the actual growing area (vertical or horizontal) used for the production of food-bearing plants.^[110]

For Dwelling Units:

The project provides a permanent and accessible space for food production within 800 m [0.5 mi] of the project boundary that meets the following requirements:

- a. The space includes at least one of the following:
 1. Garden or greenhouse with food-bearing plants.^[110]
 2. Edible landscaping (e.g., fruit trees, herbs).^[110]
 3. Hydroponic farming system.^[110]
- b. The space is open to regular building occupants during regular building hours and foods grown are made available to regular building occupants.
- c. The space is at least 1.4 m² [15 ft²] per unit (up to a maximum of 140 m² [1,500 ft²]). The area calculated is the actual growing area (vertical or horizontal) used for the production of food-bearing plants.^[110]

Part 2 Provide Planting Support (Max: 1 Pt)

For All Spaces:

■

Note: Projects may only receive points for this part if Part 1: Provide Gardening Space is also achieved.

A plan is in place that addresses the following:

- a. Management and maintenance of the gardening space(s) for a minimum of three years.^[110]
- b. Training, programming or educational opportunities available for regular building occupants (e.g., gardening workshops, plant harvesting guidelines) offered quarterly, at minimum.^[110]
- c. Provision of planting supplies, including planting medium, irrigation, lighting (interior spaces only), plants and gardening tools.^[110]

Note: Trainings must include culturally appropriate and literacy level appropriate education. Trainings may be provided on-site, off-site or online; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other qualified practitioners.

N13 LOCAL FOOD ENVIRONMENT | O (MAX: 1 PT)

Intent: Support healthy food access and reduce environmental barriers to healthy eating.

Summary: This WELL feature requires projects to take into consideration the local food environment during site selection or programming.

Issue: Dietary patterns around the world are influenced by a complex mixture of personal, cultural and environmental factors, including the local food environment. The local food environment encompasses the type and density of food retail outlets, including grocery stores and food service outlets, and the consistent availability of healthy, wholesome foods at these venues. However, certain environments have the potential to be more obesogenic than others, promoting weight gain and possibly contributing to obesity.^[111]

Solutions: Locating projects within close proximity to supermarkets and grocery stores with produce sections and farmers markets can help individuals improve their dietary and lifestyle behaviors through environments that support better food choices.^[11] Increased healthy food retail outlet density is associated with a lower BMI, while supermarket availability is associated with meeting dietary recommendations.^[112] On the other hand, exposure to an unhealthy food environment with many fast food outlets and unhealthy food choices may be associated with poorer quality diets and excess body weight.^[11] Mobile food markets, food carts and produce stands are additional ways to increase access to fruits and vegetables in the environments where individuals live, work and learn.

Impact: Local food environments with accessible and affordable healthy choices can help support individual dietary behaviors and reduce diet-related chronic disease.

Part 1 Ensure Food Access (Max: 1 Pt)

For All Spaces:

At least one of the following requirements is met:

- a. The project is located within 800 m [0.5 mi] walk distance of a supermarket or grocery store with a produce section.^[113]
- b. The project is located within 800 m [0.5 mi] walk distance of a farmers' market that is open at least once a week and operates for at least four months of the year.^[113]
- c. The project serves as a distribution point for community-based agriculture programs and has the resource capacity to deliver produce to regular building occupants at least twice a month for at least four months of the year.^[113]
- d. The project hosts on-site, weekly sale of produce within the project boundary (e.g., through food carts or mobile markets).^[114]

APPENDIX N1:

Foods and beverages sold or provided on the premises include all foods and beverages supplied by the project owner or by a vendor under contract with the owner, including items sold or provided in cafeterias, cafes and vending machines and items available to occupants in the kitchen or pantry areas. Projects that do not sell or provide food and beverages on a daily basis (defined as the majority of days in the operating week) are considered to be in compliance with the two Nourishment preconditions but will not be able to pursue most optimizations. However, projects that do not provide foods and beverages may be able to earn points for Features N04, N07, N08, N10, N12 and N13. See table below for additional information.

Maximum points available per feature by food and beverage offering:

Feature number	No foods or beverages provided	Snacks provided on a daily basis	Full-service dining; on-site food preparation
N01	0	0	0
N02	0	0	0
N03	0	3	3
N04	1	1	2
N05	0	1	1
N06	0	0	1
N07	1	1	1
N08	2	2	2
N09	0	0	2
N10	1	1	1
N11	0	1	1
N12	2	2	2
N13	1	1	1
Total points	8	13	17

REFERENCES

- 1: World Health Organization. Diet, Nutrition and the Prevention of Chronic Diseases-Report of the Joint WHO/FAO Expert Consultation. Geneva, Switzerland: WHO Press; 2003. [Reference](#).
- 2: World Health Organization. The World Health Report: Reducing Risks, Promoting Healthy Life. Geneva, Switzerland: WHO Press; 2002. [Reference](#).
- 3: Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev*. 2012;70(1):3-21. doi:10.1111/j.1753-4887.2011.00456.x.
- 4: Murray CJL, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012;380(9859):2197-2223. doi:10.1016/S0140-6736(12)61689-4.
- 5: Engbers LH, Van Poppel MNM, Chin A Paw MJM, Van Mechelen W. Worksite health promotion programs with environmental changes: A systematic review. *Am J Prev Med*. 2005;29(1):61-70. doi:10.1016/j.amepre.2005.03.001.
- 6: Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating Healthy Food and Eating Environments: Policy and Environmental Approaches. *Annu Rev Public Health*. 2008;29(1):253-272. doi:10.1146/annurev.publhealth.29.020907.090926.
- 7: Schwartz MB, Just DR, Chiqui JF, Ammerman AS. Appetite self-regulation: Environmental and policy influences on eating behaviors. *Obesity*. 2017;25:S26-S38. doi:10.1002/oby.21770.
- 8: Lock K, Pomerleau J, Causer L, Altmann DR, Mckee M. The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet. *Bull World Health Organ*. 2005;83(2). [Reference](#). Accessed October 18, 2017.
- 9: World Cancer Research Fund, American Institute for Cancer Research. Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective. Washington, D.C.; 2007. [Reference](#). Accessed October 18, 2017.
- 10: Hartley L, Igbinedion E, Holmes J, et al. Increased consumption of fruit and vegetables for the primary prevention of cardiovascular diseases. *Cochrane Database Syst Rev*. 2013. doi:10.1002/14651858.CD009874.pub2.
- 11: U.S. Department of Health and Human Services, U.S. Department of Agriculture. Dietary Guidelines for Americans, 2015-2020. 2015. [Reference](#).
- 12: Thow AM, Downs S, Jan S. A systematic review of the effectiveness of food taxes and subsidies to improve diets: Understanding the recent evidence. *Nutr Rev*. 2014;72(9). doi:10.1111/nure.12123.
- 13: Powell LM, Chiqui JF, Khan T, Wada R, Chaloupka FJ. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: A systematic review of prices, demand and body weight outcomes. *Obes Rev*. 2013;14(2):110-128. doi:10.1111/obr.12002.
- 14: Backman D, Gonzaga G, Sugerman S, Francis D, Cook S. Effect of Fresh Fruit Availability at Worksites on the Fruit and Vegetable Consumption of Low-Wage Employees. *J Nutr Educ Behav*. 2011;43(4):S113-S121. doi:10.1016/j.jneb.2011.04.003.
- 15: Centers for Disease Control and Prevention. The CDC Guide to Strategies to Increase the Consumption of Fruits and Vegetables.; 2011. doi:10.1007/BF01132983.
- 16: American Heart Association, American Stroke Association. American Heart Association Healthy Workplace Food & Beverage Toolkit. Dallas, TX; 2015. [Reference](#).
- 17: New York State Department of Health. *Food Standards - Cafeterias/Cafes Implementation Guide*. New York, NY; 2012. [Reference](#).
- 18: Centers for Disease Control and Prevention. Smart Food Choices: How to Implement Food Service Guidelines in Public Facilities, 2014. Atlanta, GA; 2014. [Reference](#).
- 19: Food Service Guidelines Federal Workgroup. Food Service Guidelines for Federal Facilities. Washington, DC; 2017. [Reference](#).
- 20: Laska MN, Pelletier JE. *Minimum Stocking Levels and Marketing Strategies of Healthful Foods for Small Retail Food*

Stores. Durham, NC; 2016. [Reference](#). Accessed November 14, 2017.

21: Caspi CE, Lenk K, Pelletier JE, et al. Association between store food environment and customer purchases in small grocery stores, gas-marts, pharmacies and dollar stores. *Int J Behav Nutr Phys Act*. 2017;14(1):76. doi:10.1186/s12966-017-0531-x.

22: Vadiveloo MK, Dixon LB, Elbel B. Consumer purchasing patterns in response to calorie labeling legislation in New York City. *Int J Behav Nutr Phys Act*. 2011;8(1):51. doi:10.1186/1479-5868-8-51.

23: Pulos E, Leng K. Evaluation of a Voluntary Menu-Labeling Program in Full-Service Restaurants. *Am J Public Health*. 2010;100(6):1035-1039. doi:10.2105/AJPH.2009.174839.

24: Bleich SN, Economos CD, Spiker ML, et al. A Systematic Review of Calorie Labeling and Modified Calorie Labeling Interventions: Impact on Consumer and Restaurant Behavior. *Obesity*. 2017;25(12):2018-2044. doi:10.1002/oby.21940.

25: Kiszko KM, Martinez OD, Abrams C, Elbel B. The influence of calorie labeling on food orders and consumption: a review of the literature. *J Community Health*. 2014;39(6):1248-1269. doi:10.1007/s10900-014-9876-0.

26: Skov LR, Lourenço S, Hansen GL, Mikkelsen BE, Schofield C. Choice architecture as a means to change eating behaviour in self-service settings: a systematic review. *Obes Rev*. 2013;14(3):187-196. doi:10.1111/j.1467-789X.2012.01054.x.

27: Chen R, Smyser M, Chan N, Ta M, Saelens BE, Krieger J. Changes in awareness and use of calorie information after mandatory menu labeling in restaurants in King County, Washington. *Am J Public Health*. 2015;105(3):546-553. doi:10.2105/AJPH.2014.302262.

28: Thorndike AN, Riis J, Sonnenberg LM, Levy DE. Traffic-Light Labels and Choice Architecture. *Am J Prev Med*. 2014;46(2):143-149. doi:10.1016/j.amepre.2013.10.002.

29: Thorndike AN, Sonnenberg L, Riis J, Barraclough S, Levy DE. A 2-Phase Labeling and Choice Architecture Intervention to Improve Healthy Food and Beverage Choices. *Am J Public Health*. 2012;102(3):527-533. doi:10.2105/AJPH.2011.300391.

30: Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012;380(9859):2224-2260. doi:10.1016/S0140-6736(12)61766-8.

31: Centers for Disease Control and Prevention. Trans Fat: The Facts. [Reference](#). Accessed November 1, 2017.

32: Anderson JW, Baird P, Davis RH, et al. Health benefits of dietary fiber. *Nutr Rev*. 2009;67(4):188-205. doi:10.1111/j.1753-4887.2009.00189.x.

33: World Health Organization. Guideline: Sugars Intake for Adults and Children. Geneva; 2015. [Reference](#). Accessed October 31, 2017.

34: Hu FB. Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases. *Obes Rev*. 2013;14(8):606-619. doi:10.1111/obr.12040.

35: Malik VS, Popkin BM, Bray GA, Després J-P, Hu FB. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. *Circulation*. 2010;121(11):1356-1364. doi:10.1161/CIRCULATIONAHA.109.876185.

36: Eckel RH, Jakicic JM, Ard JD, et al. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2014;129(25 Suppl 2):S76-99. doi:10.1161/01.cir.0000437740.48606.d1.

37: World Health Organization. *REPLACE Trans Fat: An Action Package to Eliminate Industrially-Produced Trans-Fatty Acids*; 2018.

38: Food and Agriculture Organization of the United Nations. Fats and Fatty Acids in Human Nutrition: Report of an Expert Consultation. FAO Food and Nutrition Paper 91. Rome, Italy; 2010. [Reference](#). Accessed October 31, 2017.

39: British Columbia Centre for Disease Control. Guidelines on Deep Fryers and Frying Oil. Vancouver, British Columbia; 2013. [Reference](#) and Forms/Guidelines and Manuals/EH/FPS/Food/GuidelinesonDeepFryersandFryingOilJan13.pdf.

40: Yale Rudd Center for Food Policy & Obesity. Fast Food Facts 2013. [Reference](#). Published 2013. Accessed August 18,

2017.

- 41: Wansink B. *Slim by Design: Mindless Eating Solutions for Everyday Life*. New York, NY: Harper Collins; 2014.
- 42: Bucher T, Collins C, Rollo ME, et al. Nudging consumers towards healthier choices: A systematic review of positional influences on food choice. *Br J Nutr*. 2016;115(12):2252-2263. doi:10.1017/S0007114516001653.
- 43: van Kleef E, Otten K, van Trijp HCM. Healthy snacks at the checkout counter: a lab and field study on the impact of shelf arrangement and assortment structure on consumer choices. *BMC Public Health*. 2012;12(1):1072. doi:10.1186/1471-2458-12-1072.
- 44: Rusmevichientong P, Streletskaia NA, Amatyakul W, Kaiser HM. The impact of food advertisements on changing eating behaviors: An experimental study. *Food Policy*. 2014;44:59-67. doi:10.1016/j.foodpol.2013.10.011.
- 45: Foster GD, Karpyn A, Wojtanowski AC, et al. Placement and promotion strategies to increase sales of healthier products in supermarkets in low-income, ethnically diverse neighborhoods: A randomized controlled trial. *Am J Clin Nutr*. 2014;99(6):1359-1368. doi:10.3945/ajcn.113.075572.
- 46: Glanz K, Bader MDM, Iyer S. Retail Grocery Store Marketing Strategies and Obesity. *Am J Prev Med*. 2012;42(5):503-512. doi:10.1016/j.amepre.2012.01.013.
- 47: von Philipsborn P, Stratil JM, Burns J, et al. Environmental interventions to reduce the consumption of sugar-sweetened beverages and their effects on health. *Cochrane Database Syst Rev*. July 2016. doi:10.1002/14651858.CD012292.
- 48: U.S. Department of Health and Human Services. *Health and Sustainability Guidelines for Federal Concessions and Vending Operations*. General Services Administration, ed. 2012. [Reference](#).
- 49: Centers for Disease Control and Prevention. *Increasing Access to Drinking Water in Schools*. Atlanta; 2011. [Reference](#).
- 50: Huang TT-K, Sorensen D, Davis S, et al. Healthy eating design guidelines for school architecture. *Prev Chronic Dis*. 2013;10(2):E27. doi:10.5888/pcd10.120084.
- 51: Turnwald BP, Boles DZ, Crum AJ. Association Between Indulgent Descriptions and Vegetable Consumption: Twisted Carrots and Dynamite Beets. *JAMA Intern Med*. 2017;177(8):1216. doi:10.1001/jamainternmed.2017.1637.
- 52: Wansink B. How Descriptive Menu Labels Influence Attitudes and Repatronage. *Adv Consum Res*. 2000;29:1-5.
- 53: Wansink B, Love K. Slim by design: Menu strategies for promoting high-margin, healthy foods. *Int J Hosp Manag*. 2014;42:137-143. doi:10.1016/j.ijhm.2014.06.006.
- 54: U.S. Food and Drug Administration. *Overview of Food Ingredients, Additives and Colors*. [Reference](#). Published 2010. Accessed September 14, 2017.
- 55: Simmons AL, Schleizinger JJ, Corkey BE. What Are We Putting in Our Food That Is Making Us Fat? Food Additives, Contaminants, and Other Putative Contributors to Obesity. *Curr Obes Rep*. 2014;3(2):273-285. doi:10.1007/s13679-014-0094-y.
- 56: Center for Science in the Public Interest. *Food Dyes: A Rainbow of Risks*. Ottawa, Ontario; 2010. [Reference](#).
- 57: Food Standards Agency. *Compulsory Warnings on Colours in Food and Drink*. [Reference](#). Published 2010. Accessed January 1, 2018.
- 58: Center for Science in the Public Interest. *The Science Linking Food Dyes with Impacts on Children's Behavior*. Washington, D.C.; 2016. [Reference linking food dyes.pdf](#).
- 59: The Nielson Company. *What's in Our Food and on Our Mind: Ingredient and Dining-Out Trends Around the World.*; 2016.
- 60: Center for Science in the Public Interest. *Chemical Cuisine | Center for Science in the Public Interest*. [Reference](#). Accessed September 14, 2017.
- 61: Duffey KJ, Popkin BM, Miller C, Smiciklas-Wright H, Kipnis V. Energy Density, Portion Size, and Eating Occasions: Contributions to Increased Energy Intake in the United States, 1977–2006. Ludwig D, ed. *PLoS Med*. 2011;8(6):e1001050. doi:10.1371/journal.pmed.1001050.
- 62: Nielsen SJ, Popkin BM. Patterns and trends in food portion sizes, 1977-1998. *JAMA*. 2015;289(4):450-453.

doi:10.1001/jama.289.4.450.

63: Hollands GJ, Shemilt I, Marteau TM, et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. Hollands GJ, ed. *Cochrane Database Syst Rev*. 2015;2017(3). doi:10.1002/14651858.CD011045.pub2.

64: Peng M. How does plate size affect estimated satiation and intake for individuals in normal-weight and overweight groups? *Obes Sci Pract*. 2017;3(3):282-288. doi:10.1002/osp4.119.

65: DiSantis KI, Birch LL, Davey A, et al. Plate size and children's appetite: effects of larger dishware on self-served portions and intake. *Pediatrics*. 2013;131(5):e1451-8. doi:10.1542/peds.2012-2330.

66: Wansink B. Environmental Factors that Unknowingly Increase a Consumer's Food Intake and Consumption Volume. *Annu Rev Nutr*. 2004;24:455-479. [Reference](#).

67: Wansink B, van Ittersum K, Painter JE. Ice Cream Illusions. Bowls, Spoons, and Self-Served Portion Sizes. *Am J Prev Med*. 2006;31(3):240-243. doi:10.1016/j.amepre.2006.04.003.

68: Wansink B, Cheney MM. Super Bowls: serving bowl size and food consumption. *JAMA*. 2005;293(14):1727-1728. doi:10.1001/jama.293.14.1727.

69: Robinson E, Nolan S, Tudur-Smith C, et al. Will smaller plates lead to smaller waists? A systematic review and meta-analysis of the effect that experimental manipulation of dishware size has on energy consumption. *Obes Rev*. 2014;15(10):812-821. doi:10.1111/obr.12200.

70: Yip W, Wiessing KR, Budgett S, Poppitt SD. Using a smaller dining plate does not suppress food intake from a buffet lunch meal in overweight, unrestrained women. *Appetite*. 2013;69:102-107. doi:10.1016/j.appet.2013.05.017.

71: Long Valerie, Cates Sheryl, Blitstein Jonathan, et al. *Supplemental Nutrition Assistance Program Education and Evaluation Study (Wave II)*. Washington, D.C.: U.S. Department of Agriculture; 2013. [Reference](#).

72: Pem D, Jeewon R. Fruit and Vegetable Intake: Benefits and Progress of Nutrition Education Interventions- Narrative Review Article. *Iran J Public Health*. 2015;44(10):1309-1321. doi:10.1017/CBO9781107415324.004.

73: Geaney F, Kelly C, Greiner BA, Harrington JM, Perry IJ, Beirne P. The effectiveness of workplace dietary modification interventions: A systematic review. *Prev Med (Baltim)*. 2013;57(5):438-447. doi:10.1016/j.ypmed.2013.06.032.

74: Silveira JAC, Taddei JAAC, Guerra PH, Nobre MRC. Effectiveness of school-based nutrition education interventions to prevent and reduce excessive weight gain in children and adolescents: a systematic review. *J Pediatr (Rio J)*. 2011;87(5):382-392. doi:10.2223/JPED.2123.

75: Silveira JAC da, Taddei JA de AC, Guerra PH, Nobre MRC. The effect of participation in school-based nutrition education interventions on body mass index: A meta-analysis of randomized controlled community trials. *Prev Med (Baltim)*. 2013;56(3-4):237-243. doi:10.1016/j.ypmed.2013.01.011.

76: Wall DE, Least C, Gromis J, Lohse B. Nutrition education intervention improves vegetable-related attitude, self-efficacy, preference, and knowledge of fourth-grade students. *J Sch Health*. 2012;82(1):37-43. doi:10.1111/j.1746-1561.2011.00665.x.

77: Prelip M, Kinsler J, Le Thai C, Erausquin JT, Slusser W. Evaluation of a School-based Multicomponent Nutrition Education Program to Improve Young Children's Fruit and Vegetable Consumption. *J Nutr Educ Behav*. 2012;44(4):310-318. doi:10.1016/j.jneb.2011.10.005.

78: Prelip M, Slusser W, Thai CL, Kinsler J, Erausquin JT. Effects of a school-based nutrition program diffused throughout a large urban community on attitudes, beliefs, and behaviors related to fruit and vegetable consumption. *J Sch Health*. 2011;81(9):520-529. doi:10.1111/j.1746-1561.2011.00622.x.

79: Pucher KK, Boot NMWM, De Vries NK. Systematic review: School health promotion interventions targeting physical activity and nutrition can improve academic performance in primary- and middle school children. *Health Educ*. 2013;113(5):372-391. doi:10.1108/HE-02-2012-0013.

80: Michaud P, Condrasky M, Griffin SF. Review and application of current literature related to culinary programs for nutrition educators. *Top Clin Nutr*. 2007;22(4):336-348. doi:10.1097/01.TIN.0000308470.95060.06.

81: Geaney F, Kelly C, Di Marrazzo JS, et al. The effect of complex workplace dietary interventions on employees'

- dietary intakes, nutrition knowledge and health status: A cluster controlled trial. *Prev Med (Baltim)*. 2016;89:76-83.
- 82: Contento IR. Nutrition education: linking research, theory, and practice. *Asia Pac J Clin Nutr*. 2008;17:176-179.
- 83: Hernández Betencourt L, Serra Majem L. Nontraditional nutrition education interventions: The radio ECCA method. *Eur J Clin Nutr*. 2003;57:S86-S89. doi:10.1038/sj.ejcn.1601811.
- 84: Conklin AI, Forouhi NG, Surtees P, Khaw KT, Wareham NJ, Monsivais P. Social relationships and healthful dietary behaviour: Evidence from over-50s in the EPIC cohort, UK. *Soc Sci Med*. 2014;100:167-175. doi:10.1016/j.socscimed.2013.08.018.
- 85: Kwon RA, Yoon YS, Min KP, Lee YK, Jeon JH. Eating alone and metabolic syndrome: A population-based Korean National Health and Nutrition Examination Survey 2013–2014. *Obes Res Clin Pract*. 2017. doi:Reference.
- 86: Stroebele N, de Castro JM. Listening to music while eating is related to increases in people's food intake and meal duration. *Appetite*. 2006;47(3):285-289. doi:10.1016/j.appet.2006.04.001.
- 87: Khan Z, Zadeh ZF. Mindful Eating and It's Relationship with Mental Well-Being. *Procedia -Social Behav Sci*. 2014;159:69-73. doi:10.1016/j.sbspro.2014.12.330.
- 88: Fritz C, Ellis AM, Demsky CA, Lin BC, Guros F. Embracing work breaks. Recovering from work stress. *Organ Dyn*. 2013;42(4):274-280. doi:10.1016/j.orgdyn.2013.07.005.
- 89: Prescott SL, Pawankar R, Allen KJ, et al. A global survey of changing patterns of food allergy burden in children. *World Allergy Organ J*. 2013;6(1):21. doi:10.1186/1939-4551-6-21.
- 90: Theethira TG, Dennis M, Leffler DA. Nutritional consequences of celiac disease and the gluten-free diet. *Expert Rev Gastroenterol Hepatol*. 2014;8(2):123-129. doi:10.1586/17474124.2014.876360.
- 91: Steinman H. Nutritional implications of food allergies. *South African J Clin Nutr*. 2010;23(1 SUPPL.):S37-S41. Reference
- 92: Food Allergy Research & Education (FARE). Prevent Cross-Contact. 2016. Reference. Accessed December 15, 2017.
- 93: Guthrie JF, Lin BH, Frazao E. Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: Changes and consequences. *J Nutr Educ Behav*. 2002;34(3):140-150. doi:10.1016/S1499-4046(06)60083-3.
- 94: Todd JE, Mancino L, Lin BH. The Impact of Food Away From Home on Adult Diet Quality. 2010. Reference. Accessed October 30, 2017.
- 95: Seguin RA, Aggarwal A, Vermeylen F, Drewnowski A. Consumption Frequency of Foods Away from Home Linked with Higher Body Mass Index and Lower Fruit and Vegetable Intake among Adults: A Cross-Sectional Study. *J Environ Public Health*. 2016;2016. doi:10.1155/2016/3074241.
- 96: Paulson JA, Zaoutis TE, Council on Environmental Health TCOE, Committee on Infectious Diseases TCOI. Nontherapeutic Use of Antimicrobial Agents in Animal Agriculture: Implications for Pediatrics. *Pediatrics*. 2015;136(6):e1670-7. doi:10.1542/peds.2015-3630.
- 97: Smith DL, Dushoff J, Morris JG. Agricultural Antibiotics and Human Health. *PLoS Med*. 2005;2(8):e232. doi:10.1371/journal.pmed.0020232.
- 98: Chiu YH, Afeiche MC, Gaskins AJ, et al. Fruit and vegetable intake and their pesticide residues in relation to semen quality among men from a fertility clinic. *Hum Reprod*. 2015;30(6):1342-1351. doi:10.1093/humrep/dev064.
- 99: Chiu YH, Williams PL, Gillman MW, et al. Association Between Pesticide Residue Intake From Consumption of Fruits and Vegetables and Pregnancy Outcomes Among Women Undergoing Infertility Treatment With Assisted Reproductive Technology. *JAMA Intern Med*. 2017. doi:10.1001/jamainternmed.2017.5038.
- 100: Bouchard MF, Chevrier J, Harley KG, et al. Prenatal Exposure to Organophosphate Pesticides and IQ in 7-Year-Old Children. *Environ Health Perspect*. 2011;119(8):1189-1195. doi:10.1289/ehp.1003185.
- 101: Rauh V, Arunajadai S, Horton M, et al. Seven-Year Neurodevelopmental Scores and Prenatal Exposure to Chlorpyrifos, a Common Agricultural Pesticide. *Environ Health Perspect*. 2011;119(8):1196-1201. doi:10.1289/ehp.1003160.
- 102: Koutros S, Alavanja MCR, Lubin JH, et al. An Update of Cancer Incidence in the Agricultural Health Study. *J Occup Environ Med*. 2010;52(11):1098-1105. doi:10.1097/JOM.0b013e3181f72b7c.

- 103:** Smith-Spangler C, Brandeau ML, Hunter GE, et al. Are Organic Foods Safer or Healthier Than Conventional Alternatives? *Ann Intern Med.* 2012;157(5):348. doi:10.7326/0003-4819-157-5-201209040-00007.
- 104:** Humane Farm Animal Care. Humane Farm Animal Care Comprehensive Animal Welfare Standards Comparison By Program – Chickens, Beef Cattle and Pigs. Middleburg, VA; 2013. [Reference](#).
- 105:** Curl CL, Beresford SAA, Fenske RA, et al. Estimating Pesticide Exposure from Dietary Intake and Organic Food Choices: The Multi-Ethnic Study of Atherosclerosis (MESA). *Environ Health Perspect.* February 2015. doi:10.1289/ehp.1408197.
- 106:** U.S. Department of Agriculture. National Organic Program. [Reference](#). Published 2017. Accessed October 26, 2017.
- 107:** Blair D, Giesecke CC, Sherman S. A dietary, social and economic evaluation of the Philadelphia urban gardening project. *J Nutr Educ.* 1991;23(4):161-167. doi:10.1016/s0022-3182(12)81191-5.
- 108:** Alaimo K, Packnett E, Miles RA, Kruger DJ. Fruit and Vegetable Intake among Urban Community Gardeners. *J Nutr Educ Behav.* 2008;40(2):94-101. doi:10.1016/j.jneb.2006.12.003.
- 109:** Local Government Commission. Cultivating Community Gardens: The Role of Local Government in Creating Healthy, Livable Neighborhoods. [Reference](#).
- 110:** U.S. Green Building Council. Pilot credit 82: Local food production. [Reference](#). Published 2009. Accessed December 15, 2017.
- 111:** Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: The development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Prev Med (Baltim).* 1999;29(6 I):563-570. doi:10.1006/pmed.1999.0585.
- 112:** Lamichhane AP, Puett R, Porter DE, Bottai M, Mayer-Davis EJ, Liese AD. Associations of built food environment with body mass index and waist circumference among youth with diabetes. *Int J Behav Nutr Phys Act.* 2012;9:81. doi:10.1186/1479-5868-9-81.
- 113:** U.S. Green Building Council. LEED v4 for Neighborhood Development. 2014. [Reference v4 ND_04.05.16_current.pdf](#).
- 114:** City of New York. Active Design: Guide for Community Groups. 2013. [Reference](#).

LIGHT

The WELL Light concept promotes exposure to light and aims to create lighting environments that are optimal for visual, mental and biological health.

Light is the main driver of the visual and circadian systems.^[1] Light enters the human body through the eye, where it is sensed by photoreceptors in the retina that are linked to the visual and circadian systems. The photoreceptors include rods, cones and intrinsically photosensitive retinal ganglion cells (ipRGCs).^[2] Cones and rods facilitate vision whereas ipRGCs do not have a visual response and function only to facilitate circadian synchronization and other non-visual responses to light.^[3,4] Humans are diurnal, meaning they are innately prone to wakefulness during the day and sleepiness at night. Light exposure stimulates the circadian system, which starts in the brain and regulates physiological rhythms throughout the body's tissues and organs, such as hormone levels and the sleep-wake cycle.^[5] Humans and animals have internal clocks that synchronize physiological functions on a roughly 24-hour cycle called the circadian rhythm. The circadian rhythm is synchronized with the natural day-night cycle through different environmental cues, the main cue being light. IpRGCs are non-image-forming photoreceptors in the eyes that contain the pigment melanopsin and are responsible for circadian synchronization.^[6] Disruption or desynchronization of the circadian rhythm has been linked with obesity, diabetes, depression and metabolic disorders.^[7,8,9,10,11,12] Exposure to bright light at night is associated with circadian phase disruption, which in turn can cause negative health effects, such as breast cancer and metabolic and sleep disorders.^[13,1,10] High lighting levels at night including light from bright screens can contribute to the disruption of the circadian rhythm.^[14]

All light—not just sunlight—can contribute to circadian photoentrainment.^[3] Given that people spend much of their waking day indoors, insufficient illumination or improper lighting design can lead to drifting of the circadian phase, especially if paired with inappropriate light exposure at night.^[14] Humans are continuously sensitive to light, and under normal circumstances, light exposure in the late night/early morning will shift our rhythms forward (phase advance), whereas exposure in the late afternoon/early night will shift our rhythms back (phase delay).^[14] Phase delays and phase advances in the circadian rhythm can impact sleep-wake cycles and desynchronize circadian rhythms. To maintain optimal, properly synchronized circadian rhythms, the body requires periods of both light and darkness.^[3,15]

Additionally, studies have shown that light exposure has an impact on the mood and reduces symptoms of depression in individuals.^[17,18] Exposure to light has also been directly linked with health and can affect how we recover and heal. Rooms with large, sun-facing windows reduce recovery time for patients suffering from severe depression and those recuperating after heart attacks, compared to similarly afflicted patients in rooms with windows facing buildings or other obstructions.^[16] Reduced exposure to daylight has been linked to the onset of depression and impairment of cognitive function in individuals.^[19,20] Studies show strong links between better views, brighter light and better performance in office environments.^[21]

The lighting environments where humans spend their time impact their visual, circadian and mental health. Currently, lighting conditions in most spaces are designed to meet the visual needs of individuals but do not take into account circadian and mental health. This presents an opportunity for projects to provide lighting conditions required by humans for optimal health and well-being.

Integrating daylight and electric light to create lighting strategies focused on human health, along with traditional requirements for visual acuity and comfort, can lead to healthier and more productive environments. Understanding the specific needs and preferences of users in a space is integral to creating effective lighting environments. For example, patients in a hospital ward have different lighting requirements than individuals in an office environment. Understanding user needs in a space is key to creating a healthier space. Environments that take into account these lighting strategies and user needs can contribute to improvement of the overall mood and increase the productivity of employees.^[7,13,1]

WELL aims to provide a lighting environment that reduces circadian phase disruption, improves sleep quality and positively impacts mood and productivity.

L01 LIGHT EXPOSURE AND EDUCATION | P

Intent: Provide access to indoor light exposure and light education.

Summary: This WELL feature requires projects to ensure appropriate light exposure in indoor environments by using daylighting or electric lighting strategies. To encourage users to seek light exposure on their own, projects are required to provide users with education about the importance of light for health.

Issue: Mammals function on an approximately 24-hour cycle, following what are referred to as circadian rhythms.^[5] Light is the main driver of the circadian system, which controls body processes such as digestion, the release of certain hormones, body temperature and sleep. Humans evolved their sleep schedules to be dependent on the natural day-night cycle. Electric light has only been widely used as a source of light for less than 200 years.^[22] The increase in the use of electric lighting has led to indoor environments relying on electric light over daylight. However, reduced exposure to light has been linked to the onset of depression and impairment of cognitive function in individuals.^[19,20] Irregular sleep-wake cycles have been linked to poorer academic performance in college students.^[36] Depression is a common illness worldwide, with more than 300 million people affected.^[23] Studies have shown that light exposure during daytime has been linked to increases in productivity and sleep quality in individuals.^[16,24] Light exposure has also been shown to reduce symptoms of depression.^[17]

Solutions: Access to appropriate levels of light in indoor environments can be achieved through building design, space layout and lighting design. Windows, atriums and skylights are design features that can be utilized to increase daylight in a space. The interior layout of the space also has an impact on the daylight exposure received by users; for example, conference rooms can be added to the center of the floor plate so that regularly occupied spaces have daylight exposure. Lighting strategies using electric lighting can be utilized to achieve required light exposure.

Impact: Providing indoor access to daylight can positively influence the productivity and mood of individuals while supporting the alignment of their circadian rhythms with the natural day-night cycle.^[1,28]

Part 1 Ensure Indoor Light Exposure

For All Spaces except Dwelling Units:

Daylight in regularly occupied spaces

Projects meet at least one of the following requirements:

- Spatial Daylight Autonomy of $sDA_{200,40\%}$ is achieved for at least 30% of regularly occupied space.
- 30% of all workstations are within 6 m [20 ft] of transparent envelope glazing. Visible light transmittance (VLT) of transparent glazing is greater than 40%.
- Transparent envelope glazing area is no less than 7% of the floor area for each floor level^[28]. VLT of envelope glazing is greater than 40%.

OR-----

Daylight in common spaces

Regular building occupants have unrestricted access to common spaces with unassigned seating that accommodates at least 15% of regular building occupants at any given time. The spaces are located within the project boundary and each meet at least one of the following requirements:

- Spatial Daylight Autonomy of $sDA_{300,50\%}$ is achieved for at least 70% of the space.
- 70% of all seating in the space is within 5 m [16 ft] of transparent envelope glazing with views to the exterior. Visible light Transmittance (VLT) of envelope glazing is greater than 40%.
- Transparent envelope glazing area is no less than 10% of gross internal floor area of the space. Visible Light Transmittance (VLT) of envelope glazing is greater than 40%.

Note: Common spaces may include but are not restricted to:

- Break rooms
- Cafeterias

- General spaces

OR-----

Electric light in regularly occupied spaces

Achieve Feature L03: Circadian Lighting Design. Any points earned through Feature L03: Circadian Lighting Design are still counted in the project's overall score, but may not be counted toward the required 2-point minimum for this concept.

For Dwelling Units:

One of the following requirements is met in each dwelling unit:

- a. Spatial Daylight Autonomy of sDA_{200/40%} is achieved for at least 30% of the space.
- b. Transparent envelope glazing area is no less than 7% of the floor area. Visible light transmittance (VLT) of envelope glazing is greater than 40%.
- c. Achieve Feature L03: Circadian Lighting Design. Any points earned through Feature L03: Circadian Lighting Design are still counted in the project's overall score, but may not be counted toward the required 2-point minimum for this concept.

Part 2 Promote Lighting Education

For All Spaces:

Projects provide educational resources on circadian rhythm, sleep hygiene, age-related increase in light requirements and/or importance of daylight exposure on circadian and mental health that meet at least two of the following requirements:

- a. Educational signage is placed at high traffic points around the space.
- b. Newsletters or newsletter entries are issued to all occupants at least every quarter.
- c. At least two of the resources provided for Part 2: Health and Wellness Education of Feature C01: Health and Wellness Awareness cover information on circadian rhythm, sleep hygiene, age-related increase in light requirements and/or importance of daylight exposure to circadian and mental health.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information. If the requirements of Part 2: Promote Lighting Education are met through the provision of educational materials then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

Projects should consider primary language(s) spoken by the local population when creating signage.

L02 VISUAL LIGHTING DESIGN | P

Intent: Provide visual comfort and enhance acuity for all users through electric lighting.

Summary: This WELL feature requires projects to provide appropriate illuminances on work planes for regular users of all age groups while taking into account light levels required for the tasks performed in the space.

Issue: Humans perceive the world through visual cues that are received through images formed on the retina of the eye. The light levels in a space can enhance the user's ability to perform tasks in that space while contributing to the feeling of spaciousness. The age of the individual is also a factor in the amount of light required for visual acuity. As humans age, the transmission of light through their lenses is reduced. This is due to age-related changes including increased light absorption by the lenses, smaller pupil size, increased scattering of light due to thicker lenses and yellowing of the lenses.^[30,31] This aging of the eye indicates that an increase in light levels is required to ensure visual acuity.

Solutions: While developing a lighting strategy to accommodate the visual acuity of users, it is critical to take into account the tasks conducted as well as the age of the users. Projects may refer to published recommendations by lighting associations or authorities on using electric lighting design strategies for light levels required on the work plane. Lighting recommendations published by authorities provide a range of lighting levels for different age groups and tasks.

Impact: Visual abilities of individuals are dependent on the properties of the lighting environment and the light entering the eye. Visibility and the ability to perform a task require a minimum threshold of illuminance, which may be achieved by incorporating electric lighting with adequate daylighting strategies.

Part 1 Light Levels for Visual Acuity

For All Spaces:

The following requirements are met:

- a. All indoor and outdoor spaces (including transition areas) comply with illuminance threshold requirements specified in one of the following lighting reference guidelines:
 1. IES Lighting Handbook 10th Edition.^[32]
 2. EN 12464-1: 2011.^[33]
 3. ISO 8995-1:2002(E) (CIE S 008/E:2001).^[34]
 4. GB50034-2013.^[35]
- b. A lighting plan details the below:
 1. Tasks or activities considered for visual lighting design in the project. All tasks and activities regularly undertaken by occupants are considered.
 2. Height of work plane or other target of illumination.
 3. Age ranges for the majority of occupants.

Note: Projects should provide the reference guideline used, height of work plane or target of illumination, tasks/applications considered and age groups of occupants.

L03 CIRCADIAN LIGHTING DESIGN | O (MAX: 3 PT)

Intent: Support circadian health through interventions using electric lighting.

Summary: This WELL feature requires projects to provide users with appropriate exposure to light for maintaining circadian health and aligning the circadian rhythm with the day-night cycle.

Issue: Circadian rhythms are kept in sync by various cues, including light which the body responds to in a way that is facilitated by intrinsically photosensitive retinal ganglion cells (ipRGCs), the non-image-forming photoreceptors of the eyes.^[6] Humans have evolved to base their circadian rhythms around the natural light-dark patterns associated with daytime and night-time. Being indoors for extended periods of time often does not provide humans with opportunities for the required amount of exposure to daylight, considering typical indoor electric light levels compared to the amount of light the human body expects to receive outdoors.^[18] This impacts the functioning of the circadian system and quality of sleep. Disruption of circadian rhythm has been linked with obesity, diabetes, depression and metabolic disorders.^[20] Exposure to light at night has been associated with negative health effects, such as breast cancer, circadian phase disruption and sleep disorders.^[13,1] The circadian response of humans to light is dependent on the light that enters the eye and on factors such as spectral properties of the light, brightness levels, duration and timing of exposure. The circadian system is more sensitive to shorter wavelengths of light, and the sensitivity peaks at 480 nm.^[37]

Solutions: Since ipRGCs are located in the retina of the eye, the light levels entering the eye of the occupant must be considered. While developing lighting design for circadian impact, the light levels must be achieved on the vertical plane, at the eye level of the occupant to simulate the light entering the eye of the user.^[38,39] It is also important to consider the duration of exposure to light as well as the timing of exposure. Stimulating the circadian system at night through exposure to bright light can negatively impact sleep quality.^[1,4,40]

Impact: Indoor light levels can have a larger impact on people than seasonal changes in daylight hours.^[1,43] Supporting the circadian health of users through electric lighting interventions can help maintain a healthy circadian system and improve sleep quality, mood and cognitive functions.^[1]

Part 1 Lighting for the Circadian System (Max: 3 Pt)

For All Spaces:

Electric lighting is used to achieve light levels shown in the table below as measured on the vertical plane at eye level of the occupant. The light levels are achieved at least between the hours of 9 a.m. and 1 p.m. and may be lowered after 8 p.m. at night:

- a. The project meets the following requirements in regularly occupied spaces:

Electric light only	Electric light and daylight	Points	
At least 150 EML [136 melanopic equivalent daylight D65]	OR	The project achieves at least 120 EML [109 melanopic equivalent daylight D65] with electric light and at least 2 points in Feature L05: Enhanced Daylight Access.	1
At least 240 EML [218 melanopic equivalent daylight D65]	OR	The project achieves at least 180 EML [163 melanopic equivalent daylight D65] with electric light and at least 2 points in Feature L05: Enhanced Daylight Access.	3

Note:
For workstations, the light levels may be achieved at 45 cm [18 in] above the work plane.
For spaces without workstations, light levels may be achieved at a height of 140 cm [55 in].
Note that light levels are achieved on the vertical plane at eye level to simulate the light entering the eye of the occupant.

L04 GLARE CONTROL | O (MAX: 3 PT)

Intent: Minimize visual discomfort caused by glare from daylight and electric light.

Summary: This WELL feature requires projects to manage glare by using a combination of strategies such as calculating of glare, choosing appropriate light fixtures for the space and using shading techniques.

Issue: Glare is defined as excessive brightness of the light-source, excessive brightness-contrasts and excessive quantity of light.^[44,45] Glare management is an integral part of lighting design. Glare has been associated with a host of health issues that range from visual discomfort and eye fatigue to headaches and migraines.^[44,25] Studies have shown that glare can lead to visual impairment and discomfort which can cause accidents in the workplace. Individuals under the age of 50 are more sensitive to glare.^[46] Since a substantial section of the workforce falls into this age group it is important to address glare to avoid visual fatigue and glare-induced headaches.

Solutions: Space planning and lighting design can minimize the amount of glare experienced by individuals in the space. For electric lighting, the light source, type of luminaires used and lighting layout can lead to reduced glare. For daylighting, integrating shading for all windows or conducting a daylighting analysis in the space can help manage solar glare.

Impact: The impact of reducing glare in a space improves the visual experience of the occupants in the space. Continued exposure to glare can trigger migraine attacks and headaches in sensitive individuals and eye fatigue in others. Implementing strategies to mitigate glare minimizes distraction and contributes to overall comfort and focus of users.^[47]

Part 1 Control Solar Glare (Max: 2 Pt)

For All Spaces:

Window shading

The following requirements are met:

- a. All spaces have interior or exterior shading. Atria or lobbies may be excluded.
- b. The shading is controllable by the occupants or set to automatically prevent glare. If shading is controlled by occupants, all shades are raised or retracted either manually or automatically at least twice per week.

OR-----

Glare calculation

The following requirement is met:

- a. Annual sunlight exposure of ASE_{1000,250} is achieved for no more than 10% of regularly occupied space.

Part 2 Manage Glare from Electric Lighting (Max: 2 Pt)

For All Spaces:

Each luminaire meets one of the following requirements for regularly occupied spaces. Wall wash fixtures properly aimed at walls, as specified by manufacturer’s data, as well as decorative fixtures may be excluded from meeting these requirements:

- a. 100% of light is emitted above the horizontal plane.
- b. Unified Glare Rating (UGR) values are met as per the below conditions:
 - 1. Luminaires installed at a height of 5 m (16 ft) or lower meet UGR of 17 or lower.
 - 2. Luminaires installed at a height greater than 5 m (16 ft) meet UGR of 20 or lower.
- c. Shielding angles are as described in the below table:

Luminance	Shielding angle, α (α = 90 - cutoff angle)

< 20,000 cd/m ² (including reflected sources)	No shielding required
20,000 cd/m ² to 50,000 cd/m ²	15°
50,000 cd/m ² to 500,000 cd/m ²	20°
> 500,000 cd/m ²	30°

- d. Fixtures have a luminance of less than 10,000 cd/m² between 45 and 90 degrees from nadir, and/or an intensity of less than 1,000 candela between 45 and 90 degrees from nadir.

L05 ENHANCED DAYLIGHT ACCESS | O (MAX: 3 PT)

Intent: Support circadian and psychological health through indoor daylight exposure and outdoor views.

Summary: This WELL feature requires projects to design spaces to integrate daylight into indoor environments so that daylight may be used for visual tasks along with electric lighting. It also provides individuals with a connection to outdoor spaces through view windows.

Issue: Humans spend approximately 90% of their time indoors. The way buildings are designed has an enormous impact on occupant exposure to daylight.^[16] Exposure to daylight has been proven to have a substantial impact on mood, circadian health and productivity.^[16,48] For example, studies have associated lack of exposure to daylight with a disruption in the circadian rhythms of humans and a decrease in quality of sleep.^[16] Rooms with large windows reduce recovery time for patients suffering from severe depression and those recuperating after heart attacks, compared to similarly afflicted patients in rooms with windows facing buildings or other obstructions.^[16,49,50] Exposure to daylight for at least three hours a day was found to reduce stress and increase satisfaction at work for nurses working in a hospital.^[51] Window characteristics have also been found to have an impact on students' performance in schools.^[52] Students have been shown to perform better when they have access to windows that can be opened.^[53] Studies also show strong links between quality of views in office environments and performance of employees.^[21]

Solutions: Building design and interior layout have a substantial impact on the amount of daylight in an indoor space. Indoor daylight access should be accounted for at all stages of building planning from architectural and façade design to interior design and layout. Calculation of daylight ingress accounting for seasonal variances and interior design of indoor spaces is required to ensure that users have adequate access to daylight exposure.

Impact: Providing users with daylight in a space provides visual, emotional and physiological benefits. Daylight contributes to light levels, thus helping with the performance of visual tasks in a space, while exposure to daylight has been proven to have positive impacts on mood and is an integral requirement for circadian rhythm alignment.

Part 1 Implement Enhanced Daylight Plan (Max: 1 Pt)

For All Spaces except Dwelling Units:

Projects meet at least one of the following requirements on each floor:

- a. 70% of all workstations are within 7.5 m [25 ft] of transparent envelope glazing or atria. Visible light transmittance (VLT) of transparent glazing is greater than 40%.
- b. Window area is no less than 10% of the regularly occupied floor area. Visible light transmittance (VLT) of transparent glazing is greater than 40%.

For Dwelling Units:

The following requirement is met in each dwelling unit:

- a. Window area is no less than 10% of the floor area. Visible light transmittance (VLT) of transparent glazing is greater than 40%.

Part 2 Implement Enhanced Daylight Simulation (Max: 2 Pt)

For All Spaces except Dwelling Units:

The following requirement is met:

- a. Projects demonstrate through computer simulations that sDA_{300,50%} is achieved for the area on each floor as shown in the table below:

sDA _{300,50%}	Points
Achieved for > 55% of regularly occupied floor area	1
Achieved for > 75% of regularly occupied floor area	2

For Dwelling Units:

The following requirement is met:

- a. Project demonstrate through computer simulations that sDA_{300,50%} is achieved for the area in each dwelling unit as shown in the table below:

sDA _{300,50%}	Points
Achieved for > 55% of regularly occupied floor area	1
Achieved for > 75% of regularly occupied floor area	2

Part 3 Ensure Views (Max: 1 Pt)

For All Spaces:

Transparent envelope glazing provides access to views for at least 50% of occupants. Views meet at least two of the following requirements:

- a. If at ground floor, distance from fenestration to roadway is at least 7.5 m [25 ft] from the exterior of the glazing.
- b. View factor of 3 or greater.^[21]
- c. Views with a vertical view angle of at least 30 degrees from occupant facing forward or sideways provide a direct line of sight to the ground or sky.

Note:

While considering views, permanent interior obstructions are included.

View factors may be calculated using the process outlined in *Windows and Offices: A Study of Office Worker Performance and the Indoor Environment*.^[21]

L06 VISUAL BALANCE | O (MAX: 1 PT)

Intent: Create lighting environments that enhance visual comfort.

Summary: This WELL feature requires projects to develop and implement strategies that take into account the light sources used in a space and create a visually comfortable lighting environment.

Issue: A lighting environment may utilize different kinds of light sources, including daylighting and different types of electric lighting technology. Lighting is planned across spaces to achieve the required ambience and energy efficiency goals. However, fluctuating light levels impact the visual comfort of occupants and could lead to eye fatigue.^[61] Sudden increases and decreases in brightness can cause a high level of visual discomfort.^[32] Constant changes in lighting have been linked to distraction from the task at hand which can decrease productivity and impact well-being.^[62]

Solutions: Development of a lighting layout and operations schedule to complement the lighting design in a space is key to increasing the comfort of users. Evidence suggests that thoughtful planning of lighting in a space that takes into account color temperature, daylight and electric light supports a visually comfortable lighting environment.^[63,64] Consideration of the ages of users, tasks performed and existing physical features in the space are also integral to creating a productive space.

Impact: The development of an efficient and optimized lighting layout has an impact on the visual comfort and productivity of individuals.^[62] A lighting schedule contributes to the visual comfort of individuals and also to the perception of comfort in a space.

Part 1 Manage Brightness (Max: 1 Pt)

For All Spaces:

At least four of the following requirements are met in all regularly occupied spaces:

- a. Main rooms do not exhibit 10 times greater or lesser luminance than an ancillary space.^[65] This is to avoid substantial changes in light levels as occupants move from one space to another.
- b. Surfaces do not exhibit 3 times greater or lesser luminance than an adjacent surface.^[65] This is to avoid substantial changes in light levels as occupants look around their immediate area.
- c. Surfaces do not exhibit 10 times greater or lesser luminance than another remote surface in the same room.^[65] This is to avoid substantial changes in light levels as occupants look around the room.
- d. Changes in light levels to 1.5 times higher or lower than initial light levels are carried out over the span of at least 30 minutes in steps or with a smooth transition. Timing considerations in the rate of change of light levels or spectrum diminish abrupt or disruptive lighting transitions.
- e. Uniformity of at least 0.4 is achieved on work planes. Exclude supplemental lighting from calculations.
- f. One section of the ceiling does not exhibit 10 times greater or lesser luminance than another section of the ceiling in the same room.^[65] Distribution of light across ceilings in a given room that maintains lighting variety but avoids both dark spots and bright spots.

L07 ELECTRIC LIGHT QUALITY | O (MAX: 2 PT)

Intent: Enhance visual comfort and minimize flicker using electric lighting.

Summary: This WELL feature requires projects to take into account characteristics of electric light used in the space such as color rendering, color quality and flicker.

Issue: Humans have evolved to depend on the sun as the main and ideal source of light. Humans are tuned to the color rendering provided by daylight and recognize colors in association with daylight.^[66] Color can impact peoples' cognition and behavior.^[67] Using electric light with high color rendering can improve people's perception of a space, and low color rendering can impact the ability to differentiate between objects and perceive the surroundings accurately. Electric lighting used indoors also has low frequencies of flicker that are not present in daylight. Flicker has been associated with eye strain, headaches, migraines and epileptic seizures.^[68,69] In 2016, migraines accounted for 16 million disability adjusted life years (DALYs) in men and 30 million DALYs in women.^[70]

Solutions: Identifying and utilizing lighting fixtures that emit a high quality of light and do not display signs of flicker contributes to a comfortable and healthy space. Light fixtures with higher color rendering emit light that show colors realistically. Color Rendering Index (CRI) and IES TM-30-15 are commonly used metrics used to determine the color rendering properties of a light source.

Impact: Using light sources that have characteristics similar to daylight can improve the comfort and well-being of users in a space and contribute to creating a healthy environment.

Part 1 Ensure Color Rendering Quality (Max: 1 Pt)

For All Spaces except Circulation Areas:

Electric lighting meets at least one of the following color rendering requirements. Decorative fixtures, emergency lights and other special-purpose lighting may be excluded from these requirements.

- a. Electric lighting meets one of the following requirements:

Metric	Threshold
CRI	CRI > 90
CRI, R9	CRI > 80 with R9 > 50
IES TM-30-18	IES $R_f \geq 78$, IES $R_g \geq 100$, $-1\% \leq \text{IES } R_{cs,h1} \leq 15\%$

For Circulation Areas:

Electric lighting meets at least one of the following color rendering requirements. Decorative fixtures, emergency lights and other special-purpose lighting may be excluded from these requirements.

- a. Electric lighting meets one of the following requirements:

Metric	Threshold
CRI	CRI > 80
IES TM-30-18	IES $R_f \geq 78$, IES $R_g \geq 98$, $-7\% \leq \text{IES } R_{cs,h1} \leq 15\%$

Part 2 Manage Flicker (Max: 1 Pt)

For All Spaces:

All electric lights (except decorative lights, emergency lights and other special-purpose lighting) used in regularly occupied spaces meet at least one of the following requirements for flicker:

- a. A minimum frequency of 90 Hz at all 10% intervals from 10% to 100% light output.^[73]
- b. LED products with a "low risk" level of flicker (light modulation) of less than 5%, especially below 90 Hz operation

as defined by IEEE standard 1789-2015 LED.^[73]

L08 OCCUPANT CONTROL OF LIGHTING ENVIRONMENTS | O (MAX: 2 PT)

Intent: Provide individuals with access to lighting environments that can be customized to their requirements.

Summary: This WELL feature requires projects to implement innovative lighting strategies that take into account personal preferences of users as well as their interaction with the physical space.

Issue: Humans spend about 90% of their time indoors and the ambience of the indoor environments has an impact on the well-being and productivity of occupants. Lighting in a space has been shown to have a positive impact on mood and cognitive performance.^[72,74] Lighting environments that are customizable by individuals have been shown to improve satisfaction levels.^[71] The ages of occupants have an impact on the light levels required for visual acuity.^[32,76] Lighting guidelines recommend twice the light levels for individuals over the age of 65 years compared to individuals between the ages of 25 years and 65 years.^[32,65,76] As humans age, the transmission of light through their lens is reduced. This is due to age related changes including increased light absorption by the lenses, smaller pupil size, increased scattering of light due to thicker lenses and yellowing of the lenses.^[30,31]

Solutions: Developing a lighting environment that not only seeks to satisfy the visual and circadian requirements of individuals, but also creates a customizable environment helps to improve the productivity, mood and well-being. Innovative lighting strategies, including the customization of a user's immediate environment, can contribute to occupant satisfaction with the space. Creating zones with lighting conditions that are distinct from the lighting in regular work spaces can create a comfortable and informal environment that individuals can utilize for social interaction.

Impact: Lighting environments can help to improve mental health, reduce stress and improve visual acuity.^[80]

Part 1 Enhance Occupant Controllability (Max: 1 Pt)

For All Spaces:

Ambient lighting systems in regularly occupied spaces meet the following requirements:

- a. Light systems are tunable and automated to meet the circadian and visual requirements of the occupants.
- b. Occupants have control of light levels, color temperature and color of electric light in their immediate environment and can override automated settings for at least 30% of operating hours.

Part 2 Provide Supplemental Lighting (Max: 1 Pt)

For All Spaces except Dwelling Units:

The following requirements are met:

- a. Supplemental light fixtures meet the following requirements:
 1. Can increase the light level on the task surface to at least twice the recommended light levels based on the reference used to meet Part 1: Light Levels for Visual Acuity in Feature L02: Visual Lighting Design.
 2. Are provided at no cost upon request.
- b. Requests for supplemental light fixtures are met within eight weeks of request.

REFERENCES

- 1: LeGates TA, Fernandez DC, Hattar S. Light as a central modulator of circadian rhythms, sleep and affect. *Nat Rev Neurosci.* 2014;15(7):443-454. doi:10.1038/nrn3743.
- 2: Provencio I. *The Hidden Organ in Your Eyes.* Vol 304.; 2011.
- 3: Pickard GE, Sollars PJ. Intrinsically photosensitive retinal ganglion cells. *Rev Physiol Biochem Pharmacol.* 2012;162:59-90. doi:10.1007/112_2011_4.
- 4: Ostrin LA, Abbott KS, Queener HM. Attenuation of short wavelengths alters sleep and the ipRGC pupil response. *Ophthalmic Physiol Opt.* 2017;37(4):440-450. doi:10.1111/opo.12385.
- 5: Czeisler CA, Gooley JJ. Sleep and Circadian Rhythms in Humans. *Cold Spring Harb Symp Quant Biol.* 2007;72:579-597.
- 6: Lucas RJ, Peirson SN, Berson DM, et al. Measuring and using light in the melanopsin age. *Trends Neurosci.* 2014;37(1):1-9. doi:10.1016/j.tins.2013.10.004.
- 7: Cho Y, Ryu SH, Lee BR, Kim KH, Lee E, Choi J. Effects of artificial light at night on human health: A literature review of observational and experimental studies applied to exposure assessment. *Chronobiol Int.* 2015;32(9):1294-1310. doi:10.3109/07420528.2015.1073158.
- 8: Challet E, Kalsbeek A. Circadian Rhythms and Metabolism.; 2017. doi:10.3389/978-2-88945-282-8.
- 9: Plano SA, Casiraghi LP, García Moro P, Paladino N, Golombek DA, Chiesa JJ. Circadian and Metabolic Effects of Light: Implications in Weight Homeostasis and Health. *Front Neurol.* 2017;8:558. doi:10.3389/fneur.2017.00558.
- 10: Fonken LK, Nelson RJ. The effects of light at night on circadian clocks and metabolism. *Endocr Rev.* 2014;35(4):648-670. doi:10.1210/er.2013-1051.
- 11: Boyce P, Barriball E. Circadian rhythms and depression. *Aust Fam Physician.* 2010;39(5):307-310. doi:10.1136/bmj.2.5961.3.
- 12: Germain A, Kupfer DJ. Circadian rhythm disturbances in depression. *Hum Psychopharmacol.* 2008;23(7):571-585. doi:10.1002/hup.964.
- 13: Hurley S, Goldberg D, Nelson D, et al. Light at night and breast cancer risk among California teachers. *Epidemiology.* 2014;25(5):697-706. doi:10.1097/EDE.0000000000000137.
- 14: Skeldon AC, Phillips AJK, Dijk D-J. The effects of self-selected light-dark cycles and social constraints on human sleep and circadian timing: a modeling approach. *Sci Rep.* 2017;7(February):45158. doi:10.1038/srep45158.
- 15: Buxton OM, L'Hermite-Balériaux M, Turek FW, van Cauter E. Daytime naps in darkness phase shift the human circadian rhythms of melatonin and thyrotropin secretion. *Am J Physiol Regul Integr Comp Physiol.* 2000;278(2):R373-R382. doi:10.1152/ajpregu.2000.278.2.R373.
- 16: Boubekri M, Cheung IN, Reid KJ, Wang C-H, Zee PC. Impact of Windows and Daylight Exposure on Overall Health and Sleep Quality of Office Workers: A Case-Control Pilot Study. *J Clin Sleep Med.* 2014;10(6):603-611.
- 17: Lam RW, Levitt AJ, Levitan RD, et al. Efficacy of Bright Light Treatment, Fluoxetine, and the Combination in Patients With Nonseasonal Major Depressive Disorder. *JAMA Psychiatry.* 2016;73(1):56. doi:10.1001/jamapsychiatry.2015.2235
- 18: Figueiro MG. Disruption of Circadian Rhythms by Light During Day and Night. *Curr Sleep Med Reports.* 2017;3(2):76-84. doi:10.1007/s40675-017-0069-0
- 19: Kent ST, McClure LA, Crosson WL, Arnett DK, Wadley VG, Sathiakumar N. Effect of sunlight exposure on cognitive function among depressed and non-depressed participants: a REGARDS cross-sectional study. *Environ Heal.* 2009;8(1):34. doi:10.1186/1476-069X-8-34.
- 20: Ruger M, Gordijn MC, Beersma DG, de Vries B, Daan S. Time-of-day-dependent effects of bright light exposure on human psychophysiology: comparison of daytime and nighttime exposure. *Am J Physiol Regul Integr Comp Physiol.* 2006;290(5):R1413-20. doi:10.1152/ajpregu.00121.2005.
- 21: California Energy Commission. Windows and Offices: A Study of Office Worker Performance and the Indoor

Environment. 2003. [Reference](#). Accessed December 8, 2017.

22: U.S. Department of Energy. The History of the Light Bulb | Department of Energy. [Reference](#). [Reference](#). Published 2013.

23: World Health Organization. WHO | Depression. World Heal Organ. 2017. [Reference](#). Accessed November 9, 2017.

24: Figueiro M, Steverson B, Heerwagen J, et al. *The Impact of Daytime Light Exposures on Sleep and Mood in Office Workers.*; 2017. doi:10.1016/j.sleh.2017.03.005

25: Harle DE, Shepherd AJ, Evans BJW. Visual Stimuli Are Common Triggers of Migraine and Are Associated With Pattern Glare. *Headache J Head Face Pain.* 2006;46(9):1431-1440. doi:10.1111/j.1526-4610.2006.00585.x.

26: Sanati L, Utzinger M. The effect of window shading design on occupant use of blinds and electric lighting. *Build Environ.* 2013;64:67-76. doi:10.1016/j.buildenv.2013.02.013.

27:

IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE). Illuminating Engineering Society. IES; 2013. [Reference](#)

28: Phipps-Nelson J, Redman JR, Dijk D-J, Rajaratnam SMW. Daytime exposure to bright light, as compared to dim light, decreases sleepiness and improves psychomotor vigilance performance. *Sleep.* 2003;26(6):695-700. [Reference](#).

29: The Danish Government. Building Regulations (BR10). Vol 16.; 2010. [Reference](#).

30: Pokorny J, Smith VC, Lutze M. Aging of the human lens. *Appl Opt.* 1987;26(8):1437. doi:10.1364/AO.26.001437.

31: Owsley C. Aging and vision. *Vision Res.* 2011;51(13):1610-1622. doi:10.1016/j.visres.2010.10.020.

32: Illuminating Engineering Society, David DiLaura, Kevin Houser, Richard Mistrick, Gary Steffy. *Lighting Handbook*, 10th Edition. Illuminating Engineering Society; 2011. [Reference](#).

33: British Standards Institution. BS EN 12464-2:2007-Lighting of work places. Outdoor work places. 2007. [Reference](#).

34: ISO 8995-1:2002(en), Lighting of Work Places — Part 1: Indoor. ISO; 2002. [Reference](#). Accessed February 2, 2018.

35: MOHURD and AQSIQ. GB 50034-2013 English Version, GB 50034-2013 Standard for lighting design of buildings (English Version) - Code of China. [Reference](#). Published 2013. Accessed March 13, 2018.

36: Phillips AJK, Clerx WM, O'Brien CS, et al. Irregular sleep/wake patterns are associated with poorer academic performance and delayed circadian and sleep/wake timing. *Sci Rep.* 2017;7(1):3216. doi:10.1038/s41598-017-03171-4.

37: Lockley SW, Brainard GC, Czeisler CA. High sensitivity of the human circadian melatonin rhythm to resetting by short wavelength light. *J Clin Endocrinol Metab.* 2003;88(9):4502-4505. doi:10.1210/jc.2003-030570.

38: Lockley SW, Arendt J, Skene DJ. Visual impairment and circadian rhythm disorders. *Dialogues Clin Neurosci.* 2007;9(3):301-314.

39: Technical Committee CEN/TC 169 "Light and lighting. CEN / TR 16791 : 2017 BSI Standards Publication Quantifying irradiance for eye-mediated non- image-forming effects of light in humans. 2017.

40: Koo YS, Song JY, Joo EY, et al. Outdoor artificial light at night, obesity, and sleep health: Cross-sectional analysis in the KoGES study. *Chronobiol Int.* 2016;33(3):301-314. doi:10.3109/07420528.2016.1143480.

41: Tashiro T, Kawanobe S, Kimura-Minoda T, Kohko S, Ishikawa T, Ayama M. Discomfort glare for white LED light sources with different spatial arrangements. *Light Res Technol.* 2015;47(3):316-337. doi:10.1177/1477153514532122.

42: Glickman G, Hanifin JP, Rollag MD, Wang J, Cooper H, Brainard GC. Inferior Retinal Light Exposure Is More Effective than Superior Retinal Exposure in Suppressing Melatonin in Humans. *J Biol Rhythms.* 2003;18(1):71-79. doi:10.1177/0748730402239678.

43: Crowley SJ, Molina TA, Burgess HJ. A week in the life of full-time office workers: work day and weekend light exposure in summer and winter. *Appl Ergon.* 2015;46 Pt A:193-200. doi:10.1016/j.apergo.2014.08.006.

44: Mainster MA, Turner PL. Glare's causes, consequences, and clinical challenges after a century of ophthalmic study. *Am J Ophthalmol.* 2012;153(4):587-593. doi:10.1016/j.ajo.2012.01.008.

45: Abrahamsson M, Sjöstrand J. Impairment of Contrast Sensitivity Function as a Measure of Disability Glare. *Invest Ophthalmol Vis Sci.* 1986;27(11):1131-1136).

- 46: Wolska A, Sawicki D. Evaluation of discomfort glare in the 50+ elderly: experimental study. *Int J Occup Med Environ Health*. 2014;27(3):444-459. doi:10.2478/s13382-014-0257-9.
- 47: Geerdinck LM, Van Gheluwe JR, Vissenberg MCJM. Discomfort glare perception of non-uniform light sources in an office setting. *J Environ Psychol*. 2014;39:5-13. doi:10.1016/j.jenvp.2014.04.002.
- 48: Amundadottir ML, Rockcastle S, Sarey Khanie M, Andersen M. A human-centric approach to assess daylight in buildings for non-visual health potential, visual interest and gaze behavior. *Build Environ*. 2017;113:5-21. doi:10.1016/j.buildenv.2016.09.033.
- 49: Beauchemin K, Hays P. Dying in the dark- sunshine, gender and outcomes in myocardial infarction. *J R Soc Med*. 1998;91:352-354.
- 50: Beauchemin K, Hays P. Sunny hospital rooms expedite recovery from severe and refractory depressions. *J Affect Disord*. 1996;40:49-51.
- 51: Alimoglu MK, Donmez L. Daylight exposure and the other predictors of burnout among nurses in a University Hospital. *Int J Nurs Stud*. 2005;42(5):549-555. doi:10.1016/j.ijnurstu.2004.09.001.
- 52: Heschong L, Wright RL, Okura S. Daylight Impacts on Human Performance in School. *J Illum Eng Soc*. 2002; (Summer):101-114.
- 53: Heschong L. Daylighting in Schools: An Investigation into the Relationship between Daylighting and Human Performance. Detailed Report. HMG-R-9803. 1999:140. [Reference](#).
- 54: World Health Organization. WHO | Falls. World Heal Organ. 2017. [Reference](#). Accessed November 12, 2017.
- 55: World Health Organization. Make Walking Safe: A Brief Overview of Pedestrian Safety Around the World. 2011. [Reference](#).
- 56: Brown MJ, Jacobs DE. Residential Light and Risk for Depression and Falls: Results from the LARES Study of Eight European Cities. *Public Health Rep*. 2011;126:131-140. doi:10.1177/00333549111260S117.
- 57: Figueiro MG, Plitnick B, Rea MS, Gras LZ, Rea MS. Lighting and perceptual cues: Effects on gait measures of older adults at high and low risk for falls. *BMC Geriatr*. 2011;11. doi:10.1186/1471-2318-11-49.
- 58: Kim BJ. Prevention of falls during stairway descent in older adults. *Appl Ergon*. 2009;40(3):348-352. doi:10.1016/j.apergo.2008.11.012.
- 59: Painter K. The influence of street lighting improvements on crime, fear and pedestrian street use, after dark. *Landsc Urban Plan*. 1996;35(2-3):193-201. doi:10.1016/0169-2046(96)00311-8.
- 60: British Standards Institution. EN 12464-1:2011 Light and Lighting - Lighting of Work Places. Part 1, Indoor Work Places. BSI; 2011. [Reference](#). Accessed March 9, 2018.
- 61: Kim SY, Kim JJ. The effect of fluctuating illuminance on visual sensation in a small office. *Indoor Built Environ*. 2007;16(4):331-343. doi:10.1177/1420326X06079947.
- 62: Veitch JA, Newsham GR, Boyce PR, Jones CC. Lighting appraisal, well-being and performance in open-plan offices: A linked mechanisms approach. *Light Res Technol*. 2008;40(2):133-148. doi:10.1177/1477153507086279.
- 63: Linhart F, Scartezzini JL. Evening office lighting - visual comfort vs. energy efficiency vs. performance? *Build Environ*. 2011;46(5):981-989. doi:10.1016/j.buildenv.2010.10.002.
- 64: Shen E, Hu J, Patel M. Energy and visual comfort analysis of lighting and daylight control strategies. *Build Environ*. 2014;78:155-170. doi:10.1016/j.buildenv.2014.04.028.
- 65: ANSI/IES RP-1-12, American National Standard Practice for Office Lighting. Illuminating Engineering Society of North America, American National Standards Institute. Recommended Practice for Office Lighting. Illuminating Society of North America; 2013. [Reference](#).
- 66: Papamichael K, Siminovitch M, Veitch JA, Whitehead L. High Color Rendering Can Enable Better Vision without Requiring More Power. *Leukos*. 2015;12(1-2):27-38. doi:10.1080/15502724.2015.1004412.
- 67: Elliot AJ, Maier MA. Color Psychology: Effects of Perceiving Color on Psychological Functioning in Humans. *Annu Rev Psychol*. 2014;65(1):95-120. doi:10.1146/annurev-psych-010213-115035
- 68: Lighting Ergonomics - Light Flicker. [Reference](#). Published 2015.

- 69: Poplawski M, Miller NM. Flicker in solid-state lighting: Measurement techniques, and proposed reporting and application criteria. In: Proceedings of CIE Centenary Conference "Towards a New Century of Light ", Parisndgesundheits.de. ; 2013. [Reference](#) and Miller CIE Flicker Paper 2013 shorter-1.pdf.
- 70: Institute for Health Metrics and Evaluation. GBD Compare. [Reference](#). Published 2017.
- 71: Veitch JA, Newsham GR. Exercised control, lighting choices, and energy use: An office simulation experiment. *J Environ Psychol.* 2000;20(3):219-237. doi:10.1006/jevp.1999.0169.
- 72: Küller R, Ballal S, Laike T, Mikellides B, Tonello G. The impact of light and colour on psychological mood: a cross-cultural study of indoor work environments. *Ergonomics.* 2006;49(14):1496-1507. doi:10.1080/00140130600858142.
- 73: IEEE Power Electronics Society. IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.; 2015. doi:10.1109/IEEESTD.2015.7118618.
- 74: Knez I. Effects of indoor lighting on mood and cognition. *J Environ Psychol.* 1995;15(1):39-51. doi:10.1016/0272-4944(95)90013-6.
- 75: aan het Rot M, Moskowitz DS, Young SN. Exposure to bright light is associated with positive social interaction and good mood over short time periods: A naturalistic study in mildly seasonal people. *J Psychiatr Res.* 2008;42(4):311-319. doi:10.1016/j.jpsychires.2006.11.010
- 76: ANSI/RP-28-16 Lighting and the Visual Environment for Seniors and the Low Vision Population. Lighting for the Aged and Partially Sighted Committee., Illuminating Engineering Society of North America. Recommended Practice for Lighting and the Visual Environment for Seniors and the Low Vision Population. [Reference](#)
- 77: Durak A, Camgöz Olguntürk N, Yener C, Güvenç D, Gürçinar Y. Impact of lighting arrangements and illuminances on different impressions of a room. *Build Environ.* 2007;42(10):3476-3482. doi:10.1016/j.buildenv.2006.10.048.
- 78: Veitch JA. Workplace design contributions to mental health and well-being. *Healthc Pap.* 2011;11(SPEC. ISSUE):38-46. doi:10.12927/hcpap.2011.22409.
- 79: aan het Rot M, Moskowitz DS, Young SN. Exposure to bright light is associated with positive social interaction and good mood over short time periods: A naturalistic study in mildly seasonal people. *J Psychiatr Res.* 2008;42(4):311-319. doi:10.1016/j.jpsychires.2006.11.010.
- 80: Gifford R. Light, decor, arousal, comfort and communication. *J Environ Psychol.* 1988;8(3):177-189. doi:10.1016/S0272-4944(88)80008-2.

MOVEMENT

The WELL Movement concept promotes movement, physical activity and active living and discourages sedentary behaviors through environmental design strategies, programs and policies.

Physical activity, or rather, inactivity, has emerged as a primary focus of public health due to a rise in premature mortality and chronic diseases attributed to physical inactivity, including type 2 diabetes, cardiovascular disease, depression, stroke, dementia and some forms of cancer.^[1-3] Despite the widely understood benefits of regular physical activity, the most recent global estimates from 2016 that present data from 146 countries, representing about 93% of the global population, show that nearly a quarter (23%) of the adult population are physically inactive.^[3] There are also evident disparities between developed and developing countries, where 29% and 15% of the population are estimated to be inactive, respectively.^[3] Compared to adults, adolescents and older populations exhibit even higher levels of physical inactivity—about 80% and 53%, respectively.^[3] Compared to adults, much less is known about successful interventions to improve physical activity in youth and older populations. Most recently, the research community has focused on classroom-based interventions and community-scale interventions to fill gaps in our understanding for adolescents and older adults.^[4] In 2013 alone, it is estimated that physical inactivity cost the healthcare systems globally about \$54 billion (converted for purchasing power parity) and contributed to nearly \$14 billion in productivity losses.^[5] Despite an international call to action emphasizing the need for policies that combat physical inactivity, the global response has been generally poor. The first international policy focused on physical activity was not put forth until 2004, and although 90% of the 160 countries assessed by the World Health Organization had a policy in place in 2015, only 75% are operational.^[3,6]

In addition to a rise in physical inactivity, sedentary behavior has also increased and has been linked to health outcomes including obesity, type 2 diabetes, cardiovascular risks and premature mortality.^[7-9] Sedentary behavior differs from physical inactivity and is characterized as very low-intensity, low-effort activities such as sitting.^[10] In a study published in 2011, self-reported time spent sitting ranged from three to as many as nine hours per day among adults, globally.^[11] While inactivity and sedentariness are distinct behaviors and risk factors, researchers note that those who report low physical activity levels are more likely to report higher levels of sedentary activity than their more active counterparts.^[11] The rising trends in sedentariness have led the global public health community to call for targeted efforts to reduce sedentary behavior and make evident a continued need to address physical inactivity at a population scale.

Early work in this field focused largely on personal factors and influencers of physical activity behavior. However, more recently, we have come to understand that our environment, including our sociocultural environment and communities, plays a significant role in active living and physical activity.^[2,12-17] Over time, our homes, schools, workplaces, communities, jobs and transportation systems have been physically designed to demand less movement and require more sedentary activities.^[3,18] In response, sectors that have not traditionally collaborated, such as design, planning and public health, have come together. The result is a growing body of peer-reviewed literature, evidence-based design guidelines and more progressive standards, codes and best practices that support environmental design for physical activity and active living at a building and community scale. Alongside the focus on building- and community-scale design interventions that support physical activity and active living, there is a continued need for interventions that address long-term behavior change and maintenance. Research and development in the field of physical activity behavior continue to produce a more refined body of literature on effective and scalable physical activity interventions such as incentives and structured programs.^[19,20]

WELL aims to promote movement, foster physical activity/active living and discourage sedentary behavior by creating and enhancing physical activity opportunities through the spaces where we live, learn, work and play. The impact of changing the global physical activity narrative is substantial. Worldwide, if physical inactivity were reduced by just 10%, more than half a million deaths could be averted, while over one million deaths could be averted if physical inactivity were reduced by 25%.^[21]

Note: In features that require access to on-site facilities, projects may consider off-site spaces under joint-use agreements toward these requirements provided they are within 200 m [656 ft] of the project boundary and are available to the project

population at no cost unless otherwise stated in feature-level notes/information. Unless otherwise specified, activity spaces cannot be double-counted across features or parts.

V01 ACTIVE BUILDINGS AND COMMUNITIES | P

Intent: To promote movement, physical activity and active living through the design of built spaces.

Summary: This WELL feature requires projects to select from a series of design-based optimizations.

Issue: Physical activity, or rather, inactivity, has emerged as a primary focus of public health due to a rise in premature mortality and chronic diseases attributed to physical inactivity, including type 2 diabetes, cardiovascular disease, depression, stroke, dementia and some forms of cancer.^[1-3] Despite widely disseminated physical activity guidelines (Appendix V1), global estimates from 2016 show that nearly a quarter (23%) of the adult population are physically inactive.^[3] In addition, over time, our homes, schools, workplaces, communities, jobs and transportation systems have been physically designed to demand less movement and require more sedentary activities over time.^[3,18]

Solutions: The ways in which aspects of built spaces are designed offers a ubiquitous platform through which to deliver public health intervention. Active design, a form of environmental design, considers how different components of a building such as staircases, physical activity spaces and pedestrian-scale elements around the building exterior, can encourage daily physical activity and movement.^[22] At a community scale, similar thinking leverages mixed-use development and transportation networks that are well connected and engineered to support walking, biking and thriving community life, all with the goal of encouraging active living and equity.^[22]

Impact: The impact of changing the global physical activity narrative is substantial. Worldwide, if physical inactivity were reduced by just 10%, more than half a million deaths could be averted, while over one million deaths could be averted if physical inactivity were reduced by 25%.^[21]

Part 1 Design Active Buildings and Communities

For All Spaces:

Achieve at least one point in one of the following features (this point is still added to the project's score, but any points earned in the selected feature do not count toward the required 2-point minimum for this concept):

- a. Feature V03: Movement Network and Circulation.
- b. Feature V04: Active Commuter and Occupant Support.
- c. Feature V05: Site Planning and Selection.
- d. Feature V07: Physical Activity Spaces and Equipment.
- e. Feature V09: Exterior Active Design.

V02 VISUAL AND PHYSICAL ERGONOMICS | P

Intent: Reduce physical strain and injury, improve ergonomic comfort and workplace safety and general well-being through ergonomic design and education.

Summary: This WELL feature requires projects to provide basic ergonomic workstation furnishings for desk- and standing-based workstations and education about workplace risk factors, signs and symptoms of discomfort, ergonomic policies and available furnishings.

Issue: In 2016, musculoskeletal disorders (MSDs) ranked seventh on the list of top drivers of global disability.^[23] Among those aged 15-49, the top contributors to MSDs included occupational injuries and ergonomic issues.^[23] MSDs are one of the most commonly reported causes of lost or restricted work time and also contribute to presenteeism and lost productivity.^[24,25] Estimates from the European Union value these types of losses summed to as much as 2% of gross domestic product.^[25] Risk factors for work-related MSDs include occupational hazards such as heavy lifting, bending, reaching overhead, pushing or pulling heavy objects, working in generally awkward positions or performing repetitive tasks.^[24] In addition, both prolonged sitting and standing pose health risks.^[9,26,27]

Solutions: Ergonomics is the science and practice of fitting the workplace to user need.^[24] Ergonomic interventions include both infrastructural (e.g., ergonomic design, furnishing selection) and programmatic (e.g., MSD reporting, education) strategies. Both types of interventions are required for this feature. In general, experts suggest that both prolonged standing and prolonged sitting should be considered and that occupants should alternate seated and standing positions throughout the day.^[28] In office settings, these types of recommendations draw additional support for height adjustable sit-stand workstations which allow occupants to alternate between sitting and standing easily and frequently.^[28,29] In one study, ergonomic training and the installation of negative-slope keyboards and ergonomic chairs reduced musculoskeletal symptoms by roughly 40%.^[30] A second study found that after ergonomic consultation and adjustments, self-reported prevalence, frequency and severity of work-related musculoskeletal symptoms were significantly reduced.^[31] When examining the impact of design elements that target the ergonomic challenges of prolonged standing, generally, studies conclude that use of anti-fatigue mats reduce discomfort.^[32,33] When possible, seats or sitting stools should also be provided to allow standing workers to either alternate between seated or standing positions, or to take a seated break.^[34] When considering the physical design of an ergonomic computer-based workstation, key physical characteristics to evaluate include seated position, keyboard position, mouse position and mobility, work surface and height, screen view/alignment and lighting.^[35-37] In addition to the physical characteristics of a workstation, there are also non-physical elements that projects should consider. According to a federal report completed in the U.S., key components of effective ergonomic programs include management commitment, employee involvement, problem identification, solution development, training and education for employees and medical management, including prevention and reporting.^[38]

Impact: Implementing ergonomic programs in the workplace has been associated with a return on investment; one case study demonstrated a return of \$10 USD for every \$1 USD invested in ergonomics.^[39] A more extensive study that summarized the benefits of ergonomics programs across 250 case studies found generally positive results including reductions in the number (49.5% across 37 studies) and cost (64.8% across 22 studies) of work-related MSDs and also noted that the payback period was generally less than one year.^[40] While case studies should be interpreted cautiously, they offer valuable insights into outcomes across unique and individual programs.

Part 1 Support Visual Ergonomics

For All Spaces:

All computer monitors, including laptops, can be adjusted by height and horizontal distance from the user through one or more of the following:

- a. Monitors with built-in height adjustment.^[36,37]
- b. Height-adjustable stands.^[36,37]
- c. Mounted, adjustable arms that hold primary or additional screens.^[36,37]

Note:

Projects may fulfill requirements for Part 1: Support Visual Ergonomics upon employee request, rather than providing all

ergonomic design elements at one time, so long as all employees have an opportunity to request such ergonomic design elements and requests are fulfilled within eight weeks. Delays beyond the eight-week period should be communicated to the employee.

Alternatively, projects may implement an incremental purchasing plan that fulfills requirements for Part 1: Support Visual Ergonomics by the time of recertification.

Part 2 Ensure Desk Height Flexibility

For All Spaces:

For at least 25% of seated-height workstations, employees have the ability to alternate between sitting or standing through one of the following:

- a. Adjustable height sit-to-stand desks.^[36,37]
- b. Desktop height-adjustment stands.^[36,37]

Note:

Projects may fulfill requirements for Part 2: Ensure Desk Height Flexibility upon employee request, rather than providing all ergonomic design elements at one time, so long as all employees have an opportunity to request such ergonomic design elements and requests are fulfilled within eight weeks. Delays beyond the eight-week period should be communicated to the employee.

Alternatively, projects may implement an incremental purchasing plan that fulfills requirements for Part 2: Ensure Desk Height Flexibility by the time of recertification.

Part 3 Ensure Seat Flexibility

For All Spaces:

All seating at workstations for employees meets the following adjustability requirements in compliance with the HFES 100-2007 standard or BIFMA G1-2013 guidelines:

- a. Chair height.^[36,37]
- b. Seat depth.^[36,37]
- c. One additional adjustability requirement:
 1. Seat angle.^[36,37]
 2. Backrest angle.^[36,37]
 3. Arm rests.^[36,37]

Note:

Projects may fulfill requirements for Part 3: Ensure Seat Flexibility upon employee request, rather than providing all ergonomic design elements at one time, so long as all employees have an opportunity to request such ergonomic design elements and requests are fulfilled within eight weeks. Delays beyond the eight-week period should be communicated to the employee.

Alternatively, projects may implement an incremental purchasing plan that fulfills requirements for Part 3: Ensure Seat Flexibility by the time of recertification.

Part 4 Provide Standing Support

For All Spaces:

All workstations in which employees are regularly required to stand for 50% or more of their working hours include at least 10 cm [4 in] of recessed toe space and one of the following:^[41]

- a. A footrest or footrail to allow employees to alternate resting feet or a seat or leaning chair that allows occupants to alternate between standing and sitting or leaning.^[34,42]

- b. Anti-fatigue mats or cushions that are also anti-slip and anti-trip.^[42]

Note:

Projects may fulfill requirements for Part 4: Provide Standing Support upon employee request, rather than providing all ergonomic design elements at one time, so long as all employees have an opportunity to request such ergonomic design elements and requests are fulfilled within eight weeks. Delays beyond the eight-week period should be communicated to the employee.

Alternatively, projects may implement an incremental purchasing plan that fulfills requirements for Part 4: Provide Standing Support by the time of recertification.

Part 5 Provide Ergonomics Education

For All Spaces:

Projects provide education that is appropriate for employees, type of work and workstations in the space. At a minimum, topics include:

- a. Information on how to recognize risk factors for musculoskeletal disorders and ergonomic issues in the work environment relevant to the project.^[43]
- b. Information on how to recognize signs and symptoms of musculoskeletal disorders relevant to the type of work conducted in the project space.^[43]
- c. Information on the reporting processes for risk factors and musculoskeletal disorders.^[43]
- d. Information on how to adjust ergonomic furnishings (e.g., seating) and workstations (e.g., height adjustment stands) provided by the project team.
- e. Information on the process for employees to request ergonomic furnishings (as applicable).
- f. Information on proper posture and/or form (e.g., proper posture while seated, standing, lifting, bending).

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 5: Provide Ergonomics Education are met through the provision of educational materials then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

Example educational materials include:

- Humanscale™ Healthy Workstation Guidelines.^[35]
- EWI Works resources.^[44]
- Cornell University, CUergo: Guides and Information.^[45]
- OSHA guidelines (applicable to various sectors and work environments).^[24]

V03 MOVEMENT NETWORK AND CIRCULATION | O (MAX: 3 PT)

Intent: Promote daily physical activity and movement through the design of the circulation network.

Summary: This WELL feature requires projects to consider the circulation network within the building and implement design and promotional strategies that promote regular movement and stair use (as applicable).

Issue: Physical inactivity and sedentariness have emerged as a primary focus of public health in recent years due to the host of negative health implications associated with both behaviors.^[1,2,7-9] Strategies that promote stair use and general movement throughout buildings have emerged as promising interventions that aim to encourage physical activity and break up prolonged periods of sedentary behavior.^[22]

Solutions: Evidence from systematic reviews (including international data from a variety of settings, such as airports, healthcare facilities, universities and offices) suggests that stairwell enhancements and signage increase stair use.^[46,47] In particular, point-of-decision design prompts that include directional signage and motivational messaging have been shown to be effective.^[47,48] Evidence further suggests that tailoring motivational signage and prompts to the audience or population that a space serves may help increase intervention effectiveness.^[46] Smaller studies have found that when paired with point-of-decision signage, enhancements such as artwork and music may help increase stair use in public buildings above and beyond signage alone.^[49] Novel strategies such as gamification, which leverages game elements to simulate desired behaviors, have been introduced as fun and innovative ways to encourage healthy behaviors such as stairclimbing in both public and private settings.^[50] At an infrastructural level, considering where stairs are placed, which is particularly relevant for new construction projects, can have a large impact on movement opportunities throughout the day. Evidence-based guidelines such as the Active Design Guidelines suggest that stairs should be proximate to main entry points and located physically and visibly before elevator or escalator banks.^[22]

Impact: By creating aesthetically designed staircases and hallways, WELL seeks to encourage occupants to be mobile throughout the day.

Part 1 Design Aesthetic Circulation Networks (Max: 1 Pt)

For All Spaces:

Hallways

Hallways within the project boundary are aesthetically designed through the inclusion of at least two of the following per floor:

- a. Music.^[22]
- b. Artwork.^[22]
- c. Light levels of at least 215 lux [20 fc] when in use.^[22,51]
- d. Views of an interior atrium, courtyard or daylight via windows or skylights.^[22,51]
- e. Natural design elements (e.g., plants, water features, images of nature).^[22]
- f. Gamification.^[50]

Staircases

At least one staircase or other active path between floors (e.g., ramps) is open to regular building occupants, services all floors of the project and is aesthetically designed through the inclusion of at least two of the following per floor:

- a. Music.^[22]
- b. Artwork.^[22]
- c. Light levels of at least 215 lux [20 fc] when in use.^[22,51]
- d. Views of an interior atrium, courtyard or daylight via windows or skylights.^[22,51]
- e. Natural design elements (e.g., plants, water features, images of nature).^[22]

- f. Gamification.^[50]

Part 2 Integrate Point-of-Decision Signage (Max: 1 Pt)

For All Spaces:

Projects implement point-of-decision signage that encourages stair use at each of the following locations within the project boundary (minimum of one sign per location):

- a. Elevator banks or other modes of motorized vertical circulation (e.g., escalators).^[22]
- b. Base of stairs/stairwells and re-entry points at each floor.^[22]
- c. Junctions in corridors that lead to either a stairwell open to regular building occupants or an elevator bank (or other modes of motorized vertical circulation).^[22]

Note:

Projects should consider primary language(s) spoken by the local population when creating signage.

Part 3 Promote Visible Stairs (Max: 1 Pt)

For All Spaces:

The following requirement is met:

- a. At least one staircase or other active path between floors (e.g., ramps) is open to regular building occupants, services all floors of the project and is located physically and/or visibly before any motorized vertical circulation (e.g., elevator or escalator).^[22,51]

V04 ACTIVE COMMUTER AND OCCUPANT SUPPORT | O

(MAX: 3 PT)

Intent: Promote active commuting through site amenities that support cycling and walking to the workplace.

Summary: This WELL feature requires projects to provide amenities for active commuters and active tenants, such as safe and secure bike storage and changing and shower facilities.

Issue: Active transportation is a great way to displace more sedentary modes of transportation, such as driving, and increase physical activity levels. In addition, active transportation has synergies with sustainability goals. However, many spaces are not designed to support active commuting and lack the amenities required to encourage participation. Particularly in the U.S., rates of active travel are lower than in European countries.^[52]

Solutions: Research suggests that lack of secure bicycle parking options is one of the leading reason cyclists do not bike to the workplace.^[53,54] A systematic review on this topic found that bicycle parking facilities were associated with increased perceptions that cycling to work was convenient and thus increased likelihood that employees would ride to work.^[55] Additional evidence from this same review suggests that implementing outdoor bicycle parking alone would increase mode share by 5.8%, indoor parking alone by 6.3% and indoor bicycle parking plus on-site showers by 7.1%.^[55] A separate review found similar evidence in support of bike storage, showers and locker facilities to increase active commuting.^[52] Providing amenities such as bicycle storage, lockers, and changing/shower facilities may help to shift transit mode from more sedentary, carbon-consuming options to more active modes. In addition, lockers and changing/shower facilities in particular support activity goals and behaviors not only for cyclists but all occupants such as those who might engage in physical activity before work.

Impact: Overall, these amenities signal to occupants that physical activity and, in particular, active commuting, is welcomed and encouraged. The impact of increased active commuting is substantial. Evidence from a cohort study found that cycle commuting was associated with lower cardiovascular disease incidence and mortality, cancer incidence and all-cause mortality.^[56] Evidence from a meta-analysis indicated similar conclusions regarding all-cause mortality.^[57]

Part 1 Provide Bicycle Storage (Max: 2 Pt)

For All Spaces except Dwelling Units:

Bike parking infrastructure

The following requirements are met:

- Short-term bicycle parking is located within 30 m [100 ft] of the main building entrance and can accommodate at least 2.5% of peak visitors (minimum of four spaces).^[58]
- Long-term bicycle parking is located within 30 m [100 ft] of the main building entrance and can accommodate at least 5% of regular building occupants (minimum of four spaces).^[58]
- Basic bicycle maintenance tools, including tire pumps, patch kits and hex keys, are provided on-site.

OR-----

Bike parking policy

The following requirements are met:

- A policy is in place that allows building occupants and visitors to bring bicycles to tenant spaces and utilize elevators (or freight elevators) to transport bicycles between floors (as applicable).^[54,59]
- Basic bicycle maintenance tools, including tire pumps, patch kits and hex keys, are provided on-site.

For Retail Spaces:

Bike parking Infrastructure

The following requirements are met:

- Short-term bicycle parking is located within 30 m [100 ft] of the main building entrance and includes at least two

short-term bicycle storage spaces per 465 m² [5,000 ft²] of retail floor area (minimum of two spaces per building).^[60]

- b. Long-term bicycle parking is located within 30 m [100 ft] of the main building entrance and can accommodate at least 5% of regular building occupants (minimum of two spaces per building).^[60]
- c. Basic bicycle maintenance tools, including tire pumps, patch kits and hex keys, are provided on-site.

OR-----

Bike parking policy

The following requirements are met:

- a. A policy is in place that allows building occupants and visitors to bring bicycles into retail spaces and utilize elevators (or freight elevators) to transport bicycles between floors (as applicable).^[54,59]
- b. Basic bicycle maintenance tools, including tire pumps, patch kits and hex keys, are provided on-site.

For Dwelling Units:

Bike parking Infrastructure

The following requirements are met:

- a. Short-term bicycle parking is located within 30 m [100 ft] of the main building entrance and can accommodate at least 2.5% of peak visitors (minimum of four spaces per building).^[58]
- b. Long-term bicycle parking is located within 30 m [100 ft] of the main building entrance and can accommodate at least 30% of building residents (minimum of one space per building).^[58]

OR-----

Bike parking policy

The following requirements are met:

- a. A policy is in place that allows residents to bring bicycles into dwelling unit and utilize elevators (or freight elevators) to transport bicycles between floors (as applicable).^[54,59]
- b. Basic bicycle maintenance tools, including tire pumps, patch kits and hex keys, are provided on-site.

Note:

Projects may exclude early childhood education students from their capacity calculations.^[61]

Bicycle maintenance tools are preferably provided near bike storage and/or parking areas.

Part 2 Provide Facilities for Active Occupants (Max: 2 Pt)

For All Spaces except Dwelling Units:

Projects provide the following:

- a. One on-site shower and changing room for the first 100 regular building occupants (excluding all early childhood education and primary school students) and an additional shower and changing facility for every 150 additional regular building occupants (excluding all early childhood education and primary school students).^[58,61]
- b. One on-site locker for every five regular building occupants or evidence that the lockers provided exceed demand by at least 20%.

Note: Projects may consider off-site shower and changing facilities under joint-use agreements (or similar arrangements) provided they are within 200 m [656 ft] of the project boundary and are accessible to the project population at no cost. Additional documentation must demonstrate that shared facilities can accommodate both the project population and other populations who access the space.

V05 SITE PLANNING AND SELECTION | O (MAX: 3 PT)

Intent: Promote active living and physical activity by selecting sites that offer diverse amenities and uses, are in close proximity to mass transit and offer pedestrian and cyclist infrastructure in the surrounding area.

Summary: This WELL feature requires projects to demonstrate that the project site is near diverse uses and walkable and bike-friendly streets and has proximate access to mass transit.

Issue: Beyond the physical features of a building, the context in which the building is situated, including neighborhood and site-level factors, also plays an integral role in physical activity opportunities and choices.^[12-16]

Solutions: Site planning and selection is one of the first steps a new building project takes toward their health mission. While new building projects are able to leverage site planning and selection most readily, existing projects should also consider their site as a key part of early stakeholder discussions and identify effective ways to leverage available physical activity and active living assets. Mixed-use developments, featuring nearby restaurants and markets, civic centers, pharmacies, residences, commercial buildings and other venues, have been associated with higher levels of physical activity and lower body weight and obesity.^[12,13,62] Specific to workplaces, evidence shows that proximate (400–800 m [0.25–0.5 mi]) destinations such as transit, shopping centers, restaurants/dining and residential buildings are associated with higher levels of walking.^[63] Access to mass transit is also associated with positive outcomes. Compared to car users, those who use mass transportation accrue higher levels of physical activity.^[64] In addition, access to mass transit is positively associated with socioeconomic opportunities and reduced carbon footprint.^[65] Another important consideration of site planning and selection is walkability. Walkable communities, featuring well-connected streets that leverage pedestrian-scale design strategies, are associated with higher moderate-to-vigorous activity levels, lower levels of sedentary behavior and decreased risk of diabetes, obesity and depression.^[15,66-73] Recent studies have also examined the impact of neighborhood characteristics and utilization of neighborhood space. In one study, using GPS and accelerometer data, total neighborhood space utilized by study subjects was positively associated with intersection density and walkability scores were consistently higher in utilized areas compared to non-utilized areas.^[67] Thoughtful site planning and selection can also enhance opportunities for cycling. The presence of cyclist infrastructure such as cyclist lanes and, in particular, infrastructure that promotes cyclist safety, is known to increase ridership.^[74,75] Projects should consider additional strategies such as those listed in Feature V04: Active Commuter and Occupant Support to encourage active commuting and cycling to work.

Impact: The impact of thoughtful site planning and selection reaches beyond positive impacts on physical activity and active living and improves nearly every aspect of community health and vitality from social well-being to economic development.^[76]

Part 1 Select Sites with Diverse Uses (Max: 2 Pt)

For All Spaces:

The following requirement is met:

- a. The project is located within 400 m [0.25 mi] walk distance of at least eight existing use types.^[77] Uses and restrictions are defined in Appendix V2.^[77]

Part 2 Select Sites with Access to Mass Transit (Max: 2 Pt)

For All Spaces:

One of the following requirements is met:

- a. The project is located in an area (zip or postal code) with a minimum Transit Score® of 70.^[78]
- b. The project is located in an area that offers a minimum of 72 trips per weekday and 40 trips per weekend day through some combination of transit types (e.g., bus, bus rapid transit, trolley, ferry, streetcar, commuter rail) with service stations located within:^[79]
 1. 400 m [0.25 mi] of the project boundary for bus, streetcar or other informal transit stops (e.g., trolleys).^[79]
 2. 800 m [0.5 mi] of the project boundary for bus rapid transit stops, light or heavy rail stations, commuter rail stations or ferry services.^[79]

Part 3 Select Sites with Pedestrian Friendly Streets (Max: 2 Pt)

For All Spaces:

One of the following requirements is met:

- a. The project is located in an area (zip or postal code) with a minimum Walk Score® of 70.^[80]
- b. 90% of total street length within an 800 m [0.5 mi] radius of the project boundary has continuous sidewalks or all-weather pathways present on both sides.^[81]

Part 4 Select Sites with Bike Friendly Streets (Max: 2 Pt)

For All Spaces:

One of the following requirements is met:

- a. The project is located in an area (zip or postal code) with a minimum Bike Score® of 70.^[85]
- b. The project is located within 200 m [656 ft] walk distance of an existing bicycle network that connects riders to at least 10 use types that are within a 4.8 km [3 mi] cycling distance.^[58] Uses and restrictions are defined in Appendix V2.^[77]

V06 PHYSICAL ACTIVITY OPPORTUNITIES | O (MAX: 3 PT)

Intent: Encourage regular physical activity and exercise through no cost physical activity opportunities and education.

Summary: This WELL feature requires projects to provide no cost physical activity opportunities led by a qualified professional.

Issue: International physical activity recommendations address both cardiovascular and muscle strengthening activities for the general population. Despite widely disseminated guidelines, nearly a quarter of the general population fails to achieve physical activity guidelines and is considered physically inactive.^[3] Key determinants of physical activity behavior include time, convenience, motivation, self-efficacy, weather conditions, travel and family obligations, fear of injury, lack of social support and environmental barriers such as availability of sidewalks, parks and bicycle lanes.^[86,87]

Solutions: The workplace is considered an effective platform through which a broad segment of the adult population can be reached.^[17] Workplace wellness programs and offerings are considered great steps toward decreasing barriers to physical activity engagement among employees.^[88] The Community Preventive Services Task Force recommends worksite programs that make physical activity more readily available (e.g., providing health club memberships, changing insurance benefits, providing opportunities to be physically active) as a strategy to improve physical activity engagement.^[19] While some research supports structured programming through the workplace, more research is still needed to understand the efficacy of these strategies.^[17] Similar to the workplace, schools represent a ubiquitous platform through which to reach adolescents and youth.^[17] The Community Preventive Services Task Force reviewed school-based interventions targeting physical activity behavior and recommends classroom-based teaching strategies and physical education curriculum that incorporate activity as promising strategies to increase physical activity among adolescents.^[90] When considering physical activity education and programming, it is important to consider the needs of the population that the project serves. Activities and education should be relevant to the population (i.e., ability and age appropriate). Projects should also seek to solicit on-going feedback from their population and make an effort to consider feedback in revisions to programmatic offerings.

Impact: We have much to gain by reducing barriers to physical activity beyond the individual benefits associated with physical activity. In a review conducted by the Centers for Disease Control and Prevention, two studies highlighted economic benefits of workplace programs, including reduced healthcare costs, decreased costs and days lost due to disability, reduced absenteeism and increased productivity.^[89]

Part 1 Implement Activity Programs for Employees (Max: 2 Pt)

For All Spaces:

The following requirements are met:

- Age and ability appropriate physical activity/exercise programming, led by a qualified professional, is offered to eligible employees at no cost at one of the frequencies shown in the table below:

Frequency	Points
At least one event per month	1
At least one event per week	2

Part 2 Implement Activity Programs for Students (Max: 2 Pt)

For All Spaces:

The following requirements are met for early childhood education and primary school students:

- Meet one of the frequency requirements in the table below for physical activity opportunities (e.g., recess, physical education curriculum, before or after school programming):

Frequency	Points

≥ 180 minutes per week	1
≥ 60 minutes per day ^[2]	2

- b. Have policies in place that stipulate physical activity opportunities are not to be withheld as a form of punishment.^[91]

Note:

Physical activity programming for early childhood education or primary school students may occur before, during or after the school day. Recess is encouraged before mid-day lunch periods but may be included during other times of day if this cannot be accommodated.

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 2: Implement Activity Programs and Education for Students are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

V07 ACTIVE FURNISHINGS | O (MAX: 2 PT)

Intent: Discourage prolonged sitting and sedentary behaviors by providing active workstations and furnishings to as many people in the building as possible.

Summary: This WELL feature requires projects to provide occupants access to traditional sit-stand desks and active workstations such as treadmill or cycle desks.

Issue: Sedentary behavior has been linked to numerous negative health outcomes, including obesity, type 2 diabetes, cardiovascular and metabolic risks and premature mortality.^[7-992] Sedentary behavior has received increased public health attention due to the independent nature of its relationship with health. To explain this concept, think of the “active couch potato,” someone who meets physical activity guidelines but also spends a good amount of time sitting. Research on these individuals shows that the health benefits of physical activity are essentially negated by their sedentary activity.^[10,18,92] For example, data from an Australian cohort, where participants self-reported achieving physical activity guidelines, showed that there was an adverse dose-response relationship between TV-viewing time and outcomes such as waist circumference, blood pressure and 2-h plasma glucose.^[93] These findings suggest that our efforts should not only focus on increasing physical activity but also decreasing sedentary behavior.

Solutions: Active workstations are effective at decreasing time spent sitting.^[94,95] Evidence suggests that active workstations have no detrimental impact on work performance or cognitive function.^[96-100] While active workstations are effective at reducing sitting time in workplace and classroom environments,^[94,95,101,102] additional systematic evidence is still needed to draw firm conclusions about their broader impact on health outcomes such as mental health and body composition.^[94,103] When integrating active workstations into a space, projects should consider complementary strategies that may further reduce sedentary time. Evidence suggests that offering active workstations along with education, prompts and/or behavior change counseling may support sustained behavior change and further reduce sitting time.^[104-106]

Impact: Active workstations play a valuable role in addressing sedentary behaviors. When considered within a comprehensive approach that addresses workstation infrastructure and behavior change, this intervention can help discourage prolonged sedentary behavior and encourage movement throughout the day.

Part 1 Provide Active Workstations (Max: 2 Pt)

For All Spaces:

Sit-stand desks

Sit-stand desks are available to all employees and present in quantities described in the table below and may include the following types:

- Standard, adjustable-height standing desk.
- Standard desks with a height-adjustable desktop stand.

Sit-Stand Desks	Points
At least 50% of workstations	1
At least 75% of workstations	2

Dynamic workstations

Dynamic workstations are available to all employees and present in sufficient quantities such that at least 3% of employees could reserve or use them at any time and may include the following types:

- Treadmill desk.
- Bicycle desk.
- Portable furnishings (e.g., stepper machine, balance board).

V08 PHYSICAL ACTIVITY SPACES AND EQUIPMENT | O

(MAX: 2 PT)

Intent: Promote regular physical activity and exercise by providing physical activity spaces and equipment at no cost.

Summary: This WELL feature requires projects to provide occupants access to dedicated physical activity spaces and equipment at no cost.

Issue: International physical activity recommendations address both cardiovascular and muscle strengthening activities for the general population.^[2] Despite widely disseminated guidelines, nearly a quarter of the general population fails to achieve recommended physical activity levels.^[3] Key determinants of physical activity behavior include time, convenience, motivation, self-efficacy, weather conditions, travel and family obligations, fear of injury, lack of social support and environmental barriers such as availability of sidewalks, parks and bicycle lanes.^[86,87]

Solutions: Research supports that above and beyond offering incentives and physical activity programs, impactful measures for improving physical activity engagement include offering convenient spaces for employees to engage in physical activity.^[86,88] In a systematic review conducted by the U.S. Centers for Disease Control and Prevention, creating enhanced places for physical activity increased engagement and biomarkers for physical fitness including aerobic capacity and energy expenditure, with a few studies documenting some decrease in body weight and body fat.^[89] A study in Finland showed that a shorter distance from an individual's home to physical activity facilities was associated with higher engagement, and as distance and sparsity of recreational facilities increased, engagement decreased.^[107] In workplace settings, those who reported higher support from their work environment (e.g., pedestrian-friendly exterior spaces, showers and other facilities) were more likely to be physically active.^[108] When incorporating physical activity spaces and/or equipment into a design plan or leveraging existing, nearby amenities, it is important to consider the needs of the population who will access the amenity. For example, if the project serves an adolescent or elderly population, projects will need to consider the unique needs of these groups to ensure the space and equipment are age- and ability-appropriate. Furthermore, it is important to consider the entirety of the population that will access the space when determining capacity requirements to ensure that occupants are not deterred by overcrowded amenities.

Impact: Proximity to nearby fitness facilities has the potential to increase and improve physical activity and exercise engagement.

Part 1 Provide Dedicated Activity Spaces (Max: 1 Pt)

For All Spaces except Dwelling Units:

The following is made available to employees at no cost:

- a. A dedicated physical activity space that is at least 18.6 m² [200 ft²] plus 0.1 m² [1 ft²] per employee.^[51]

For Dwelling Units:

The following is made available to residents and students (as applicable) at no cost:

- a. A dedicated physical activity space that is at least 37 m² [400 ft²] per dwelling unit or classroom (as applicable) up to a maximum of 370 m² [4,000 ft²].^[51]

Note:

Projects (including educational facilities) may consider shared, off-site spaces toward Part 1: Provide Dedicated Activity Spaces provided they are within 200 m [656 ft] of the project boundary or located within the campus and are available to the project population at no cost.

Indoor and outdoor spaces (including shared, off-site spaces) may be considered toward Part 1: Provide Dedicated Activity Spaces provided they meet the capacity requirements but may not be double-counted toward Part 3: Promote Off-Site Activity Spaces.

Part 2 Provide Physical Activity Equipment (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. At least one type of equipment from each of the following categories, accompanied by instructions for safe use, is made available to employees, students or residents (as applicable). Additional documentation should demonstrate that the equipment is age appropriate based on the project population:
 1. Cardiorespiratory equipment.
 2. Muscle-strengthening equipment.
- b. Total units for each category should allow for use by at least 1% of employees, students or residents (as applicable) at any given time.

Note:

Examples of equipment can be found in Appendix V3.

Projects (including educational facilities) may consider shared, off-site spaces toward Part 2: Provide Physical Activity Equipment provided they are within 200 m [656 ft] of the project boundary or located within the campus and are accessible to the project population at no cost.

Indoor and outdoor spaces (including shared, off-site spaces) may be considered toward Part 2: Provide Physical Activity Equipment provided they meet the capacity requirements but may not be double-counted toward Part 3: Provide Off-Site Activity Spaces.

Part 3 Provide Off-Site Activity Spaces (Max: 1 Pt)

For All Spaces:

At least one of the following is available at no cost to employees or residents (as applicable) within 800 m [0.5 mi] walk distance of the project boundary and is available for use at least 75% of the year:

- a. A green space.
- b. Recreational field or court.
- c. A gym, fitness center or similar facility.
- d. A walking, hiking or biking trail.
- e. Outdoor fitness zone that includes all-weather fitness equipment.
- f. A play space geared toward children (e.g., a playground) that meets design requirements outlined by the U.S. Consumer Product Safety Commission (Appendix V4).^[109]

V09 EXTERIOR ACTIVE DESIGN | O (MAX: 1 PT)

Intent: Promote daily physical activity through pedestrian-friendly site amenities.

Summary: This WELL feature requires that projects leverage site design and amenities within the immediate vicinity to encourage physical activity throughout the day.

Issue: Over time, nearly every aspect of our environment has been physically designed to demand less movement and facilitate more sedentary activities.^[18] As a result, physical inactivity and sedentariness are on the rise along with a host of poor health outcomes.^[1-37-911]

Solutions: Beyond the neighborhood context in which a building is situated, and beyond the interior elements of a building and programs that encourage physical activity, exterior elements of the project site can also be leveraged to encourage physical activity. In a systematic review conducted by the Centers for Disease Control and Prevention, researchers identified several evidence-based design strategies that can be used to improve the pedestrian experience and encourage activity, including street lighting, sidewalk continuity, crosswalk safety (e.g., center islands or raised crosswalks) and pedestrian-scale aesthetics (e.g., landscaping).^[110] Additional pedestrian-friendly design strategies, such as active façades and street furnishings, are outlined in evidence-based guidelines including the Active Design Guidelines: Shaping the Sidewalk Experience and are supported by other types of literature.^[111,112] For example, a systematic review found that the presence of aesthetic design and placemaking features helped to maintain pedestrian interest, invite increased use by both pedestrians and cyclists and supported co-benefits including social cohesion, mental health and well-being, economic benefits and public safety.^[113]

Impact: Maximizing site amenities to encourage and invite physical activity can not only engage tenants to move throughout the day, but also enhance the experience of the broader community and create more vibrant places.

Part 1 Integrate Active Façades (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. The articulation of the building's first-level, street-facing façade is designed such that no more than 40% or 15 m [50 ft] (whichever is less) is blank.^[114]
- b. The building's first-level, street-facing façade includes at least one of the following design elements:
 1. Street-level windows, which allow visibility into the space.
 2. Window display cases.
 3. Murals or other artistic installations.
 4. Biophilic and other landscape elements.
 5. Mixed building textures, colors and/or other design elements.

Note:

Amenities outside of the WELL project boundary may not be counted toward Feature V09: Exterior Active Design.

Part 2 Provide On-Site Pedestrian Destinations (Max: 1 Pt)

For All Spaces:

Projects provide at least two of the following within the WELL project boundary:

- a. An outdoor plaza or similar open-air space that can be used year-round and contains seating and biophilic elements, provides access to daylight and is supported with wayfinding signage.^[112]
- b. A fountain or water feature.^[112]
- c. A walking path or trail supported with wayfinding signage.^[112]
- d. A drinking fountain or water refilling station.^[112]
- e. Trees, planters and/or other landscaped elements.^[112]

f. Artistic installations.^[112]

Note:

Projects should consider primary language(s) spoken by the local population when creating signage.

V10 ENHANCED ERGONOMICS | O (MAX: 1 PT)

Intent: Audit existing ergonomic conditions and provide access to ongoing consultation, education and resources to improve and maintain ergonomic comfort over time.

Summary: This WELL feature requires that projects collaborate with a qualified professional to audit the ergonomic conditions of the space and implement changes or recommendations through a qualified professional.

Issue: In 2016, musculoskeletal disorders (MSDs) ranked 7th on the list of top drivers of global disability.^[23] Among those aged 15–49, the top contributors to MSDs included occupational injuries and ergonomic issues.^[23] MSDs are one of the most commonly reported causes of lost or restricted work time and also contribute to presenteeism and productivity losses.^[24,25] Estimates from the European Union value these types of losses summed to as much as 2% of gross domestic product.^[25]

Solutions: Beyond the provision of ergonomic workstation furnishings, evidence and recommendations from leading ergonomic experts suggest that ergonomic consultation and education add value to ergonomic design in the workplace.^[31] Implementing ergonomic programs in the workplace has been associated with a return on investment; one case study demonstrated a return of \$10 USD for every \$1 USD invested in ergonomics.^[39] According to a federal report completed in the U.S., key components of effective ergonomic programs include management commitment, employee involvement, problem identification, solution development, training and education for employees and medical management, including prevention and reporting.^[38]

Impact: Working with experts to implement a comprehensive ergonomics program that includes both ergonomic design and ergonomic programming may further support ergonomic health, well-being and comfort.

Part 1 Utilize Ergonomic Consultation (Max: 1 Pt)

For All Spaces:

At least twice per year, a certified ergonomist or an individual with a professional degree in human factors/ergonomics (or equivalent) offers the following educational services to all employees:

- a. An audit of existing ergonomic conditions in the space, including workstations, furnishings, work areas and existing policies.
- b. On-site adjustments to existing furnishings at occupant request and/or on-site training for staff on how to adjust workstation furnishings.

Note:

Projects are encouraged to utilize results of the audit to inform policy and design decisions related to ergonomics and, in particular, those that are required in Feature V02: Visual and Physical Ergonomics.

Education must be culturally appropriate and literacy level appropriate.

V11 PHYSICAL ACTIVITY PROMOTION | O (MAX: 1 PT)

Intent: Encourage physical activity and active lifestyles through diverse monetary and non-monetary incentive offerings.

Summary: This WELL feature requires projects to provide at least two types of physical activity incentives and monitor uptake of incentive offerings.

Issue: Physical inactivity has emerged as a primary focus of public health due to a rise in premature mortality and chronic diseases attributed to inactive lifestyles, including type 2 diabetes, cardiovascular disease, depression, stroke and some forms of cancer.^[1,2]

Solutions: Physical activity incentives can take on many forms including monetary and non-monetary types. Both types are available through this feature. Leading public health advocates recommend as effective strategies to improve physical activity engagement both a) worksite programs that make physical activity more accessible and/or available and b) providing or enhancing opportunities to be physically active.^[19,20] Promising worksite programs include counseling, health promotion messaging and workplace walking programs.^[17] There is also some evidence to support incentives, although researchers caution that more is needed to fully understand these strategies.^[115] In a systematic review examining different incentives, conditional incentives—particularly those that rewarded positive physical activity behavior—were effective at improving physical activity levels as compared to unconditional incentives (e.g., subsidized memberships that do not require participation).^[116] In addition, a randomized controlled trial in a U.S. population found that a combination of individual and team rewards for physical activity behavior was effective at improving physical activity engagement during the intervention period and those positive outcomes were reversed/reduced when the incentives were removed.^[117] Studies have shown that incentives are particularly effective as part of multi-component interventions such as those that also aim to increase self-awareness of activity behaviors.^[118,119] Projects should consider incentives as part of a comprehensive approach to wellness offerings and take care to consider what incentives are meaningful to the population they serve. Additionally, special care must be given when implementing these types of initiatives to ensure that they are achieving their core goals while maintaining equity and limiting unintended consequences such as stigma or discrimination.^[115,120] For example, projects should not set minimum participation requirements that are unreasonable or that eliminate the possibility of achieving desired outcomes for certain groups of participants as this would be counterproductive to promoting health behavior change.^[121]

Impact: In addition to design strategies that aim to foster physical activity opportunities, WELL seeks to leverage programmatic strategies that aim to improve physical activity engagement.

Part 1 Promote Physical Activity (Max: 1 Pt)

For All Spaces:

Employee programs

Projects provide at least two of the following physical activity incentives for all eligible employees:

- a. Financial rewards including direct payments or subsidies, gift cards or prizes.
- b. Tax-exempt payroll deductions related to active transportation, mass transportation or other types of physical activity opportunities (e.g., gym membership).
- c. Bike share memberships, gym memberships, fitness classes or other types of opportunities (e.g., races, sports teams or training) that are offered at no cost or subsidized by at least 50%.
- d. Healthcare bonuses (e.g., additional coverage for health programs or lower co-pays and/or premiums).
- e. Paid time off (at least one eight-hour day per quarter).
- f. Flexible scheduling to accommodate physical activity that is not deducted from paid time off.
- g. Other non-monetary awards or programs (e.g., employee recognition, wellness challenges or similar activities).

Student programs

Early childhood education, primary and secondary schools develop and implement the following programs:

- a. A program that aims to reduce daily time spent in at least one of the following sedentary behaviors:

1. TV viewing.^[90,122]
 2. Recreational computer or smartphone use.^[122]
 3. Video gaming.^[122]
 4. Other recreational, screen-based sedentary behaviors.^[122]
- b. A program that aims to promote daily physical activity through at least one of the following:
1. Teaching strategies that incorporate movement and activity into the lesson.^[17,90,123]
 2. Physical education.^[17,90,123]
 3. Recess or similar physical activity breaks.^[17,90,91]
 4. Combined school-based physical education and community-based interventions such as those that engage families or foster community partnerships.^[90]

Part 2 Promote Participation Awareness (Max: 1 Pt)

For All Spaces:

The following requirement is met:

- a. Projects maintain awareness of engagement in physical activity promotion programs and report anonymized monthly averages submitted annually through WELL Online .

V12 SELF-MONITORING | O (MAX: 1 PT)

Intent: Promote awareness of health behaviors and health metrics by providing access to sensors and wearables.

Summary: This WELL feature requires projects to provide occupants access to wearables that can monitor their own physical activity metrics and allow occupants to access their own data in a central platform.

Issue: Much of what we understand about physical activity's relationship to health and well-being is derived from studies that utilize self-reported measures of physical activity.^[124] Evidence suggests that self-reported measures tend to overestimate actual physical activity behaviors.^[125]

Solutions: Objective, accelerometer-based tools that track physical activity have proliferated the marketplace.^[126-128] Estimates in U.S. populations indicate that one in six consumers (15%) use wearables to monitor health behaviors.^[126] In addition, 35% of employers utilize wearables and even more (44.5%) leverage them in strategic planning of wellness programs.^[129] Early studies evaluating these products have found that common wearables (e.g., Fitbit, Misfit, Jawbone) include many elements that support behavior change: prompts, feedback on performance, social support and goal setting.^[130] In a comprehensive review led by the U.S. Physical Activity Guidelines Committee, researchers found strong evidence that wearable activity monitors including simple step counters, when paired with goal-setting, were effective at increasing physical activity.^[17] While more evidence is needed to understand their long-term effects, early research has shown activity trackers help to maintain long-term physical activity behaviors.^[119] Additional evidence from a systematic review conducted by the U.S. Centers for Disease Control and Prevention shows that, particularly when paired with coaching and counseling, technology tools can have a positive impact on health outcomes such as weight-loss maintenance.^[131] There is also evidence that wearables may help to alter sedentary behaviors. In a meta-analysis of several randomized controlled trials, use of a step counter paired with a step goal significantly reduced sedentary time among adults.^[132] Increasingly, wearables are not only tracking physical activity such as steps and active minutes but also metrics such as sleep, energy expenditure and heart rate.^[126,127] In addition, these devices often rely on integrative platforms that allow users to track their data over time and self-report other health-related behaviors such as dietary intake via a web browser or smartphone application.^[126,127] Given the amount and type of data collected through wearables, projects should consider and emphasize privacy and data security among users, particularly when they are vetting technologies to recommend to their occupants.

Impact: WELL seeks to leverage wearables in an effort to create a more health-conscious population and motivate individuals to monitor their own health behaviors.

Part 1 Provide Self-Monitoring Tools (Max: 1 Pt)

For All Spaces:

Wearables are made available to all eligible employees and meet the following requirements:

- a. Are provided for personal use at no cost or are subsidized by at least 50%.
- b. Aggregate data via the device's central platform, allowing individuals to monitor their own metrics over time.
- c. Measure at least two of the following physical activity metrics:
 1. Steps.
 2. Active minutes and/or intensity.
 3. Distance.
 4. Activity types.
 5. Floors climbed.

APPENDIX V1:

Physical activity recommendations established by the World Health Organization:^[133]

- **Children and adolescents aged 5-17 years:**
 - At least 60 minutes of moderate- to vigorous-intensity physical activity (MVPA) per day.
 - Activities that strengthen muscle and bone at least three times per week.
- **Adults aged 18–64 years:**
 - At least 150 minutes of moderate-intensity physical activity per week, at least 75 minutes of vigorous-intensity physical activity per week or an equivalent combination of MVPA.
 - Muscle-strengthening activities involving major muscle groups on at least two days per week.
- **Adults aged 65 years and above:**
 - At least 150 minutes of moderate-intensity physical activity per week, at least 75 minutes of vigorous-intensity physical activity per week or an equivalent combination of MVPA.
 - For individuals with poor mobility, perform physical activity to enhance balance and prevent falls on three or more days per week.
 - Muscle-strengthening activities involving major muscle groups on two or more days per week.

APPENDIX V2:

Diverse use types.^[77]

Category	Use type
Food retail	Supermarket
	Grocery with a produce section
Community-serving retail	Convenience store
	Farmers market
	Hardware store
	Pharmacy
	Other retail
Services	Bank
	Family entertainment venue (e.g., theater, sports)
	Gym, health club, exercise studio
	Hair care
	Laundry, dry cleaner
	Restaurant, café or diner (excluding those with only drive-thru service)
Civic and community facilities	Adult or senior care (licensed)
	Child care (licensed)
	Community or recreation center
	Cultural arts facility (museum, performing arts)
	Education facility (e.g., K-12 school, university, adult education center, vocational school, community college)
	Government office that serves public on-site
	Medical clinic or office that treats patients
	Place of worship
	Police or fire station
	Post office
	Public library
	Public park
	Social services center
	Commercial office (100 or more full-time equivalent jobs)

Community anchor uses	Housing (100 or more dwelling units)
-----------------------	--------------------------------------

The following restrictions apply to Appendix V2:

1. A use may be counted as only one use type (e.g., a single retail space may be counted only once even if it sells products in several use categories).
2. No more than two uses in each use type may be counted (e.g., if five restaurant spaces are within the required distance, only two may be counted).

APPENDIX V3:

Examples of cardiorespiratory equipment include but are not limited to:

- Treadmill
- Elliptical
- Stationary bike
- Rowing machine
- Step-up

Examples of muscle-strengthening equipment include but are not limited to:

- Free weights, kettlebells
- Medicine ball
- Squat rack, bench press or other types of machinery
- TRX system
- Resistance bands

Examples of other types of equipment include:

- Yoga mat
- Exercise ball
- Foam roller

APPENDIX V4:

Playground design requirements:^[109]

1. Surfaces within the space are at minimum 30 cm [12 in] thick and extend at least 1.8 m [6 ft] in all directions around equipment and include wood chips, mulch, sand or mats made of safety-tested rubber or similar materials. For swings, surfaces should extend to twice the height of the suspension bar in front and back.
2. Openings in guardrails or between rungs measure less than 8.9 cm [3.5 in] or more than 22.9 cm [9 in] wide.
3. Dangerous hardware such as "S" hooks, sharp edges, or protruding bolts is not present or is protected.
4. Structures more than 76 cm [30 in] high are placed at least 2.7 m [9 ft] apart.
5. Elevated surfaces such as platforms or ramps have guardrails to prevent falls.
6. A policy is in place that ensures playground equipment is regularly inspected (at least once per year) and is maintained.

REFERENCES

- 1: Centers for Disease Control and Prevention. Facts about Physical Activity. [Reference](#). Published 2014. Accessed December 6, 2017.
- 2: World Health Organization. Physical Activity. [Reference](#). Published 2015. Accessed February 1, 2017.
- 3: Sallis JF, Bull F, Guthold R, et al. Progress in physical activity over the Olympic quadrennium. *Lancet*. 2017;388(10051):1325-1336. doi:10.1016/S0140-6736(16)30581-5
- 4: Remington PL, Brownson RC, Wegner M V. *Chronic Disease Epidemiology and Control*. 3rd ed. Washington, DC: American Public Health Association; 2010.
- 5: Ding D, Lawson KD, Kolbe-Alexander TL, et al. The economic burden of physical inactivity: A global analysis of major non-communicable diseases. *Lancet*. 2016;388(10051):1311-1324. doi:10.1016/S0140-6736(16)30383-X.
- 6: World Health Organization. Global Strategy on Diet, Physical Activity and Health. World Heal Organ. 2004. [Reference](#). Accessed February 14, 2018.
- 7: Owen N, Salmon J, Koohsari MJ, Turrell G, Giles-Corti B. Sedentary behaviour and health: mapping environmental and social contexts to underpin chronic disease prevention. *Br J Sports Med*. 2014;48(3):174-177. doi:10.1136/bjsports-2013-093107
- 8: Young DR, Hivert M-F, Alhassan S, et al. Sedentary Behavior and Cardiovascular Morbidity and Mortality: A Science Advisory From the American Heart Association. *Circulation*. 2016;134(13):e262-79. doi:10.1161/CIR.0000000000000440
- 9: Chau JY, Grunseit AC, Chey T, et al. Daily sitting time and all-cause mortality: A meta-analysis. *PLoS One*. 2013;8(11). doi:10.1371/journal.pone.0080000
- 10: Owen N, Healy GN, Matthews CE, Dunstan DW. Too Much Sitting: The Population-Health Science of Sedentary Behavior. *Exerc Sport Sci Rev*. 2010;38(3):105-113. doi:10.1097/JES.0b013e3181e373a2.
- 11: Bauman A, Ainsworth BE, Sallis JF, et al. The descriptive epidemiology of sitting. A 20-country comparison using the International Physical Activity Questionnaire (IPAQ). *Am J Prev Med*. 2011;41(2):228-235. doi:10.1016/j.amepre.2011.05.003
- 12: Durand CP, Andalib M, Dunton GF, Wolch J, Pentz MA. A systematic review of built environment factors related to physical activity and obesity risk: Implications for smart growth urban planning. *Obes Rev*. 2011;12(5):e173-82. doi:10.1111/j.1467-789X.2010.00826.x.
- 13: McCormack GR, Shiell A. In search of causality: A systematic review of the relationship between the built environment and physical activity among adults. *Int J Behav Nutr Phys Act*. 2011;8(1):125. doi:10.1186/1479-5868-8-125.
- 14: Transportation Research Board. *Does the Built Environment Influence Physical Activity? Examining the Evidence - Special Report 282*. Washington, DC; 2005. [Reference](#).
- 15: Renalds A, Smith TH, Hale PJ. A systematic review of built environment and health. *Fam Community Heal*. 2010;33(1):68-78. doi:10.1097/FCH.0b013e3181c4e2e5.
- 16: Urban Land Institute. *Intersections: Health and the Built Environment*. Washington, DC: Urban Land Institute; 2013. [Reference](#).
- 17: King AC, Powell KE, Physical Activity Guidelines Advisory Committee. 2018 Physical Activity Guidelines Advisory Committee Scientific Report. 2018. [Reference](#).
- 18: Owen N, Sparling PB, Healy GN, Dunstan DW, Matthews CE. Sedentary Behavior : Emerging Evidence for a New Health Risk. *Mayo Clin Proc*. 2010;85(12):1138-1141. doi:10.4065/mcp.2010.0444.
- 19: Task Force on Community Preventive Services. Obesity: Worksite Programs. *The Community Guide*. [Reference](#). Published 2007. Accessed August 21, 2017
- 20: Lee V, Mikkelsen L, Srikantharajah J, Cohen, Lady. Promising Strategies for Creating Healthy Eating and Active Living Environments. 2008. [Reference](#). Accessed September 9, 2017.

- 21: Lee IM, Shiroma EJ, Lobelo F, et al. Effect of physical inactivity on major non-communicable diseases worldwide: An analysis of burden of disease and life expectancy. *Lancet*. 2012;380(9838):219-229. doi:10.1016/S0140-6736(12)61031-9.
- 22: City of New York. *Active Design Guidelines: Promoting Physical Activity and Health in Design*. New York, NY; 2010. [Reference](#).
- 23: Institute for Health Metrics and Evaluation (IHME). GBD Compare. 2015. [Reference](#).
- 24: Occupational Safety and Health Administration. Ergonomics - Overview. [Reference](#). Accessed October 31, 2017.
- 25: Bevan S. Economic impact of musculoskeletal disorders (MSDs) on work in Europe. *Best Pract Res Clin Rheumatol*. 2015;29(3):356-373. doi:10.1016/j.berh.2015.08.002.
- 26: Waters TR, Dick RB. Evidence of health risks associated with prolonged standing at work and intervention effectiveness. *Rehabil Nurs*. 2015;40(3):148-165. doi:10.1002/rnj.166.
- 27: Smith P, Ma H, Glazier RH, Gilbert-Ouimet M, Mustard C. The Relationship Between Occupational Standing and Sitting and Incident Heart Disease Over a 12-Year Period in Ontario, Canada. *Am J Epidemiol*. 2018;187(1):27-33. doi:10.1093/aje/kwx298.
- 28: Buckley JP, Hedge A, Yates T, et al. The sedentary office: a growing case for change towards better health and productivity. Expert statement commissioned by Public Health England and the Active Working Community Interest Company. *Sport Med*. 2015;0:1-6. doi:doi:10.1136/bjsports-2015-094618.
- 29: Canadian Centre for Occupational Health and Safety. Sit/Stand Desk. [Reference](#). Accessed May 15, 2018.
- 30: Rudakewych M, Valent-Weitz L, Hedge A. Effects of an Ergonomic Intervention on Musculoskeletal Discomfort among Office Workers. *Proc Hum Factors Ergon Soc Annu Meet*. 2001;45(10):791-795. doi:10.1177/154193120104501002
- 31: Hedge A, Puleio J, Wang V. Evaluating the Impact of an Office Ergonomics Program. *Proc Hum Factors Ergon Soc Annu Meet*. 2011;55(1):594-598. doi:10.1177/1071181311551121
- 32: Wiggermann N, Keyserling WM. Effects of anti-fatigue mats on perceived discomfort and weight-shifting during prolonged standing. *Hum Factors*. 2013;55(4):764-775. doi:10.1177/0018720812466672.
- 33: Redfern MS, Cham R. The influence of flooring on standing comfort and fatigue. *AIHAJ*. 2000;61(5):700-708.
- 34: Canadian Centre for Occupational Health and Safety. Working in a Standing Position - Basic Information. [Reference](#). Accessed May 15, 2018.
- 35: Humanscale Consulting. Healthy Workstation Guidelines. 2009.
- 36: Business + Institutional Furniture Manufacturers Association. *BIFMA G1-2013 - Ergonomics Guideline: Ergonomics Guideline for Furniture Used in Office Work Spaces Designed for Computer Use*. Business + Institutional Furniture Manufacturers Association; 2013. [Reference](#).
- 37: Human Factors and Ergonomics Society. *ANSI/HFES 100-2007 - Human Factors Engineering of Computer Workstations*. Human Factors and Ergonomics Society; 2007. [Reference](#).
- 38: U.S. General Accounting Office. *Worker Protection: Private Sector Ergonomics Programs Yield Positive Results*. Washington, DC; 1997. [Reference](#).
- 39: Heller-ono A. A Prospective Study of a Macroergonomics Process over Five Years Demonstrates Significant Prevention of Workers' Compensation Claims Resulting in Projected Savings. 2009:1-4. [Reference](#).
- 40: Goggins RW, Spielholz P, Nothstein GL. Estimating the effectiveness of ergonomics interventions through case studies: Implications for predictive cost-benefit analysis. *J Safety Res*. 2008;39(3):339-344. doi:10.1016/J.JSR.2007.12.006.
- 41: U.S. Occupational Safety and Health Administration. Guidelines for Retail Grocery Stores: Ergonomics for the Prevention of Musculoskeletal Disorders. 2004. [Reference](#).
- 42: Ebben JM. Improved Ergonomics for Standing Work. *Occup Saf Heal*. 2003;72(4):72-76.
- 43: Centers for Disease Control and Prevention, The National Institute for Occupational Safety and Health. Elements of Ergonomic Programs. 1997. [Reference](#).

- 44: EWI Works. EWI Works: Resources. [Reference](#). Accessed January 5, 2017.
- 45: Cornell University Ergonomics Web, Hedge A. CUergo: Guides and Information.
- 46: Task Force on Community Preventive Services. Physical Activity: Point-of-Decision Prompts to Encourage Use of Stairs. The Community Guide. [Reference](#). Published 2005. Accessed August 21, 2017.
- 47: Bellicha A, Kieusseian A, Fontvieille AM, Tataranni A, Charreire H, Oppert JM. Stair-use interventions in worksites and public settings - A systematic review of effectiveness and external validity. *Prev Med (Baltim)*. 2015;70. doi:10.1016/j.ypmed.2014.11.001
- 48: Lee KK, Perry AS, Wolf SA, et al. Promoting Routine Stair Use: Evaluating the Impact of a Stair Prompt Across Buildings. *Am J Prev Med*. 2012;42(2):136-141. doi:[Reference](#)
- 49: Boutelle KN, Jeffery RW, Murray DM, Schmitz MKH. Using signs, artwork, and music to promote stair use in a public building. *Am J Public Health*. 2001;91(12):2004-2006. doi:10.2105/AJPH.91.12.2004
- 50: Flynn N, Asquer A. Public Sector Management. 7th ed. SAGE; 2016. [Reference](#). Accessed March 8, 2018.
- 51: U.S. Green Building Council. LEED v4 BD+C: New Construction. Innovation: Design for Active Occupants. [Reference](#).
- 52: Active Living Research, Robertwood Johnson Foundation. Moving Toward Active Transportation: How Policies Can Encourage Walking and Bicycling. San Diego, CA: Robert Wood Johnson Foundation; 2016. [Reference](#).
- 53: Transportation Alternatives. Indoor Bicycle Parking. [Reference](#).
- 54: Transportation Alternatives. Bicycle Parking Solutions: A Resource Guide for Improving Secure Bicycle Parking in New York City. [Reference](#).
- 55: Pucher J, Dill J, Handy S. Infrastructure, programs, and policies to increase bicycling: an international review. *Prev Med*. 2010;50 Suppl 1:S106-25. doi:10.1016/j.ypmed.2009.07.028
- 56: Celis-Morales CA, Lyall DM, Welsh P, et al. Association between active commuting and incident cardiovascular disease, cancer, and mortality: prospective cohort study. *BMJ*. 2017;357:j1456. doi:10.1136/BMJ.J1456.
- 57: Kelly P, Kahlmeier S, Götschi T, et al. Systematic review and meta-analysis of reduction in all-cause mortality from walking and cycling and shape of dose response relationship. *Int J Behav Nutr Phys Act*. 2014;11(1):132. doi:10.1186/s12966-014-0132-x.
- 58: U.S. Green Building Council. LEED BD+C: New Construction - Bicycle Facilities. [Reference](#). Accessed August 21, 2017.
- 59: New York City Department of Transportation. Bikes in Buildings. [Reference](#).
- 60: U.S. Green Building Council. LEED BD+C: Retail - Bicycle Facilities.
- 61: U.S. Green Building Council. LEED BD+C: Schools - Bicycle Facilities.
- 62: Mackenbach JD, Rutter H, Compernelle S, et al. Obesogenic environments: a systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project. *BMC Public Health*. 2014;14:233. doi:10.1186/1471-2458-14-233
- 63: Zimring C, Joseph A, Nicoll GL, Tsepas S. Influences of building design and site design on physical activity: Research and intervention opportunities. *Am J Prev Med*. 2005;28(2 SUPPL. 2):186-193. doi:10.1016/j.amepre.2004.10.025.
- 64: Batista Ferrer H, Cooper A, Audrey S. Associations of mode of travel to work with physical activity, and individual, interpersonal, organisational, and environmental characteristics. *J Transp Heal*. February 2018. doi:10.1016/J.JTH.2018.01.009.
- 65: American Public Transportation Association. Public Transportation Benefits. [Reference](#).
- 66: Zhu X, Yu CY, Lee C, Lu Z, Mann G. A retrospective study on changes in residents' physical activities, social interactions, and neighborhood cohesion after moving to a walkable community. *Prev Med*. 2014;69 Suppl 1:S93-7. doi:10.1016/j.ypmed.2014.08.013
- 67: Rundle AG, Sheehan DM, Quinn JW, et al. Using GPS Data to Study Neighborhood Walkability and Physical Activity. *Am J Prev Med*. 2016;50(3):e65-e72. doi:10.1016/j.amepre.2015.07.033

- 68: Hajna S, Ross NA, Brazeau AS, Belisle P, Joseph L, Dasgupta K. Associations between neighbourhood walkability and daily steps in adults: a systematic review and meta-analysis. *BMC Public Health*. 2015;15:768. doi:10.1186/s12889-015-2082-x
- 69: Freeman L, Neckerman K, Schwartz-Soicher O, et al. Neighborhood walkability and active travel (walking and cycling) in New York City. *J Urban Heal*. 2013;90(4):575-585. doi:10.1007/s11524-012-9758-7
- 70: Creatore MI, Glazier RH, Moineddin R, et al. Association of Neighborhood Walkability With Change in Overweight, Obesity, and Diabetes. *JAMA*. 2016;315(20):2211-2220. doi:10.1001/jama.2016.5898
- 71: Booth GL, Creatore MI, Moineddin R, et al. Unwalkable neighborhoods, poverty, and the risk of diabetes among recent immigrants to Canada compared with long-term residents. *Diabetes Care*. 2013;36(2):302-308. doi:10.2337/dc12-0777
- 72: Muller-Riemenschneider F, Pereira G, Villanueva K, et al. Neighborhood walkability and cardiometabolic risk factors in Australian adults: an observational study. *BMC Public Health*. 2013;13:755. doi:10.1186/1471-2458-13-755
- 73: Tabaei BP, Rundle AG, Wu WY, et al. Associations of Residential Socioeconomic, Food, and Built Environments With Glycemic Control in Persons With Diabetes in New York City From 2007-2013. *Am J Epidemiol*. 2018;187(4):736-745. doi:10.1093/aje/kwx300.
- 74: National Association of City Transportation Officials. Urban Bikeway Design Guide, Second Edition. 2014:260. [Reference](#).
- 75: Reynolds CC, Harris MA, Teschke K, Cipton PA, Winters M. The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature. *Environ Heal*. 2009;8(1):47. doi:10.1186/1476-069X-8-47
- 76: Centers for Disease Control and Prevention. Physical Activity: Community Strategies. [Reference](#). Published 2015. Accessed December 1, 2015.
- 77: U.S. Green Building Council. LEED BD+C: Core and Shell - Surrounding density and diverse uses.
- 78: Walk Score. Transit Score Methodology. [Reference](#). Accessed January 1, 2018.
- 79: U.S. Green Building Council. LEED BD+C: New Construction - Access to quality transit. [Reference](#). Accessed August 22, 2017.
- 80: Walk Score. Walk Score Methodology. [Reference](#). Accessed January 1, 2018.
- 81: U.S. Green Building Council. LEED ND: Plan - Walkable Streets. [Reference](#). Accessed August 22, 2017.
- 82: National Association of City Transportation Officials. Global Street Design Guide. Island Press; 2016. [Reference](#).
- 83: National Complete Streets Coalition. Greenfield Tool Box: Connectivity Index. [Reference](#).
- 84: U.S. Green Building Council. LEED v4 for Neighborhood Development. 2014. [Reference](#).
- 85: Walk Score. Bike Score. [Reference](#). Accessed January 1, 2018.
- 86: Humpel N, Owen N, Leslie E. Environmental factors associated with adults' participation in physical activity: A review. *Am J Prev Med*. 2002;22(3):188-199. doi:[Reference](#)
- 87: Centers for Disease Control and Prevention. Overcoming Barriers to Physical Activity. [Reference](#). Accessed March 7, 2018.
- 88: Carnethon M, Whitsel LP, Franklin BA, et al. Worksite Wellness Programs for Cardiovascular Disease Prevention: A Policy Statement From the American Heart Association. *Circulation*. 2009;120(17):1725-1741. doi:10.1161/CIRCULATIONAHA.109.192653
- 89: Task Force on Community Preventive Services. Physical Activity: Enhanced School-Based Physical Education. The Community Guide. [Reference](#). Published 2013. Accessed August 21, 2017.
- 90: Task Force on Community Preventive Services. Physical Activity: Creating or Improving Places for Physical Activity. The Community Guide. [Reference](#). Published 2001.
- 91: Healthy Schools Campaign. Play Well. [Reference](#).
- 92: Hamilton MT, Healy GN, Dunstan DW, Zderic TW, Owen N. Too Little Exercise and Too Much Sitting: Inactivity Physiology and the Need for New Recommendations on Sedentary Behavior. *Curr Cardiovasc Risk Rep*.

2008;2(4):292-298. doi:10.1007/s12170-008-0054-8.

- 93:** Healy GN, Dunstan DW, Salmon J, Shaw JE, Zimmet PZ, Owen N. Television time and continuous metabolic risk in physically active adults. *Med Sci Sports Exerc.* 2008;40(4):639-645. doi:10.1249/MSS.0b013e3181607421.
- 94:** Neuhaus M, Eakin EG, Straker L, et al. Reducing occupational sedentary time: A systematic review and meta-analysis of evidence on activity-permissive workstations. *Obes Rev.* 2014;15(10):822-838. doi:10.1111/obr.12201
- 95:** Torbeyns T, Bailey S, Bos I, Meeusen R. Active workstations to fight sedentary behaviour. *Sports Med.* 2014;44(9):1261-1273. doi:10.1007/s40279-014-0202-x
- 96:** Carr LJ, Leonhard C, Tucker S, Fethke N, Benzo R, Gerr F. Total Worker Health Intervention Increases Activity of Sedentary Workers. *Am J Prev Med.* 2016;50(1). doi:10.1016/j.amepre.2015.06.022
- 97:** Ghesmaty Sangachin M, Gustafson WW, Cavuoto LA. Effect of Active Workstation Use on Workload, Task Performance, and Postural and Physiological Responses. *IIE Trans Occup Ergon Hum Factors.* 2016;4(1):67-81. doi:10.1080/21577323.2016.1184196
- 98:** Karol S, Robertson MM. Implications of sit-stand and active workstations to counteract the adverse effects of sedentary work: A comprehensive review. *Work.* 2015;52(2):255-267. doi:10.3233/WOR-152168
- 99:** Commissaris DACM, Könemann R, Hiemstra-van Mastriht S, et al. Effects of a standing and three dynamic workstations on computer task performance and cognitive function tests. *Appl Ergon.* 2014;45(6). doi:10.1016/j.apergo.2014.05.003
- 100:** MacEwen BT, MacDonald DJ, Burr JF. A systematic review of standing and treadmill desks in the workplace. *Prev Med (Baltim).* 2015;70:50-58. doi:10.1016/j.ypmed.2014.11.011
- 101:** Minges KE, Chao AM, Irwin ML, et al. Classroom Standing Desks and Sedentary Behavior: A Systematic Review. *Pediatrics.* 2016;137(2):e20153087. doi:10.1542/peds.2015-3087
- 102:** Sherry AP, Pearson N, Clemes SA. The effects of standing desks within the school classroom: A systematic review. *Prev Med Reports.* 2016;3:338-347. doi:10.1016/j.pmedr.2016.03.016
- 103:** Tew GA, Posso MC, Arundel CE, McDaid CM. Systematic review: Height-adjustable workstations to reduce sedentary behaviour in office-based workers. *Occup Med (Chic Ill).* 2015;65(5):357-366. doi:10.1093/occmed/kqv044
- 104:** Neuhaus M, Healy GN, Dunstan DW, Owen N, Eakin EG. Workplace sitting and height-adjustable workstations: A randomized controlled trial. *Am J Prev Med.* 2014;46(1). doi:10.1016/j.amepre.2013.09.009
- 105:** Healy GN, Eakin EG, LaMontagne AD, et al. Reducing sitting time in office workers: Short-term efficacy of a multicomponent intervention. *Prev Med (Baltim).* 2013;57(1). doi:10.1016/j.ypmed.2013.04.004
- 106:** Grunseit, A.C., Chau, J.Y., Van der Ploeg, H.P. & Bauman A. Thinking on your feet: A qualitative evaluation of an installation of sit-stand desks in a medium-sized workplace. *J Sci Med Sport.* 2013;13(1):365. doi:10.1016/j.jsams.2012.11.479
- 107:** Halonen JI, Stenholm S, Kivimaki M, et al. Is change in availability of sports facilities associated with change in physical activity? A prospective cohort study. *Prev Med.* 2015;73:10-14. doi:10.1016/j.ypmed.2015.01.012
- 108:** Watts AW, Mâsse LC. Is access to workplace amenities associated with leisure-time physical activity among Canadian adults? *Can J Public Heal.* 2013;104(1).
- 109:** U.S. Consumer Product Safety Commission. Public Playground Safety Checklist. <https://www.cpsc.gov/safety-education/safety-guides/playgrounds/public-playground-safety-checklist>. Accessed January 12, 2018.
- 110:** Heath GW, Ross CB, Kruger J, et al. The Effectiveness of Urban Design and Land Use and Transport Policies and Practices to Increase Physical Activity: A Systematic Review. *J Phys Act Heal.* 2006;3((suppl 1)):S55-S76. [Reference.](#)
- 111:** Ewing R, Hajrasouliha A, Neckerman KM, Purciel-Hill M, Greene W. Streetscape Features Related to Pedestrian Activity. *J Plan Educ Res.* 2015;36(1):5-15. doi:10.1177/0739456x15591585
- 112:** City of New York, York C of N. Active Design: Shaping the Sidewalk Experience. 2013. [Reference](#) or [Reference.](#)
- 113:** American Planning Association, Robertwood Johnson Foundation. The Benefits of Street-Scale Features for Walking and Biking. Princeton, NJ: Planning and Community Health Center; 2015. [Reference.](#)
- 114:** U.S. Green Building Council. LEED ND: Built Project - Walkable Streets. Presented at the: [Reference.](#)

- 115:** Volpp K, Asch D, Galvin R, Loewenstein G. Redesigning Employee Health Incentives—Lessons from Behavioral Economics. *N Engl J Med*. 2011;365(5):388-390. doi:10.1056/NEJMp1105966.
- 116:** Barte JCM, Wendel-Vos GCW. A Systematic Review of Financial Incentives for Physical Activity: The Effects on Physical Activity and Related Outcomes. *Behav Med*. 2015;43(2):1-12. doi:10.1080/08964289.2015.1074880
- 117:** Patel MS, Asch DA, Rosin R, et al. Individual Versus Team-Based Financial Incentives to Increase Physical Activity: A Randomized, Controlled Trial. *J Gen Intern Med*. 2016;31(7):746-754. doi:10.1007/s11606-016-3627-0
- 118:** Shin DW, Yun JM, Shin JH, et al. Enhancing physical activity and reducing obesity through smartcare and financial incentives: A pilot randomized trial. *Obesity*. 2017;25(2):302-310. doi:10.1002/oby.21731
- 119:** Finkelstein EA, Haaland BA, Bilger M, et al. Effectiveness of activity trackers with and without incentives to increase physical activity (TRIPPA): a randomised controlled trial. *Lancet Diabetes Endocrinol*. 2016;4(12):983-995. doi:10.1016/S2213-8587(16)30284-4
- 120:** Lunze K, Paasche-Orlow MK. Financial Incentives for Healthy Behavior. *Am J Prev Med*. 2013;44(6):659-665. doi:10.1016/j.amepre.2013.01.035
- 121:** Grant RW, Sugarman J. Ethics in Human Subjects Research: Do Incentives Matter? *J Med Philos*. 2004;29(6):717-738. doi:10.1080/03605310490883046
- 122:** Task Force on Community Preventive Services. Obesity: Behavioral Interventions that Aim to Reduce Recreational Sedentary Screen Time Among Children. The Community Guide. [Reference](#). Published 2014. Accessed August 21, 2017.
- 123:** Healthy Schools Campaign. Move Well. [Reference](#).
- 124:** Celis-Morales CA, Perez-Bravo F, Ibañez L, Salas C, Bailey MES, Gill JMR. Objective vs. Self-Reported Physical Activity and Sedentary Time: Effects of Measurement Method on Relationships with Risk Biomarkers. Dasgupta K, ed. *PLoS One*. 2012;7(5). doi:10.1371/journal.pone.0036345
- 125:** Hagstromer M, Ainsworth BE, Oja P, Sjostrom M. Comparison of a Subjective and an Objective Measure of Physical Activity in a Population Sample. *J Phys Act Heal*. 2010;7:541-550. [Reference](#). Accessed January 10, 2018.
- 126:** Piwek L, Ellis DA, Andrews S, Joinson A. The Rise of Consumer Health Wearables: Promises and Barriers. *PLoS Med*. 2016;13(2). doi:10.1371/journal.pmed.1001953
- 127:** Evenson KR, Goto MM, Furberg RD. Systematic review of the validity and reliability of consumer-wearable activity trackers. *Int J Behav Nutr Phys Act*. 2015;12(1):159. doi:10.1186/s12966-015-0314-1
- 128:** Lee J, Finkelstein J. Activity Trackers: A Critical Review. In: *Studies in Health Technology and Informatics*. Vol 205. ; 2014:558-562. doi:10.3233/978-1-61499-432-9-558
- 129:** Springbuk. Employer Guide to Wearables 2.0.; 2017. [Reference](#). Accessed February 23, 2018.
- 130:** Mercer K, Li M, Giangregorio L, Burns C, Grindrod K. Behavior Change Techniques Present in Wearable Activity Trackers: A Critical Analysis. *JMIR mHealth uHealth*. 2016;4(2):e40. doi:10.2196/mhealth.4461
- 131:** Task Force on Community Preventive Services. Obesity: Technology-Supported Multicomponent Coaching or Counseling Interventions—To Maintain Weight Loss. The Community Guide. [Reference](#). Published 2009. Accessed January 10, 2018.
- 132:** Qiu S, Cai X, Ju C, et al. Step Counter Use and Sedentary Time in Adults: A Meta-Analysis. Antonino B, ed. *Medicine (Baltimore)*. 2015;94(35). doi:10.1097/MD.0000000000001412.
- 133:** World Health Organization. Global Recommendations on Physical Activity for Health. Geneva, Switzerland; 2010. [Reference](#).

THERMAL COMFORT

The WELL Thermal Comfort concept aims to promote human productivity and ensure a maximum level of thermal comfort among all building users through improved HVAC system design and control and by meeting individual thermal preferences.

Thermal comfort is defined as “the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation.”^[1] Thermal comfort in the body is provided through a homeostatic system that balances heat gains and losses to maintain the body’s core temperature within its optimal range, 36-38 °C [97-100 °F], and is regulated by the hypothalamus.^[2]

The indoor thermal environment not only impacts our buildings’ energy use, as cooling and heating in developed and many developing countries account for approximately half of a building’s energy consumption,^[3,4] but also plays a large role in the way we experience the places where we live and work.^[5] Thermal comfort is linked to our health, well-being and productivity^[6,7,8] and is ranked as one of the highest contributing factors influencing overall human satisfaction in buildings.^[9,10] Due to its influence on the integumentary, endocrine and respiratory body systems, thermal comfort can impact multiple health outcomes. For example, exposure to cold air and sudden temperature change can trigger asthma in adults.^[11] Leading research also indicates employees perform 6% poorer when the office is overheated and 4% poorer when the office is cold.^[12] Thermal discomfort is also known to play a role in sick building syndrome symptoms, which will similarly cause decreases in productivity.^[13,14] Thermal comfort is an issue in most building types, and similar outcomes have been studied in a wide variety of settings, including educational institutions^[15,16] and residential buildings.^[17] In contrast to those who are dissatisfied with thermal conditions, office workers who are satisfied with their thermal environment can be more productive in the workplace.^[13]

Despite technological advancements and great improvements in our understanding of thermal comfort in buildings, many people still feel uncomfortable during the work day.^[18] Studies have also shown that only 11% of the office buildings surveyed in the U.S. provided thermal environments that met generally accepted goals of human satisfaction.^[13] Similarly, as many as 41% of office workers have expressed dissatisfaction with their thermal environment.^[13]

This is due to the complexities involved in controlling the interaction between people and the buildings in which we live, learn, work and play. Thermal comfort is subjective, meaning that not everyone will be equally comfortable under the same conditions. This highlights that a one-size-fits-all approach to thermal comfort in buildings invariably fails for large numbers of people.^[19]

A comfortable thermal environment that satisfies all occupants is challenging to achieve due to individual preferences and possible spatial and temporal variations in the thermal environment.^[20] Therefore, there is a need for a holistic approach to thermal comfort that can satisfy the individual preferences of all (or nearly all) building users. Correctly sized HVAC equipment is essential for optimal thermal comfort. Building HVAC systems should be designed to monitor and control for variations in indoor temperature, radiant heat transfer through the building envelope, relative humidity and air movement. Ultimately, the design should enable the people who live, work, learn, and play to easily make system adjustments for individual thermal preferences. Systems should always be designed with human-centric thermal zoning in mind, helping to optimize the system’s thermal performance.^[21]

Due to the difficulties of setting temperature levels that suit all individual preferences,^[1] thermal comfort conditions should create baseline satisfaction for the largest number of people. Where zoning allows, individually accessible thermostats that enable users to set their own thermal conditions independent of other zones should be used.^[22] In larger spaces such as open offices, it may be necessary to provide localized control to people who work in cubicles and other work areas.^[23] It is important, however, that energy-efficient devices are selected and that employees are educated about how to use these devices effectively and safely. Similar solutions can be implemented in other spaces, such as residences and schools. A significant benefit for users is the ability to control and adjust their environment to maintain comfort. New building control apps allow people in commercial buildings to “vote” and to directly influence the operation of HVAC systems without use of thermostats or intervention by building operators.^[24,25] These systems offer promise to enable highly granular individual control in new and existing buildings. Additionally, when possible,

personal thermal comfort devices should be used; these have been shown to improve self-reported productivity rates, decrease symptoms associated with sick building syndrome and increase thermal comfort.^[26]

WELL takes a holistic approach to thermal comfort and provides a combination of research-based interventions to help design buildings that address individual thermal discomfort and support human health, well-being and productivity.

T01 THERMAL PERFORMANCE | P

Intent: Ensure that the majority of building users find the thermal environment acceptable.

Summary: This WELL feature requires projects to create indoor thermal environments that provide comfortable thermal conditions to the majority of people in support of their health, well-being and productivity.^[6,8]

Issue: The indoor thermal environment is ranked as one of the strongest contributing factors to overall human satisfaction in the built environment.^[9,10] The thermal environment impacts human health, comfort and productivity.^[6,7] Due to its linkages to integumentary, endocrine and respiratory body systems, thermal comfort can cause a variety of detrimental health outcomes. For example, cold and dry spaces are known to facilitate the spread of the influenza virus because low humidity levels allow the virus to persist longer in the air, while low air temperature extends the virus shedding period.^[27,28] On the other hand, overly warm indoor spaces are linked to increases in sick building syndrome symptoms, irregular heart rate, respiratory issues, fatigue and negative mood.^[29] Warm and humid indoor spaces are also associated with mold and fungal growth.^[30]

Solutions: Thermal comfort standards utilize a model that provides a means of predicting whether humans in a mechanically conditioned space will be satisfied with the thermal environment based on six core parameters: air temperature, humidity, air movement, mean radiant temperature of surrounding surfaces, metabolic rate and clothing insulation.^[2,31] For naturally conditioned buildings, the adaptive thermal comfort model correlates human comfort directly with indoor operative temperature and outdoor temperature.^[1,32] Achieving thermal satisfaction among people requires some level of control over thermal comfort parameters in any given environment.

Impact: Controlling the thermal environment substantially impacts a building's energy footprint, as in many countries heating and cooling account for approximately half of a building's energy consumption.^[3,4] Furthermore, thermal conditions play a large role in the way we experience the indoor environment.

Part 1 Support Thermal Environment

For All Spaces except Commercial Kitchen Spaces:

Mechanically ventilated spaces

The following requirements are met:

- During 98% of the standard occupied hours of the year, 95% of regularly occupied spaces achieve thermal conditions representing Predicted Mean Vote (PMV) levels within ± 0.5 ; $PPD \leq 10\%$ (as per ASHRAE 55-2013, ISO 7730: 2005 or EN 15251:2007).^[1,33,34] Project describes outdoor weather conditions under which PMV and PPD levels would not be achieved, including historical weather data demonstrating that they are not expected to occur more than 2% of standard occupied hours per year.
- During all standard occupied hours of the year, all regularly occupied spaces achieve thermal conditions representing Predicted Mean Vote (PMV) levels within ± 0.7 ; $PPD \leq 15\%$.
- Projects submit assumptions of clothing insulation and metabolic rate (and for projects using the elevated air speed method, air speed at a height between 0.6 and 1.7 m [2 to 5.6 ft]) used in design calculations.

OR-----

Naturally ventilated spaces

One of the following requirements is met:

- 80% acceptability limit (as per ASHRAE 55-2013).^[1]
- Class I or II acceptability limit (as per EN 15251:2007).^[34]

For Commercial Kitchen Spaces:

The following requirement is met:

- The operative temperature in the kitchen does not exceed 27 °C [80 °F] at any time.

For Dwelling Units:

All regularly occupied spaces meet one of the following requirements:

- a. Satisfy the conditions listed for “All spaces.”
- b. Meet the below:
 - 1. If the local climate requires cooling, each dwelling unit has the flexibility to accommodate the installation of cooling device(s) that allow tenants to maintain desirable comfort conditions in bedrooms and living spaces.
 - 2. Project owner identifies at least three types of cooling mechanisms (e.g., split systems, ceiling fans or other systems that improve thermal comfort) and provides installation assistance for the cooling mechanism selected by a tenant.
 - 3. Project owner educates or assists tenants with maintaining their cooling mechanism(s).
 - 4. Projects provide a heating system to meet minimum temperature requirements from ASHRAE 55:2013, ISO 7730:2005 or EN 15251:2005.

Note:

Mixed-mode-conditioned spaces are deemed compliant with the feature if requirements for both mechanically and naturally conditioned spaces are satisfied.

Part 2 Monitor Thermal Parameters

For All Spaces:

Conduct ongoing monitoring according to the following requirements:

- a. The dry-bulb temperature, relative humidity, air speed (only for projects that use elevated air speed method) and mean radiant temperature are monitored in regularly occupied spaces within the building at intervals no less than twice a year (once in winter and once in summer season), and results are annually submitted through WELL Online.
- b. The number and location of sampling points comply with the requirements outlined in the Performance Verification Guidebook.

T02 ENHANCED THERMAL PERFORMANCE | O (MAX: 3 PT)

Intent: Enhance thermal comfort and promote human productivity by ensuring that a substantial majority of building users (above 80%) perceive their environment as thermally acceptable.

Summary: This WELL feature requires projects to provide high levels of thermal comfort through compliance with design requirements or by determining occupant satisfaction through a survey.

Issue: Building users who are satisfied with their thermal environment have been shown to be more productive in the workplace,^[13] while thermal discomfort is associated with sick building syndrome symptoms and other conditions that lead to a decrease in productivity.^[13,14] Unfavorable levels of heat, humidity and ventilation are associated with symptoms of itchy eyes, headache and throat irritation in building users.^[35] Studies have also shown that only 11% of office buildings surveyed in the U.S. provide thermal environments that meet generally accepted goals of human satisfaction. Similarly, as many as 41% of office workers have expressed dissatisfaction with the thermal environment.^[13]

Solutions: Achieving optimal thermal comfort requires some level of control over the six core thermal comfort parameters in any given environment (air temperature, humidity, air movement, mean radiant temperature of surrounding surfaces, metabolic rate, clothing insulation).^[2,31] This can practically be achieved through correct sizing of HVAC equipment, optimal system control, passive building design strategies, and/or through optimizing personal factors. Furthermore, building occupants are an invaluable source of information that can be used for improving the performance of buildings. Thermal comfort surveys allow projects to objectively gauge which building services and design features are or are not performing well, and help to prioritize the steps needed to improve occupant thermal comfort satisfaction and workplace productivity. If survey results indicate that percentage of occupants dissatisfied with thermal conditions in the building exceeds the targeted thresholds, it is necessary to develop a detailed plan for action and commitment to address occupant dissatisfaction with thermal conditions.

Impact: The impact of increasing the number of people satisfied with their thermal environment is substantial, as it extends beyond comfort and is linked to improved health, well-being and productivity.^[6,8] WELL encourages projects to go beyond the minimum requirements of the standards for thermal comfort listed in Feature T01: Thermal Performance.

Part 1 Enhance Thermal Environment (Max: 1 Pt)

For All Spaces except Commercial Kitchen Spaces:

Mechanically ventilated spaces

The following requirements are met:

- a. During all standard occupied hours of the year, all regularly occupied spaces achieve thermal conditions representing Predicted Mean Vote (PMV) levels within +/- 0.5; PPD \leq 10% (as per ASHRAE 55-2013, ISO 7730:2005 or EN 15251:2007).^[1,33,34]

OR-----

Naturally ventilated spaces

During all standard occupied hours of the year, all regularly occupied spaces achieve one of the following thermal conditions:

- a. 90% acceptability limit (as per ASHRAE 55-2013).^[1]
- b. Class I acceptability limit (as per EN 15251:2007).^[34]

Note:

Mixed-mode-conditioned spaces are deemed compliant with the feature if requirements for both mechanically and naturally conditioned spaces are satisfied.

Part 2 Achieve Thermal Comfort (Max: 3 Pt)

For All Spaces except Commercial Kitchen Spaces:

A post-occupancy survey is administered at least twice a year, including once in June, July or August and once in December, January or February, at least six months after occupancy, which satisfies the following conditions:

- a. All employees are invited to participate in the anonymous survey, and responses are collected from the following number of respondents:^[1]
 1. At least 35% the total occupants if more than 45 occupants are solicited.
 2. At least 15 occupants if solicited occupants number is between 20 and 45.
 3. At least 80% of the total occupants if less than 20 occupants are solicited.
- b. All eligible employees are invited to participate in the survey.
- c. The survey includes an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related issues in accordance with either:
 1. The sample survey in Appendix T1.
 2. Any pre-approved survey listed in Part 1: Administer Project Survey in Feature C03: Occupant Survey.
- d. The results of the survey responses comply with one of the target satisfaction thresholds as specified in the table below:

Thermal Comfort Satisfaction Thresholds	Points
80% of regular occupants	2
90% of regular occupants	3

Note:

Surveys may be given to occupants via a website, phone application or handed out as hard copies. The surveys should be distributed during mid-morning or mid-afternoon, at least 30 minutes after arrival or after a lunch break. The distribution of the results are submitted as part of documentation for this feature. See example in Appendix T1. For initial certification, only the results from the first survey are required. For recertification, the median value of occupant satisfaction from the previous six surveys is used.

T03 THERMAL ZONING | O (MAX: 2 PT)

Intent: Enhance thermal comfort of people in building through provision of thermal zoning in each space.

Summary: This WELL feature requires projects to increase thermal control of the space by allowing control of either the conditions of a thermal zone or movement between thermal zones.

Issue: People in buildings who are satisfied with their thermal environment have been shown to be more productive in the workplace.^[13] In contrast, indoor thermal discomfort has been associated with sick building syndrome symptoms, and reduced satisfaction is tenuously linked to productivity.^[13,14] For instance, individuals tend to perform 6% poorer when their office is overheated or 4% poorer when the office is cold.^[12] An average 2% decrease in work performance per 1 °C [1.8 °F] of air temperature rise has been found when the air temperature is above 25 °C [77 °F].^[37] On the other hand, even a 1 °C decrease in air temperature within the range of 20-25 °C [68-77 °F] is linked to increased student performance in mathematics.^[36] Furthermore, thermal comfort preferences are highly individual and can be affected by metabolism, body type, clothing and other personal factors.^[5,38,39] These factors make it nearly impossible to find a temperature that will satisfy all individuals in the same space at the same time.^[1]

Solutions: Indoor air temperature is one of the key characteristics of the indoor environment. It can be influenced by a number of factors, including the building physics and orientation, building location and structure, occupant density, ventilation strategy and mode of operation. In the majority of buildings, the HVAC system is responsible for controlling indoor air temperature and humidity. Where temperature zoning is an option, individually accessible thermostats that enable people to set their own thermal conditions independently of other zones should be used. An additional strategy is to ensure that people can choose areas with temperatures that best fit their thermal preferences. Temperature variations across the building allow the individuals the flexibility to select a work area where they are most comfortable (termed “free address”).

Impact: As temperature preferences are highly personal and differ from one individual to another, allowing people to control air temperature is linked to increased thermal satisfaction and productivity.^[12,37]

Part 1 Ensure Thermostat Control (Max: 2 Pt)

For All Spaces except Commercial Kitchen Spaces:

The following requirements are met for all regularly occupied spaces equipped with a heating and/or cooling system:

- a. All regularly occupied spaces contain thermal zones, as shown in the table below (note: individual rooms less than 30 m² [320 ft²] or 5 occupants are still considered separate zones):

Zone Density	Points
Minimum 1 thermal zone per 60 m ² [650 ft ²] or per 10 occupants (whichever results in fewer thermal zones)	1
Minimum 1 thermal zone per 30 m ² [320 ft ²] or per 5 occupants (whichever results in fewer thermal zones)	2

- b. Temperature sensors are positioned at least 1 m [3.3 ft] away from walls, windows, doors, direct sunlight, air supply diffusers, mechanical fans, heaters or any other significant source of heat or cold.
- c. All regular building occupants have control over temperature through either:
 1. Thermostats Present within the thermal zone.
 2. Digital interface available on a computer or phone.

Note: Individual rooms less than 30 m² [320 ft²] or 5 occupants are still considered separate zones.

Part 2 Promote Free Address (Max: 1 Pt)

For Office Spaces:

Projects meet the following requirements:

- a. The building provides a thermal gradient of at least 3 °C [5 °F] across open workspaces over 200 m² [2,150 ft²], between rooms with more than 10 people and/or between floors.
- b. All office spaces with employees performing tasks that require similar workstations use free address to allow employees to select a work space with a desired temperature.

T04 INDIVIDUAL THERMAL CONTROL | O (MAX: 3 PT)

Intent: Maximize and personalize thermal comfort among all individuals.

Summary: This WELL feature requires projects to improve thermal comfort of people in the space through the provision of personal thermal comfort devices and flexible dress codes that ensure individual thermal preferences are met.

Issue: The current standards that govern thermal comfort in buildings aim to provide a thermal environment where at minimum 80% of people will perceive the thermal environment as acceptable.^[1] Thermal comfort preferences are highly individual, meaning that not everyone will be equally comfortable under the same environmental conditions. Besides the six primary factors of thermal comfort, many secondary factors may at least subtly influence thermal comfort. Age, sex, health condition, personal thermal adaptation and thermal history, including climatological origin, are considered as major secondary factors.^[40,41] Factors such as temperament, preferences, social and cultural norms and seasonal variation also play an important role in determining individual thermal comfort.^[39,42] These factors make it nearly impossible to find indoor thermal comfort conditions that will satisfy all people in the same space at the same time.^[1]

Solutions: The capability of controlling the thermal environment in individuals’ immediate surroundings can be important for achieving personal thermal comfort. Provision of individual thermal control devices results in improved individual thermal comfort and in expansion of the thermal comfort acceptability limits.^[42,43] For example, a personal ventilation device that allows user control over airflow rate and air temperature can efficiently provide thermal comfort.^[44] The provision of individual thermal control allows for a broader range of recommended indoor air temperatures, which is linked to energy savings potential.^[45] For example, the use of a chair equipped with fans allows the room air temperature to increase without compromising thermal comfort.^[46] In larger shared spaces, it is necessary to provide localized control to people who work in cubicles and other work areas. The use of personalized equipment, such as desktop fans or heating/cooling chairs and pads, is a good strategy to give people the ability to better control their sensation and comfort.^[47,48,49] In addition, flexible dress codes are important because clothing insulation is also one of the primary forms of intervention for addressing suboptimal thermal conditions.^[50]

Impact: The design of the thermal environment can allow people to easily make system adjustments and therefore maximize their thermal comfort. WELL encourages projects to adopt a holistic approach to thermal comfort that results in the provision of acceptable thermal environment for all people in buildings.

Part 1 Ensure Personal Thermal Comfort (Max: 3 Pt)

For All Spaces except Commercial Kitchen Spaces:

The following requirements are met:

- a. In all regularly occupied and shared spaces within the same heating or cooling zone, regular building occupants have access upon request to personal thermal comfort devices (e.g., personalized fans, heated/cooled chairs, and others, except combustion-based space heaters) that provide individual user control of air speed, air temperature and/or mean radiant temperature, per requirements specified in the table below:

Availability	Points
Can accommodate upon request at least 50% of occupants at one time	2
Can accommodate upon request 100% of occupants	3

- b. All rooms with a heating and/or cooling system that are regularly occupied by a single occupant meet one of the below conditions:
 - 1. Occupant has the ability to adjust the temperature.
 - 2. Occupant has access to personal thermal comfort devices.
 - 3. Implement localized air delivery as described in Part 4: Implement Advanced Air Distribution of Feature A06: Enhanced Ventilation.

Part 2 Facilitate Thermal Adaptation (Max: 1 Pt)

For All Spaces except Commercial Kitchen Spaces:

Projects meet the following requirements:

- a. All occupants have access upon request to blankets. Used blankets are washed at minimum on a weekly basis.
- b. A flexible dress code policy allows for individual thermal preferences.^[51]

T05 RADIANT THERMAL COMFORT | O (MAX: 2 PT)

Intent: Maximize volume of the space, reduce dust transmission, improve ventilation control and increase thermal comfort by incorporating radiant heat and cooling systems into the building design.

Summary: This WELL feature requires projects to use radiant systems and independently controlled ventilation systems.

Issue: Mean radiant temperature is one of the six core thermal comfort parameters. It is influenced by a surface material's ability to absorb or emit radiant heat, the extent to which the surface area is exposed to the person (view factor) and the temperatures of the surrounding objects. Non-uniform thermal radiation can result from cold windows, uninsulated walls, equipment and improperly sized heating panels, all of which can cause local discomfort.^[52] In addition, conventional "all-air" systems have a higher risk of draft discomfort due to elevated indoor air velocity.^[53] Furthermore, inadequate humidity control can also impair thermal comfort. Low humidity levels in winter can lead to dryness and irritation of the airways, skin, eyes, throat and mucous membranes^[58] and are also linked to the slower inactivation of virus particles.^[28]

Solutions: Radiant heating systems are designed to affect mean radiant temperature, and thus the heat exchange with the people in the space, by supplying heat directly to the surrounding surfaces of the floors, walls and ceilings. With radiant systems, the heat transfer due to radiation increases, while the heat transfer due to convection decreases. There is evidence that radiant systems have potential to provide better comfort than conventional air systems as well as a host of other benefits.^[53] For example, radiant heating and cooling systems are known to have lower risk of draught and local discomfort because of lower vertical air temperature gradients.^[54,55,56] There are also fewer local discomfort complaints in the region of human feet (often under desks) during the heating season, due to reduced temperature fluctuations and vertical temperature gradients.^[56] The use of radiant heating and cooling reduces the number of allergens circulated in the air as this type of system does not use forced air to distribute heating or cooling. In addition, buildings with radiant systems have the advantage of quiet operation, low energy consumption and the capability of design integration with an independent ventilation system.^[54] The use of radiant systems is also easily scaled to match the area being covered, ensuring proper heating and cooling capacity.^[57] With the use of radiant heating, the mean radiant temperature in a space can be kept lower compared to convective heating, providing the benefit of a higher relative humidity in winter time. In addition, by the provision of a radiant system coupled with a dedicated air system, it is possible to separate the twofold role of the mechanical system in controlling both heating/cooling and ventilation, which could result in better control of thermal environment.

Impact: Proper design and operation of radiant heating and cooling systems can provide equal or even better thermal comfort compared to all-air systems, which could ultimately be linked to increased human comfort and well-being.^[53]

Part 1 Implement Radiant Systems (Max: 1 Pt)

For All Spaces except Commercial Kitchen Spaces:

At least 50% of the project floor area is serviced by one of the following systems:

- a. Hydronic radiant heating and/or cooling systems.^[57]
- b. Electric radiant systems.^[57]

Note: Projects pursuing this part for radiant cooling systems must also meet the condensation management requirements of Part 1: Manage Relative Humidity in Feature T07: Humidity Control.

Part 2 Implement Dedicated Outdoor Air Systems (Max: 1 Pt)

For All Spaces:

Mechanically ventilated spaces

In spaces where an independent system is used for heating and/or cooling, dedicated outdoor air systems meet one of the following requirements:

- a. The system complies with ASHRAE Design Guide For Dedicated Outdoor Air Systems (2017).^[59]

- b. A detailed design review of the proposed system is conducted by an independent, qualified and registered professional mechanical engineer demonstrated not to have a conflict of interest. The review addresses thermal comfort (dry-bulb temperature, humidity and air velocity, at a minimum) and ventilation rates, as well as overall serviceability and system reliability. Reports must demonstrate satisfactory compliance with ventilation standards of Part 1: Ensure Adequate Ventilation in Feature A03: Ventilation Effectiveness .

T06 THERMAL COMFORT MONITORING | O (MAX: 1 PT)

Intent: Monitor and effectively address unacceptable thermal comfort conditions and inform building managers and users of the thermal comfort parameters of their indoor environment.

Summary: This WELL feature requires projects to monitor thermal comfort parameters using sensors in their buildings that can be used as feedback for building managers and users to take appropriate actions.

Issue: Unfavorable levels of heat, humidity and ventilation are associated with people's experience of itchy eyes, headache and throat irritation.^[35] Outdoor weather, indoor occupancy and building physics and performance, including ventilation rates, are highly variable and have a direct impact on human perceptions of thermal comfort. To maintain ideal performance metrics, projects should continuously gather data on thermal comfort parameters in order to inform remediation actions.

Solutions: Building HVAC systems should be designed to monitor and control for variations in indoor air temperature, mean radiant temperature, relative humidity and air movement. Thermal comfort monitoring can help building users to be aware of and promptly fix any deviations in thermal comfort metrics. These measures by themselves will not resolve the issue of potential thermal discomfort, but they certainly raise awareness and are an important first step toward a solution. In addition to having calibrated sensors, the positioning of the sensors plays an important role in accurate assessment of the thermal environment.

Impact: Monitoring thermal comfort parameters in real-time is important to prevent and resolve thermal comfort issues promptly, which ultimately contributes to improved human health, well-being and productivity.

Part 1 Monitor Thermal Environment (Max: 1 Pt)

For All Spaces:

Thermal comfort monitors

Projects monitor dry-bulb temperature, relative humidity, air speed and mean radiant temperature in regularly occupied areas within the building, satisfying the following requirements:

- Measurements are taken in occupied zones at least 1 m [3.3 ft] away from walls, doors, direct sunlight, air supply/exhausts, mechanical fans, heaters or any other significant source of heat or cold.
- The sensor placement density is minimum one per floor or one every 325 m² [3,500 ft²], whichever is more stringent.
- Measurements are taken at intervals and heights specified in the table below:

Parameter	Sampling Interval	Sampling Height Above the Floor
Dry-bulb temperature	10 minutes or less	1.1–1.7 m [3.6–5.6 ft]
Relative humidity	10 minutes or less	1.1–1.7 m [3.6–5.6 ft]
Air speed (only if elevated air speed is used)	3 months or less	1.1–1.7 m [3.6–5.6 ft]
Mean radiant temperature	3 months or less	1.1–1.7 m [3.6–5.6 ft]

- Data are analyzed for regularly occupied hours (e.g., median, mean, 75th and 95th percentile) and annually submitted through WELL Online.
- Dry-bulb temperature and relative humidity sensors are recalibrated or replaced annually and certificates attesting their calibration or replacement are annually submitted through WELL Online. Air speed and mean radiant temperature sensors used for quarterly measurements are calibrated as per manufacturer's specification.

Environmental measures display

Real-time display of dry-bulb temperature and relative humidity is made available to occupants through one of the following:

- a. At least one monitor screen prominently positioned at the height of 1.1–1.7 m [3.6–5.6 ft] per 930 m² [10,000 ft²] of regularly occupied space.
- b. A website or phone application. At least one visible sign is positioned per 930 m² [10,000 ft²] of regularly occupied space indicating the website or phone application where the data may be accessed.

T07 HUMIDITY CONTROL | O (MAX: 1 PT)

Intent: Limit the growth of pathogens, reduce off-gassing and maintain thermal comfort by providing the appropriate level of humidity.

Summary: This WELL feature requires projects to maintain optimum relative humidity levels that are conducive to human health and well-being.

Issue: Humidity can influence degradation of building materials and the ability of the human body to release heat through evaporation.^[60,61] If the humidity is too high, the human body has a limited capacity to cool down through sweating.^[62] Elevated humidity can lead to increased off-gassing; for example, an increase in relative humidity of 35% can increase the emissions of formaldehyde by a factor of 1.8 to 2.6.^[63] Moreover, high humidity may promote the accumulation and growth of microbial pathogens including bacteria, dust mites and mold, which can lead to odors and cause respiratory irritation and allergies in sensitive individuals.^[30] Conversely, low humidity can lead to dryness and irritation of the airways, skin, eyes, throat and mucous membranes.^[58] Low relative humidity is also associated with longer survival (slower inactivation) of viruses.^[27,28]

Solutions: Buildings situated in climates with broad humidity ranges can maintain relative humidity within healthy and comfortable levels by adding or removing moisture from the air.^[64]

Impact: The provision of recommended relative humidity levels has multiple benefits to human health through control of pathogen growth, improved air quality and thermal comfort.

Part 1 Manage Relative Humidity (Max: 1 Pt)

For All Spaces:

All parts of the project except high-humidity areas meet one of the following requirements:

- a. The mechanical system has the capability of maintaining relative humidity between 30% and 60% at all times by adding or removing moisture from the air.^[34,65]
- b. The modeled relative humidity levels in the space are between 30% and 60% for at least 98% of all business hours of the year.

APPENDIX T1:

Survey Questionnaire:

Please answer the following questions regarding your general thermal experience during the current heating/cooling season.

1. Please rate your satisfaction level with the thermal environment in this space:

- ☐ Very Dissatisfied
- ☐ Dissatisfied
- ☐ Slightly Dissatisfied
- ☐ Neutral
- ☐ Slightly Satisfied
- ☐ Satisfied
- ☐ Very Satisfied

2. Would you prefer this area to be:

- ☐ Cooler
- ☐ Slightly Cooler
- ☐ No Change Required
- ☐ Slightly Warmer
- ☐ Warmer

If your answer to Question 1 contains the word "Dissatisfied," please answer the following two questions:

3. How do you generally perceive the thermal environment in this area:

- ☐ Cold
- ☐ Cool
- ☐ Slightly Cool
- ☐ Neutral
- ☐ Slightly Warm
- ☐ Warm
- ☐ Hot

4. Please mark the potential source (or sources) of your thermal discomfort:

- ☐ Inappropriate room thermostat setpoint temperature
- ☐ Thermostat setpoint temperature being adjusted by occupants
- ☐ Daily variations in room temperature (such as higher temperature in the afternoons)
- ☐ Occasional variations in room temperature (such as being occasionally warm or cold)
- ☐ Parts of the room being too hot
- ☐ Parts of the room being too cold
- ☐ Humidity level is too high
- ☐ Dry air
- ☐ Air movement is too high

- ☐ Air movement is too low
- ☐ Hot/cold air coming from windows
- ☐ Hot/cold walls
- ☐ Solar radiation
- ☐ Local discomfort (part/parts of the body being cold or hot)
- ☐ Heat from equipment and appliances
- ☐ Strict dress code
- ☐ Hot/cold furniture surfaces
- ☐ Furniture causing hot/cold thermal discomfort or sweating
- ☐ Others _____

Example of Result Analysis:

The Percentage of Satisfaction should be reported as the percentage of people who are satisfied with the thermal environment of the space as shown in the following equation:

$$\text{Percentage of Satisfaction} = (\text{Number of Satisfied Occupants}) / (\text{Number of Surveyed Occupants}) \cdot 100$$

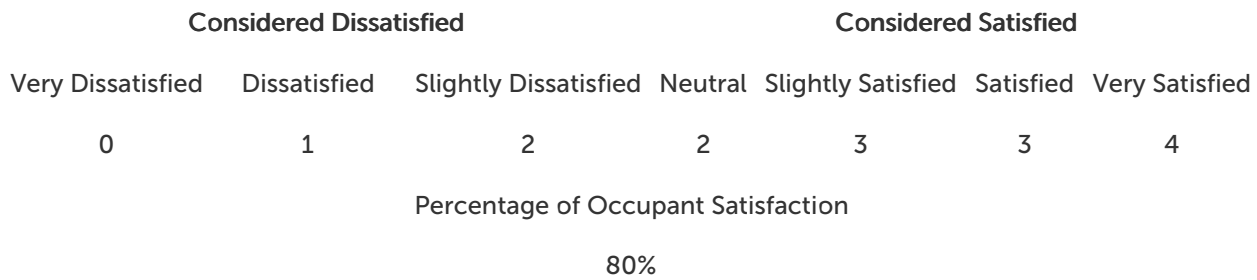
Occupants voting for "Neutral," "Slightly Satisfied," "Satisfied," and "Very Satisfied" should be deemed satisfied with the room's thermal environment. Table 1 shows the results from a typical survey and Table 2 depicts a simple example of the survey report. The results of question 2 (and question 3 if applicable) should be submitted as the number of votes for each thermal sensation and preferences condition as specified in Table 2.

Table 1 Results from a Typical Thermal Comfort Satisfaction Survey with 15 Participants

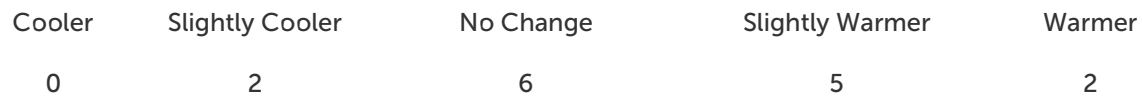
	Question 1	Question 2	Question 3	Question 4
Subject 1	Very Satisfied	No Change		
Subject 2	Satisfied	Slightly Cooler		
Subject 3	Slightly Dissatisfied	Warmer	Cold	Parts of the room being too cold
Subject 4	Slightly Dissatisfied	Slightly Warmer	Cool	Hot/Cold air coming from windows
Subject 5	Satisfied	No Change		
Subject 6	Very Satisfied	No Change		
Subject 7	Neutral	Slightly Warmer		
Subject 8	Very Satisfied	No Change		
Subject 9	Dissatisfied	Warmer	Slightly Cool	Inappropriate room thermostat setpoint temperature
Subject 10	Slightly Satisfied	Slightly Cooler		
Subject 11	Neutral	Slightly Warmer	Slightly Cool	Hot/Cold air coming from windows
Subject 12	Slightly Satisfied	Slightly Warmer		
Subject 13	Very Satisfied	No Change		
Subject 14	Slightly Satisfied	Slightly Warmer		
Subject 15	Satisfied	No Change		

Table 2 A typical Thermal Comfort Satisfaction Survey Report

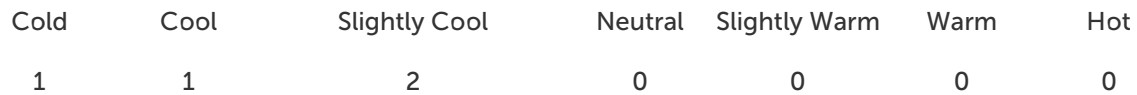
1. Please rate your satisfaction level with the temperature in this room:



2. Would you prefer this area to be (based on the number of votes):



3. How do you generally perceive the thermal environment in this area (based on the number of votes):



REFERENCES

- 1: American Society of Heating, Refrigeration and Air Conditioning Engineers. ANSI/ASHRAE Standard 55-2013: Thermal Environmental Conditions for Human Occupancy. Atlanta: ASHRAE; 2013.
- 2: Fanger PO. Thermal Comfort: Analysis and Applications in Environmental Engineering. Danish Technical Press; 1970.
- 3: Chua KJ, Chou SK, Yang WM, Yan J. Achieving better energy-efficient air conditioning – A review of technologies and strategies. Appl Energy. 2013;104:87-104. doi:10.1016/J.APENERGY.2012.10.037.
- 4: Pérez-Lombard L, Ortiz J, Pout C. A review on buildings energy consumption information. Energy Build. 2008;40(3):394-398. doi:10.1016/J.ENBUILD.2007.03.007.
- 5: Nicol JF, Humphreys MA. Adaptive thermal comfort and sustainable thermal standards for buildings. Energy Build. 2002;34(6):563-572. doi:10.1016/S0378-7788(02)00006-3.
- 6: Mendell MJ, Fisk WJ, Kreiss K, et al. Improving the health of workers in indoor environments: priority research needs for a national occupational research agenda. Am J Public Health. 2002;92(9):1430-1440. [Reference](#). Accessed November 22, 2017.
- 7: Fisk W. Indoor Air Quality Handbook. New York: McGraw Hill; 2000.
- 8:
Fisk WJ. How IEQ Affects Health, Productivity. 2002. [Reference](#) Accessed May 22, 2018.
- 9: Zhang A. Human thermal sensation and comfort in transient and non-uniform thermal environments. September 2003. [Reference](#). Accessed November 27, 2017.
- 10: Frontczak MWP. Literature survey on how different factors influence human comfort in indoor environments. Build Environ. 2011;46(4):922-937. doi:10.1016/J.BUILDENV.2010.10.021.
- 11: American Lung Association. Asthma in Adults Fact Sheet. [Reference](#). Accessed November 22, 2017.
- 12: Seppanen O, Fisk WJ, Faulkner D. Control of Temperature for Health and Productivity in Offices. 2004. [Reference](#). Accessed May 22, 2018.
- 13: Huizenga C, Abbaszadeh S, Zagreus L, Zagreus L, Arens E. Air quality and thermal comfort in office buildings: Results of a large indoor environmental quality survey. In: Proceedings of Healthy Buildings 2006. Vol 3. 2006:393-397. Accessed November 27, 2017.
- 14: Wargocki P, Wyon DP, Sundell J, Clausen G, Fanger PO. The effects of outdoor air supply rate in an office on perceived air quality, sick building syndrome (SBS) symptoms and productivity. Indoor Air. 2000;10(4):222-236. [Reference](#). Accessed November 1, 2017.
- 15: Wargocki P, Wyon D. Ten questions concerning thermal and indoor air quality effects on the performance of office work and schoolwork. Build Environ. 2017;112:359-366. doi:10.1016/J.BUILDENV.2016.11.020.
- 16: Xiong J, Lian Z, Zhou X, You J, Lin Y. Potential indicators for the effect of temperature steps on human health and thermal comfort. Energy Build. 2016;113:87-98. doi:10.1016/J.ENBUILD.2015.12.031.
- 17: Ormandy D, Ezratty V. Health and thermal comfort: From WHO guidance to housing strategies. Energy Policy. 2012;49:116-121. doi:10.1016/J.ENPOL.2011.09.003.
- 18: Schiller A, Arens G, Bauman EA, et al. A field study of thermal environments and comfort in office buildings. 1988;94 Part 2. [Reference](#). Accessed March 8, 2018.
- 19: Djongyang N, Tchinda R, Njomo D. Thermal comfort: A review paper. Renew Sustain Energy Rev. 2010;14(9):2626-2640. [Reference](#). Accessed March 8, 2018.
- 20: van Hoof J. Forty years of Fanger's model of thermal comfort: comfort for all? Indoor Air. 2008;18(3):182-201. doi:10.1111/j.1600-0668.2007.00516.x.
- 21: Erickson VL, Cerpa AE. Thermovote: participatory sensing for efficient building HVAC conditioning. In: Proceedings of the Fourth ACM Workshop on Embedded Sensing Systems for Energy-Efficiency in Buildings - BuildSys '12. New York, New York, USA: ACM Press; 2012:916. doi:10.1145/2422531.2422534.

- 22: Karjalainen S, Koistinen O. User problems with individual temperature control in offices. *Build Environ.* 2007;42(8):2880-2887. doi:10.1016/J.BUILDENV.2006.10.031.
- 23: Vesely M, Zeiler W. Personalized conditioning and its impact on thermal comfort and energy performance – A review. *Renew Sustain Energy Rev.* 2014;34:401-408. doi:10.1016/J.RSER.2014.03.024.
- 24: Zhao J, Lam KP, Loftness V, Ydstie BE. Occupant Individual Thermal Comfort Data Analysis in an Office. In: *Sustainable Human–Building Ecosystems*. Reston, VA: American Society of Civil Engineers; 2015:108-116. doi:10.1061/9780784479681.012.
- 25: Zhao Q, Zhao Y, Wang F, Wang J, Jiang Y, Zhang F. A data-driven method to describe the personalized dynamic thermal comfort in ordinary office environment: From model to application. *Build Environ.* 2014;72:309-318. doi:10.1016/J.BUILDENV.2013.11.008.
- 26: Boerstra AC, te Kulve M, Toftum J, Loomans MGLC, Olesen BW, Hensen JLM. Comfort and performance impact of personal control over thermal environment in summer: Results from a laboratory study. *Build Environ.* 2015;87:315-326. doi:10.1016/J.BUILDENV.2014.12.022.
- 27: Mbithi JN, Springthorpe VS, Sattar SA. Effect of relative humidity and air temperature on survival of hepatitis A virus on environmental surfaces. *Appl Environ Microbiol.* 1991;57(5):1394-1399. [Reference](#). Accessed November 3, 2017.
- 28: Casanova LM, Jeon S, Rutala WA, Weber DJ, Sobsey MD. Effects of air temperature and relative humidity on coronavirus survival on surfaces. *Appl Environ Microbiol.* 2010;76(9):2712-2717. doi:10.1128/AEM.02291-09.
- 29: Lan L, Wargocki P, Wyon DP, Lian Z. Effects of thermal discomfort in an office on perceived air quality, SBS symptoms, physiological responses, and human performance. *Indoor Air.* 2011;21(5):376-390. doi:10.1111/j.1600-0668.2011.00714.x.
- 30: Arundel AV, Sterling EM, Biggin JH, Sterling TD. Indirect health effects of relative humidity in indoor environments. *Environ Health Perspect.* 1986;65:351-361. [Reference](#). Accessed November 3, 2017.
- 31: de Dear R. Thermal comfort in practice. *Indoor Air.* 2004;14(s7):32-39. doi:10.1111/j.1600-0668.2004.00270.x.
- 32: Mora R. Thermal Comfort: Designing for People. *ASHRAE J.* 2018:40-46.
- 33: International Organization for Standardization. ISO 7730:2005 Ergonomics of the Thermal Environment. 2005.
- 34: European Committee for Standardization. EN 15251 Standard: Indoor Environmental Input Parameters for Design and Assessment of Energy Performance of Buildings Addressing Indoor Air Quality, Thermal Environment, Lighting and Acoustics. European committee for Standardization; 2007. Accessed February 12, 2018.
- 35: Bluysen PM, Roda C, Mandin C, et al. Self-reported health and comfort in “modern” office buildings: first results from the European OFFICAIR study. *Indoor Air.* 2016;26(2):298-317. doi:10.1111/ina.12196.
- 36: Haverinen-Shaughnessy U, Shaughnessy RJ. Effects of Classroom Ventilation Rate and Temperature on Students’ Test Scores. Shaman J, ed. *PLoS One.* 2015;10(8):e0136165. doi:10.1371/journal.pone.0136165.
- 37: Olli Seppänen, Fisk WJ, Faulkner D. Cost Benefit Analysis of the Night-Time Ventilative Cooling in Office Building. 2003. [Reference](#). Accessed November 27, 2017.
- 38: Nicol JF, Raja IA, Allaudin A, Jamy GN. Climatic variations in comfortable temperatures: the Pakistan projects. *Energy Build.* 1999;30(3):261-279. doi:10.1016/S0378-7788(99)00011-0.
- 39: de Dear R, Brager GS. Developing an adaptive model of thermal comfort and preference. *ASHRAE Trans.* 1998;104:145. [Reference](#). Accessed March 8, 2018.
- 40: Ning H, Wang Z, Zhang X, Ji Y. Adaptive thermal comfort in university dormitories in the severe cold area of China. *Build Environ.* 2016;99:161-169. doi:10.1016/J.BUILDENV.2016.01.003.
- 41: Luo M, Ji W, Cao B, Ouyang Q, Zhu Y. Indoor climate and thermal physiological adaptation: Evidences from migrants with different cold indoor exposures. *Build Environ.* 2016;98:30-38. doi:10.1016/J.BUILDENV.2015.12.015.
- 42: Nicol F, Humphreys M. Maximum temperatures in European office buildings to avoid heat discomfort. *Sol Energy.* 2007;81(3):295-304. doi:10.1016/J.SOLENER.2006.07.007.
- 43: Forgiarini Rupp R, Vásquez NG, Lamberts R. A review of human thermal comfort in the built environment. *Energy Build.* 2015;105:178-205. doi:10.1016/j.enbuild.2015.07.047.

- 44: Melikov AK. Advanced air distribution: improving health and comfort while reducing energy use. *Indoor Air*. 2016;26(1):112-124. doi:10.1111/ina.12206
- 45: Zhang H, Arens E, Pasut W. Air temperature thresholds for indoor comfort and perceived air quality. *Build Res Inf*. 2011;39(2):134-144. doi:10.1080/09613218.2011.552703
- 46: Watanabe S, Shimomura T, Miyazaki H. Thermal evaluation of a chair with fans as an individually controlled system. *Build Environ*. 2009;44(7):1392-1398. doi:10.1016/J.BUILDENV.2008.05.016
- 47: Pan C-S, Chiang H-C, Yen M-C, Wang C-C. Thermal comfort and energy saving of a personalized PFCU air-conditioning system. *Energy Build*. 2005;37(5):443-449. doi:10.1016/J.ENBUILD.2004.08.006
- 48: Gao C, Kuklane K, Wang F, Holmér I. Personal cooling with phase change materials to improve thermal comfort from a heat wave perspective. *Indoor Air*. 2012;22(6):523-530. doi:10.1111/j.1600-0668.2012.00778.x
- 49: Pasut W, Zhang H, Arens E, Zhai Y. Energy-efficient comfort with a heated/cooled chair: Results from human subject tests. *Build Environ*. 2015;84:10-21. doi:10.1016/J.BUILDENV.2014.10.026
- 50: Nicol JF, Humphreys MA. Thermal comfort as part of a self-regulating system. *Build Res Pract*. 1973;1(3):174-179. doi:10.1080/09613217308550237
- 51: Great Britain. Health and Safety Executive., Great Britain. Health and Safety Executive. Thermal Comfort in the Workplace: Guidance for Employers. HSE Books; 1999.
- 52: American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE Handbook: Fundamentals. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.; 2013.
- 53: Caroline Karmann, Stefano Schiavon FB. Thermal comfort in buildings using radiant vs. all-air systems: A critical literature review. *Build Environ*. 2017;111:123-131. doi:10.1016/J.BUILDENV.2016.10.020.
- 54: Rhee K-N, Olesen BW, Kim KW. Ten questions about radiant heating and cooling systems. *Build Environ*. 2017;112:367-381. doi:10.1016/j.buildenv.2016.11.030.
- 55: Tian Z, Love JA. A field study of occupant thermal comfort and thermal environments with radiant slab cooling. *Building and Environment*. 2008 Oct 1;43(10):1658-70.
- 56: Lin B, Wang Z, Sun H, Zhu Y, Ouyang Q. Evaluation and comparison of thermal comfort of convective and radiant heating terminals in office buildings. *Building and Environment*. 2016 Sep 1;106:91-102. [Reference](#). Accessed May 22, 2018.
- 57: U.S. Department of Energy. Radiant Heating. [Reference](#). Accessed December 20, 2017.
- 58: Wolkoff P, Kjærgaard SK. The dichotomy of relative humidity on indoor air quality. *Environ Int*. 2007;33(6):850-857. doi:10.1016/j.envint.2007.04.004.
- 59: American Society of Heating, Refrigerating and Air-Conditioning Engineers. Design Guide for Dedicated Outdoor Air Systems (DOAS). Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.; 2017.
- 60: Nematchoua MK, Orosa JA. Building construction materials effect in tropical wet and cold climates: A case study of office buildings in Cameroon. *Case Stud Therm Eng*. 2016;7:55-65. doi:10.1016/J.CSITE.2016.01.007.
- 61: Petrofsky JS, Berk L, Alshammari F, et al. The interrelationship between air temperature and humidity as applied locally to the skin: the resultant response on skin temperature and blood flow with age differences. *Med Sci Monit*. 2012;18(4):CR201-8. doi:10.12659/MSM.882619.
- 62: Harvard T.H. Chan School of Public Health. The 9 Foundations of a Healthy Building. *Sch Public Heal*. 2017. [Reference](#).
- 63: Parthasarathy S, Maddalena RL, Russell ML, Apte MG. Effect of Temperature and Humidity on Formaldehyde Emissions in Temporary Housing Units. *J Air Waste Manag Assoc J*. 2011;616:1096-2247.
- 64: U.S. Environmental Protection Agency. Mold. [Reference](#). Accessed January 12, 2018.
- 65: U.S. Environmental Protection Agency. A Brief Guide to Mold, Moisture and Your Home. 2012. [Reference](#). Accessed January 25, 2018.

SOUND

The WELL Sound concept aims to bolster occupant health and well-being through the identification and mitigation of acoustical comfort parameters that shape occupant experiences in the built environment.

The acoustical comfort of a space can be quantified by the overall level of satisfaction of an occupant in a given environment.^[1,2] The word “sound” itself is generally defined as the human response to mechanical vibrations through a medium such as air. By this definition, human perception of sound is paramount in shaping a sonic environment. Only in recent years has it been determined that exposure to noise has been shown to hinder the health and well-being of people in a number of different ways.^[3] For instance, the effects of exterior noise from transportation or industrial sources have been linked to sleep disturbance, hypertension and the reduction of mental arithmetic in school-aged children.^[4-8] A number of studies have also indicated that internally generated noise is a major cause of complaint and ultimately results in occupant dissatisfaction.^[1,9-12] Sound within an enclosed space from sources such as HVAC equipment, appliances and other occupants has been shown to hinder productivity, focus, memory retention and mental arithmetic.^[8,10,11,13-16] In addition to airborne noise sources, impact noise from adjacent activity such as footfall, exercise or mechanical vibration can create uncomfortable environments for occupants in receiving locations.^[13,17] Another common acoustical issue is the overall level of privacy within and between enclosed spaces. For instance, research has indicated that occupants are generally dissatisfied when conversations can readily transmit between rooms or across an open office, thus hindering confidentiality or creating distraction from tasks.^[18] Inappropriate reverberation times and background noise levels in a space can impede speech intelligibility and cause strain for occupants who may possess hearing impairments.^[19-22] Speech intelligibility is also a crucial element in educational facilities where information is being presented to large audiences and aural comprehension is vital for memory retention and task completion.^[23] With the rise in hearing impairments and various other health concerns as a result of over-exposure to noise, designing a single space to meet the acoustical comfort needs of every individual is challenging. However, existing research into the effects of best-practice acoustical design within a space suggests that a holistic approach to addressing the issue of acoustical comfort in the built environment is achievable.^[11,13,24] The planning and commissioning of an isolated and balanced HVAC system provides a firm baseline for the anticipated background noise level in a given enclosure.^[13] The fortification of façade elements can ensure that exterior noise intrusion is subdued much to the benefit of occupant comfort during work, study or sleep.^[4,6,25-30] Adding mass and glazing to partition elements, sealing gaps at connections and doors and providing airspace between enclosed spaces bolsters sound privacy and increases occupant comfort.^[29,31,32] Replacing areas of hard surfaces in a space with absorptive materials can reduce reflected sound energy and better facilitate acoustical privacy or, conversely, improve speech projection.^[19,24,33,34] Consistent background noise levels can be introduced into a space using a sound masking system, thus improving the signal-to-noise ratio in favor of acoustical privacy between occupants.^[12,35]

WELL aims to provide a comprehensive and holistic approach to addressing the concerns of acoustical comfort through research-based design considerations that buildings can accommodate for the purposes of improving occupant health and well-being.

S01 SOUND MAPPING | P

Intent: Incorporate strategic planning and mitigation required to prevent general issues of acoustical disturbance from both externally and internally generated noise.

Summary: This WELL feature requires strategic interior planning and site zoning to create an acoustical plan that identifies internal and external noise sources that can negatively impact the acoustical environment of interior spaces.

Issue: With increasing architectural trends toward open office collaboration, use of lightweight materials in construction, exposed slab finishes and mechanical equipment, the acoustical comfort in a space is more likely to become compromised unless treatment is considered.^[24,36-39] When noise from internal activity or external sources increases the background noise level in a space, occupants become susceptible to distraction, thus reducing productivity and memory retention and increasing stress levels.^[1,10,23,40,41] Specifically, in office environments, employees care about privacy and the ability to collaborate.^[2,10] In one study from the UK, 99% of employees reported that their concentration was impaired by poor acoustical comfort in the workplace.^[1] This is shown to be an ever growing problem worldwide in open office environments.^[10,12,40,42,43] In some instances, it has been shown that occupants are less likely to help others under high noise conditions, which may have an impact on collaboration in the workplace.^[41]

Solutions: In addressing internally generated noise, floor plans should be designed with intent and use in mind.^[31] For example, the typical office environment has been classified via four key groups in order to identify the relationship between worker satisfaction and office programming: spaces for focus, collaboration, socialization and learning.^[11] The locations of these spaces matter, as noise from social or collaborative spaces impacts the use of a space intended for focused work or learning comprehension.^[11,35] However, this approach is not limited to office environments. This same strategy can be implemented in any space type that incorporates spaces of socialization and recreation in tandem with areas of task-centric, focused work or learning.^[11] The sonic environments of these spaces are described below as loud, quiet and mixed spaces in order to easily indicate the potential for noise from loud spaces to impact more sensitive, quiet locations for focused work, learning or amenity.

Impact: With the number of noise complaints on the rise, increased awareness of acoustical comfort may assist designers in identifying sources of noise.^[43] If a plan is implemented from the start, the level of occupant satisfaction has the potential to strengthen with the level of acoustical comfort.

Part 1 Manage Background Noise Level

For All Spaces:

Projects meet at least one of the following requirements to address background noise levels:

- An annotated document is provided that indicates the projected background noise level (dBA or NC) attributable to HVAC equipment noise, external noise intrusion or a similar source (e.g., a floor plan is color-coded to indicate dBA levels between regularly occupied spaces or across façade elements).
- A professional narrative is provided that indicates the measured background noise level (dBA or NC) attributable to HVAC equipment noise, external noise intrusion or a similar source in each space as denoted in Feature S02: Maximum Noise Levels.

Part 2 Manage Acoustical Privacy

For All Spaces:

Projects meet at least one of the following requirements to address acoustical privacy:

- An annotated document is provided that indicates the projected acoustical performance of typical walls that separate regularly occupied spaces throughout the project (e.g., STC/R_w, NIC/D_w or equivalent sound transmission metrics denoted on a partition schedule from an architectural drawing set).
- A professional narrative is provided that indicates the measured level of acoustical privacy between regularly occupied spaces or within open workspace environments (e.g., NIC/D_w (or equivalent) or SPP data across partitions).

Part 3 Label Acoustic Zones

For All Spaces:

An annotated document is provided that labels specific zones throughout the project floor plan based on the following:

- a. Loud zones: includes areas intended for appliances, mechanical equipment or amenities (e.g., kitchens, fitness rooms, social spaces, recreational rooms).
- b. Quiet zones: includes areas intended for focused work, wellness, rest, study and/or privacy.
- c. Mixed zones: includes areas intended for learning, collaboration and/or presentation.

S02 MAXIMUM NOISE LEVELS | O (MAX: 3 PT)

Intent: Establish background noise level criteria for enclosed spaces in order to promote best-practice HVAC and façade design techniques and ultimately bolster acoustical comfort within.

Summary: This WELL feature requires design- and performance-based compliance that projects can adhere to in order to facilitate comfortable interior noise levels. This feature can operate in tandem with Feature S01: Sound Mapping by introducing the specific performance thresholds for background noise levels within specified locations as attributed by internal and external noise sources.

Issue: A space that is negatively shaped by HVAC system and exterior noise intrusion can be described as either too loud or distracting. Both instances are individually problematic: the level of background sound may affect speech communication, audio features and, in extreme conditions, the effectiveness of public address systems.^[23,44] Studies indicate that employees are unable to habituate to noise in office environments over time, and office noise, with or without speech, can create stress and disrupt performance on more complex cognitive tasks (e.g., memory of prose, mental arithmetic).^[45,46] Background noise also poses a problem from a universal design and accessibility standpoint when the signal-to-noise ratio favors background noise over speech intelligibility, thus making it hard to engage in critical listening for the purposes of learning or performing tasks.^[19,20,42] Similarly, external noise intrusion from sources like transportation or industry is a dominant source of annoyance in buildings, especially in Europe.^[47] In adults, exposure to traffic noise can lead to complications with the cardiovascular system, diabetes, hypertension, stroke, depression and high blood pressure.^[6,7,48-51] For children, chronic aircraft noise exposure impairs reading comprehension, mental arithmetic and proofreading.^[8,52-55] In both industrial and community studies, road traffic noise exposure is related to raised catecholamine secretion levels in urine, indicating an increased stress level in subjects exposed to such noise.^[56] Increase in the use of light-weight construction materials has the potential to result in poor sound transmission performance across building façade elements.

Solutions: Acoustical comfort can be impacted by noise emitted from HVAC systems. HVAC systems are ideally designed with the initial intent to meet specific Noise Criteria (NC) and in some cases can be retrofitted with acoustical treatment needed to meet sound pressure level (dBA) thresholds.^[13] Distracting and potentially harmful exterior noise can also be mitigated by providing façade elements that are most conducive to reducing outdoor noise transmission. While some retrofitting options exist for controlling exterior noise intrusion, exterior noise is most effectively treated during the design stages of a given space.

Impact: Designing with background noise level criteria in mind is key to ensuring acoustical comfort across a range of project types. When exposure to noise is reduced, occupants are less susceptible to distraction, overall stress and potential health risk.^[46]

Part 1 Limit Background Noise Levels (Max: 3 Pt)

For All Spaces:

The following is achieved:

- a. Background noise levels do not exceed the thresholds below:

Sound Pressure Level (SPL)		Open Workspaces Dining Areas	Enclosed Offices Residential Living & Sleeping Areas (Daytime)	Conference Rooms Classrooms Residential Sleeping Areas (Nighttime)	Points
Average SPL (L _{eq})	dBA	45	40	35	3
	dBC	70	65	60	
Max SPL (L _{Max})	dBA	55	50	45	
	dBC	80	75	70	

Average SPL (L_{eq})	dBA	50	45	40	2
	dBC	75	70	65	
Max SPL (L_{Max})	dBA	60	55	50	
	dBC	85	80	75	
Average SPL (L_{eq})	dBA	55	50	45	1
	dBC	80	75	70	

Note:

1. L_{eq} measurements may exceed optimal levels by no more than a 4 dB tolerance.
2. L_{Max} measurements are slow-weighted and may exceed optimal levels by no more than a 9 dB tolerance.

S03 SOUND BARRIERS | O (MAX: 3 PT)

Intent: Increase the level of speech privacy between horizontally adjacent enclosures and highlight design constraints that may hinder acoustical comfort.

Summary: This WELL feature requires design- and performance-based compliance that projects can adhere to in order to bolster acoustical privacy between rooms. This feature can operate in tandem with Feature S01: Sound Mapping by introducing the specific performance metrics of partition acoustical performance criteria and privacy [e.g., Noise Isolation Class (NIC), Sound Insulation (D_w), Speech Privacy Potential (SPP)].

Issue: The sound that transmits through partitions that lack acoustical performance can be highly distracting for people who may be located in the adjacent room.^[24] This is most noticeable across partitions that separate sensitive spaces that require lower background noise levels (e.g., human resources, legal, AV-equipped conference rooms, wellness rooms, bedrooms, classrooms). As lightweight construction and demountable partitions become the norm in typical architectural design, there is still a need for greater acoustical privacy that can only be provided by less visibly transparent building materials with greater mass. There is evidence that suggests if occupants know that their room is not private (i.e., that sound transmits readily from one room to another), they will be less inclined to divulge personal information to a doctor, colleague, family member etc.^[57] When an enclosed, private office allows sound to be transmitted easily, the expectation of privacy is stunted unless acoustical treatment is provided.

Solutions: Sound has the ability to transmit readily between enclosed spaces if proper acoustical reinforcement is not provided. Controlling the transmission of noise across separating media is crucial in supporting privacy between rooms. Typical partition constructions can be reinforced with privacy in mind to increase the acoustical performance between spaces. One best practice solution for increasing privacy between rooms is increasing the mass of a given partition by providing additional laminations, insulation and/or airspace to interrupt the transmission of sound. Sound can also flank across openings above finished ceilings, imperfections in partition construction and through floors, doorways and windows. Such flanking can be avoided by sealing imperfections in construction and closing any penetrations that may exist in, around or above partitions. While this approach to privacy may seem easier for new construction, acoustical abatement does exist for retrofitting instances where existing partition construction is lacking in the necessary performance for existing fit-outs. A sealant can be provided at partition imperfections, mass-loaded vinyl can be used above partial height partitions to block sound and doors can be provided with gaskets and seals. Lastly, where partition performance may lack, intentional background noise via a dedicated sound masking system can be introduced to bolster the overall SPP in any given receiver location.

Impact: Increasing privacy between spaces, especially sensitive spaces, has the potential to reduce distraction or disturbances that external noise sources may cause for occupants.

Part 1 Ensure Adequate Wall Construction (Max: 2 Pt)

For Office Spaces:

The following is achieved:

- Spaces listed below, if present, have interior partition walls and background noise that together meet the minimum SPP ratings listed in the table.^[36]

Source Room	Receiving Room	Minimum SPP
Enclosed Offices	Enclosed Offices	75
	Conference Rooms	80
	Open Offices	70
Conference Rooms	Enclosed Offices	85
	Conference Rooms	80
	Open Offices	70

Note: SPP is the sum of the noise reduction across a partition and the background noise level within a receiving space.^[58]

For Dwelling Units:

Dwelling unit partitions are constructed to meet the following requirements:

- a. Minimum STC-50 for demising walls that separate dwelling units from other units and corridors.
- b. Minimum STC-45 for walls that separate bedrooms from other rooms within a given dwelling unit.

For Classroom:

Student Classrooms

Partitions in schools are designed and constructed to meet the following requirements:

- a. Minimum STC-45 for walls that separate classrooms from corridors, staircases, offices or conference rooms.
- b. Minimum STC-50 for walls that separate classrooms from classrooms, therapy rooms and healthcare rooms.
- c. Minimum STC-53 for walls that separate classrooms from bathrooms.
- d. Minimum STC-60 for walls that separate classrooms from music rehearsal or performance spaces, auditoriums, mechanical equipment rooms, workshops, cafeterias, gymnasiums or indoor swimming pools.

Part 2 Ensure Proper Door Specifications (Max: 1 Pt)

For All Spaces:

Doors which connect private offices, conference rooms, classrooms and dwelling units to other spaces are constructed with two of the following requirements:

- a. Minimum STC-30 acoustical performance.
- b. Gaskets at the head and jambs.
- c. Automatic drop seal or sweep at base.
- d. A non-hollow core door.

S04 SOUND ABSORPTION | O (MAX: 3 PT)

Intent: Design spaces in accordance with comfortable reverberation times that support speech intelligibility and are conducive to focus.

Summary: This WELL feature requires steps be taken to address acoustical comfort by assigning requirements for surface finishes and reverberation time depending on the room functionality.

Issue: In spaces that incorporate hard surface finish materials, reverberation time and reflected sound energy have the potential to build and create uncomfortable environments. For example, a space that is designed for learning, presenting, critical listening or a similar purpose will benefit from having a reverberation time that is conducive to high speech intelligibility and articulation class (i.e., the words or sounds that are intentionally introduced to that space are heard as needed by all occupants). In a classroom, for instance, this requires a reverberation time that is low enough to foster clear speech intelligibility but high enough to allow speech to project to all areas of the classroom.^[26,59] From a universal design and accessibility standpoint, this focus on optimal acoustical design is crucial in designing spaces where all occupants can clearly understand information, sometimes critical information, that is being audibly presented.^[20,44] Over-reverberance and reflected sound energy have the potential to interrupt audio-visual equipment in small spaces, in some instances even making phone calls unintelligible on the receiving and/or source end.^[24] There may be instances where enhanced speech intelligibility is not ideal (e.g., office environments, restaurants) where focus or intimacy at a task plane is anticipated.^[60] Achieving optimal reverberation times in specific spaces is crucial for designing with acoustical comfort in mind.

Solutions: Controlling the effects of reverberant and reflected acoustical energy can be achieved via a number of combinations: by designing a space to meet specific reverberation times that are conducive to the intended programming therein, by providing absorptive finishes throughout an enclosure, or a combination of the two. Absorptive finishes can be classified by a number of metrics [e.g., Noise Reduction Coefficient (NRC, α_w or equivalent), Articulation Class (AC)]. For best results, absorptive finishes are provided along surfaces that are located opposite harder surface finishes. If possible, absorption should exist at ceiling planes when floor finishes are programmed to be hard (i.e., wood, polished concrete or similar). Similarly, and where possible, absorptive wall finishes should complement opposite walls that are reflective (e.g., glass office fronts, fenestration).

Impact: Designing a space with reverberation time and reflected sound energy in mind can drastically improve the comfort level of occupants in terms of critical listening, speech projection, memory retention and speech privacy.

Part 1 Meet Thresholds for Reverberation Time (Max: 1 Pt)

For All Spaces:

The following is achieved:

- a. Spaces meet the maximum $RT_{(60)}$ thresholds in the table below:

Room Type	Size	$RT_{(60)}$ (seconds)
Conference rooms	N/A	< 0.6
Classrooms	< 280 m ³ [10,000 ft ³]	< 0.6
	Between 280 m ³ [10,000 ft ³] and 570m ³ [20,000 ft ³]	0.5 to 0.8
	> 570 m ³ [20,000 ft ³]	0.6 to 1.0
Lecture halls	< 280 m ³ [10,000 ft ³]	< 0.7
	Between 280 m ³ [10,000 ft ³] and 570m ³ [20,000 ft ³]	0.6 to 0.9
	> 570 m ³ [20,000 ft ³]	0.7 to 1.3
Music rehearsal spaces	< 280 m ³ [10,000 ft ³]	< 1.1

	Between 280 m ³ [10,000 ft ³] and 570m ³ [20,000 ft ³]	1.0 to 1.4
Fitness facilities	< 280 m ³ [10,000 ft ³]	0.7 to 0.8
	Between 280 m ³ [10,000 ft ³] and 570m ³ [20,000 ft ³]	0.8 to 1.1
	> 570 m ³ [20,000 ft ³]	1.0 to 1.8

Part 2 Implement Sound Reducing Ceilings (Max: 1 Pt)

For All Spaces:

Spaces have ceiling finishes that meet the following specifications:^[61]

- Ceiling treatment meets the NRC/ α_w Min values described below:

Space Type	NRC/ α_w Min.
Open Workspaces	0.7 for at least 75% of available ceiling area
Enclosed Offices	
Dining Spaces	
Conference Rooms	0.7 for at least 50% of available ceiling area
Classrooms	

Part 3 Implement Sound Reducing Vertical Surfaces (Max: 1 Pt)

For All Spaces:

Spaces have wall finishes that meet following requirement:^[61]

- Wall treatments meet the specifications described:

Space Type	NRC/ α_w Min.
Open workspaces	0.7 for at least 25% of at least one wall
Enclosed offices	
Dining spaces	
Conference rooms	0.7 for at least 25% of at least two (preferably adjacent) walls
Classrooms	

S05 SOUND MASKING | O (MAX: 2 PT)

Intent: Increase acoustical privacy in open workspaces and between enclosed spaces.

Summary: This WELL feature requires that a sound masking system is utilized as a means of suppressing noises from HVAC equipment, speech from other occupants or other distracting sounds by increasing the background noise level evenly throughout a given area.

Issue: Levels can vary by zone in a given interior space and at certain times of day or year by 15 dBA or more.^[35] HVAC systems do not reliably generate a sound spectrum conducive to speech privacy. Instead, the sound is largely arbitrary and varies considerably from space to space, as well as over time. In some cases, different heating and cooling strategies are employed in the exterior and core, resulting in even more variable acoustic conditions across the space. For projects in warm climate areas, such as Australia, where chilled beam systems are used, the overall level will be dramatically lower than traditional HVAC. Whenever and wherever background sound falls below the 30 dBA on which STC ratings are based, occupants can no longer rely on the partition assembly for speech privacy.^[35]

Solutions: The design of a sound masking system should consider the following for even dispersion across a given zone: sound masking should be evenly spaced, either in a 30- or 60-degree offset, at a distance proportional to the ceiling height and plenum depth;^[63] sound masking ideally locates away from building structures and serves the centermost area of the space for the most even coverage; sound masking speakers can be plenum suspended, exposed, directly mounted or beneath raised access floors for best results. The sound emitted by a sound masking system resembles a combination of human speech and human hearing frequency content.

Impact: Sound masking is an effective method that, when installed and commissioned correctly, has the potential to bolster acoustical privacy in open workspace and enclosed office environments.

Part 1 Implement Sound Masking (Max: 2 Pt)

For All Spaces:

Sound masking sound levels meet the following requirements when measured from the nearest workstation:

- a. Open offices, libraries, cafeterias, corridors/hallways: 45 - 48 dBA.^[64]
- b. Enclosed offices, conference rooms, wellness rooms: 40 - 42 dBA.^[64]

REFERENCES

- 1: Banbury SP, Berry DC. Office noise and employee concentration: Identifying causes of disruption and potential improvements. *Ergonomics*. 2005;48(1):25-37. doi:10.1080/00140130412331311390
- 2: Sailer U, Hassenzahl M. Assessing noise annoyance: An improvement-oriented approach. *Ergonomics*. 2000;43(11):1920-1938. doi:10.1080/00140130050174545
- 3: Hänninen O, Knol AB, Jantunen M, et al. Environmental Burden of Disease in Europe: Assessing Nine Risk Factors in Six Countries. *Environ Health Perspect*. 2014;122(5):439-446. doi:10.1289/ehp.1206154
- 4: Fyhri A, Aasvang GM. Noise, sleep and poor health: Modeling the relationship between road traffic noise and cardiovascular problems. *Sci Total Environ*. 2010;408(21):4935-4942. doi:10.1016/j.scitotenv.2010.06.057
- 5: Bluhm GL, Berglind N, Nordling E, Rosenlund M. Road traffic noise and hypertension. *Occup Environ Med*. 2007;64(2):122-126. doi:10.1136/oem.2005.025866
- 6: Jarup L, Babisch W, Houthuijs D, et al. Hypertension and exposure to noise near airports: The HYENA study. *Environ Health Perspect*. 2008;116(3):329-333. doi:10.1289/ehp.10775
- 7: Chang TY, Lai YA, Hsieh HH, Lai JS, Liu CS. Effects of environmental noise exposure on ambulatory blood pressure in young adults. *Environ Res*. 2009;109(7):900-905. doi:10.1016/j.envres.2009.05.008
- 8: Belojević G, Öhrström E, Rylander R. Effects of noise on mental performance with regard to subjective noise sensitivity. *Int Arch Occup Environ Health*. 1992;64(4):293-301. doi:10.1007/BF00378288
- 9: Sundstrom E, Town J, Rice R, Osborn D, Brill M. Office Noise, Satisfaction, and Performance. *SAGE Soc Sci Collect*. 1994:195-222.
- 10: Hedge A. The open-plan office: A Systematic Investigation of Employee Reactions to Their Work Environment. *Environ Behav*. 1982;14(5):519-542. doi:10.1177/0013916582145002
- 11: Gensler. What we've learned about focus in the workplace. 2012.
- 12: Keus van de Poll M, Carlsson J, Marsh JE, et al. Unmasking the effects of masking on performance: The potential of multiple-voice masking in the office environment. *J Acoust Soc Am*. 2015;138(2):807-816. doi:10.1121/1.4926904
- 13: The American Society of Heating Refrigerating and Air-Conditioning Engineers. Chapter 48 . Noise and Vibration Control. *ASHRAE Handb HVAC Appl*. 2009;(1):1-28.
- 14: Jones DM, Miles C, Page J. Disruption of proofreading by irrelevant speech: Effects of attention, arousal or memory? *Appl Cogn Psychol*. 1990;4(2):89-108. doi:10.1002/acp.2350040203
- 15: Söderlund, Göran BW, Sverker Sikström, Jan M Loftesnes EJS-B. Behavioral and Brain Functions The effects of background white noise on memory performance in inattentive school children. *Behav Brain Funct*. 2010:1-10. doi:10.1186/1744-9081-6-55
- 16: Lercher P, Evans GW, Meis M. Ambient noise and cognitive processes among primary schoolchildren. *Environ Behav*. 2003;35(6):725-735. doi:10.1177/0013916503256260
- 17: Dudarewicz A. the Impact of Low Frequency Noise on Human Mental Performance. 2005;18(2):185-199.
- 18: Cavanaugh WJ, Farrell WR, Hirtle PW, Watters BG. Speech Privacy in Buildings. 2011.
- 19: Hornsby BWY. The Speech Intelligibility Index : What is it and what ' s it good for ? *Hear J*. 2004;57(10):10-17.
- 20: The National Disability Authority's Centre for Excellence in Universal Design. Building for Everyone: A universal design approach. 2012:4-106.
- 21: Hongisto V. A model predicting the effect of speech of varying intelligibility on work performance. *Indoor Air*. 2005;15(6):458-468. doi:10.1111/j.1600-0668.2005.00391.x
- 22: Venetjoki N, Kaarlela-Tuomaala A, Keskinen E, Hongisto V. The effect of speech and speech intelligibility on task performance. *Ergonomics*. 2006;49(11):1068-1091. doi:10.1080/00140130600679142
- 23: Brammer A, Laroche C. Noise and communication: A three-year update. *Noise Heal*. 2012;14(61):281. doi:10.4103/1463-1741.104894

- 24: Hodsman P. Planning for Psychoacoustics. Ecophon, Saint-Gobain. 2015;(April):1-51.
- 25: Anna L, Blangiardo M, Fortunato L, et al. Aircraft noise and cardiovascular disease near Heathrow airport in London: Small area study. *BMJ*. 2013;347(7928):9-12. doi:10.1136/bmj.f5432
- 26: Klatte M, Bergström K, Lachmann T. Does noise affect learning? A short review on noise effects on cognitive performance in children. *Front Psychol*. 2013;4(August):1-6. doi:10.3389/fpsyg.2013.00578
- 27: Trimmel K, Sch??tzer J, Trimmel M. Acoustic noise alters selective attention processes as indicated by direct current (DC) brain potential changes. *Int J Environ Res Public Health*. 2014;11(10):9938-9953. doi:10.3390/ijerph111009938
- 28: Kaltenbach M, Maschke C, Klink R. Health consequences of aircraft noise. *Dtsch Arztebl Int*. 2008;105(31-32):548-556. doi:10.3238/arztebl.2008.0548
- 29: Solet J, Buxton O, Ellenbogen J, Wang W, Carballiera a. Validating Acoustic Guidelines for Healthcare Facilities: Evidence-based design meets Evidence-based medicine: The Sound Sleep Study. 2010:1-56. papers2://publication/uuid/C795CF4F-BD80-4B4F-B5B0-C3FAADD03030.
- 30: Goines L, Hagler L. Noise Pollution: A Modern Plague: Adverse Health Effects of Noise. *South Med J*. 2007;100(3):287-294. [Reference](#).
- 31: Service PB. PBS-P100 Facilities Standards for the Public Buildings Service. 2016;(March):333. doi:10.1017/CBO9781107415324.004
- 32: CISCA. Acoustics in Healthcare Environments. 2010:36. [Reference](#) in Healthcare Environments_CISCA.pdf.
- 33: Pierrette M, Parizet E, Chevret P, Chatillon J. Noise effect on comfort in open-space offices: development of an assessment questionnaire. *Ergonomics*. 2015;58(1):96-106. doi:10.1080/00140139.2014.961972
- 34: Schellenberg EG, Nakata T, Hunter PG, Tamoto S. Exposure to music and cognitive performance: tests of children and adults. *Psychol Music*. 2007;35(1):5-19. doi:10.1177/0305735607068885
- 35: Moeller N. Placing Sound Masking on the Front Line of Acoustic Design. *Constr Canada*. 2017:36-44.
- 36: Acoustic Comfort by Screen Solutions. Speech Privacy Potential (SPP). 44(0).
- 37: Park SH, Lee PJ, Yang KS, Kim KW. Relationships between non-acoustic factors and subjective reactions to floor impact noise in apartment buildings. *J Acoust Soc Am*. 2016;139(3):1158-1167. doi:10.1121/1.4944034
- 38: Oseland N. Psychoacoustics Survey Results. 2015;(September):1-32.
- 39: Distractions RN. Psychoacoustics in the Workplace. :73-102.
- 40: Kaarlela-Tuomaala A, Helenius R, Keskinen E, Hongisto V. Effects of acoustic environment on work in private office rooms and open-plan offices - Longitudinal study during relocation. *Ergonomics*. 2009;52(11):1423-1444. doi:10.1080/00140130903154579
- 41: Kim J, de Dear R. Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *J Environ Psychol*. 2013;36:18-26. doi:10.1016/j.jenvp.2013.06.007
- 42: Navai M, Veitch J a. Acoustic Satisfaction in Open-Plan Offices : Review and Recommendations- Report RR-151. 2003:23. doi:[Reference](#)
- 43: Frontczak M, Schiavon S, Goins J, Arens E, Zhang H, Wargocki P. Quantitative relationships between occupant satisfaction and satisfaction aspects of indoor environmental quality and building design. *Indoor Air*. 2012;22(2):119-131. doi:10.1111/j.1600-0668.2011.00745.x
- 44: Ihrig W. Improving Intelligibility of Airport Terminal Public Address Systems. National Academies Press; 2017. doi:10.17226/24839
- 45: Jahncke H, Hygge S, Halin N, Green AM, Dimberg K. Open-plan office noise: Cognitive performance and restoration. *J Environ Psychol*. 2011;31(4):373-382. doi:10.1016/j.jenvp.2011.07.002
- 46: Evans GW, Johnson D. Stress and open-office noise. *J Appl Psychol*. 2000;85(5):779-783. doi:10.1037/0021-9010.85.5.779
- 47: Kim J, Lim C, Hong J, Lee S. Noise-induced annoyance from transportation noise: short-term responses to a single noise source in a laboratory. *J Acoust Soc Am*. 2010;127(2):804-814. doi:10.1121/1.3273896

- 48: Babisch W, Beule B, Schust M, Kersten N, Ising H. Traffic noise and risk of myocardial infarction. *Epidemiology*. 2005;16(1):33-40. doi:10.1097/01.ede.0000147104.84424.24
- 49: Heidemann C, Niemann H, Paprott R, Du Y, Rathmann W, Scheidt-Nave C. Residential traffic and incidence of Type 2 diabetes: the German Health Interview and Examination Surveys. *Diabet Med*. 2014;31(10):1269-1276. doi:10.1111/dme.12480
- 50: Sørensen M, Hvidberg M, Andersen ZJ, et al. Road traffic noise and stroke: A prospective cohort study. *Eur Heart J*. 2011;32(6):737-744. doi:10.1093/eurheartj/ehq466
- 51: Niemann H, Bonnefoy X, Braubach M, et al. Noise-induced annoyance and morbidity results from the pan-European LARES study. *Noise Heal*. 2006;8(31):63. doi:10.4103/1463-1741.33537
- 52: Bronzaft AL, McCarthy DP. The effect of elevated train noise on reading ability. *Environ Behav*. 1975;7(4):517-528. doi:10.1177/001391657500700406
- 53: Hygge S, Evans GW, Bullinger M. A prospective study of some effects of aircraft noise on cognitive performance in schoolchildren. *Psychol Sci*. 2002;13(5):469-474. doi:10.1111/1467-9280.00483
- 54: Haines MM, Stansfeld SA, Job RF, Berglund B, Head J. Chronic aircraft noise exposure, stress responses, mental health and cognitive performance in school children. *Psychol Med*. 2001;31(2):265-277. doi:10.1017/S0033291701003282
- 55: Weinstein ND. Effect of Noise on Intellectual Performance. *J Appl Psychol*. 1974;59(5):548-554. [Reference](#).
- 56: Stansfeld SA, Matheson MP. Noise pollution: Non-auditory effects on health. *Br Med Bull*. 2003;68:243-257. doi:10.1093/bmb/ldg033
- 57: Berkeley UC, Jensen OC, Arens E, Quality A. Acoustical Quality in Office Workstations, as assessed by occupant surveys. 2005.
- 58: Bradley JS, Gover BN. A new system of speech privacy criteria in terms of Speech Privacy Class (SPC) values. *Int Congr Acoust*. 2010;(August):1-5.
- 59: Klatte M, Hellbrück J, Seidel J, Leistner P. Effects of Classroom Acoustics on Performance and Well-Being in Elementary School Children: A Field Study. *Environ Behav*. 2010;42(5):659-692. doi:10.1177/0013916509336813
- 60: National Instruments. Spatial Acoustics and Reverberation Time.
- 61: GSA Public Buildings Service. Sound Matters: How to Achieve Acoustic Comfort in the Contemporary Office. 2011; (January):1-42. [Reference](#).
- 62: Architectural Joint Technical Committee AV-004 Acoustical. AS/NZS 2107:2016. 2016:24.
- 63: Loewen L, Suedfeld P. Cognitive and Arousal Effects of Masking Office Noise. *SAGE Soc Sci Collect*. 1992:381-395.
- 64: Public Buildings Service. PBS-P100 Facilities Standards for the Public Buildings Service. 2016;(April):333. doi:10.1017/CBO9781107415324.004

MATERIALS

The WELL Materials concept aims to reduce human exposure to hazardous building material ingredients through the restriction or elimination of compounds or products known to be toxic and the promotion of safer replacements. Compounds known to be hazardous to the health of occupational workers and/or known to bioaccumulate or aggregate in the environment are also restricted and in some instances not permitted.

The chemicals industry is a central part of the global economy and is integral to a number of sectors that have played a major role in improving life expectancy and the quality of life over the past 150 years. However, the health and environmental impacts of most chemicals in circulation, despite their ubiquity, are unknown. For example, an estimated 95% of chemicals largely used in construction lack sufficient data on health impacts.^[1]

As the global population grows and urban centers expand in size and number, the demand for material goods and the rate of chemical production is expected to rise. The global chemicals output grew by 84% between 2000 and 2010, with emerging economies accounting for 65% of the increase.^[2] Chemical production is estimated to increase at a rate three times greater than global population growth and is expected to double every 25 years.^[3] Many of these chemicals will be used in the construction industry, one of the largest and most active sectors globally. Building materials and products are not only an integral part of our lives but, unlike most consumer goods, have a much longer use phase, making their chemical composition, and potential impact on indoor air quality, significant.

Volatile organic compounds (VOCs) comprise a large group of chemicals abundant in indoor environments due to various source materials, including insulation, paints, coatings, adhesives, furniture and furnishings, composite wood products and flooring materials.^[4] Both VOCs and semi-volatile organic compounds (SVOCs) have a wide range of health effects, from respiratory irritation to reproductive damage and cancer.^[5] Similarly, legacy chemicals are typically toxic, persistent and prone to bioaccumulation. These include lead, asbestos, mercury, chromated copper arsenate (CCA) and polychlorinated biphenyls (PCBs). Although these chemicals are largely restricted in manufacture and use, they continue to pose dangers not only in older structures but also through environmental contamination.^[6,7,8,9] For example, the blood lead burden of today's population is 500 to 1,000 times greater than that of our pre-industrial counterparts. Global lead contamination across soil, water and air is still a significant issue, even in countries that regulate the production and use of the heavy metal.^[10]

Additionally, hazardous waste that is improperly handled can be detrimental to both human health and the environment.^[11] Land contamination poses significant public health concerns. The World Health Organization maintains a list of chemicals of major public health concern in relation to soils, including arsenic, asbestos, dioxin, pesticides and heavy metals (mercury, lead and cadmium). These chemicals of concern are found abundantly across the globe and are linked to various health impacts.^[8] Many pesticides, in particular, pose exposure risks to vulnerable populations such as children due to the fact that they are used across various space types, both indoors and outdoors.^[8] Wood treated with biocides can leach arsenic and preservative components into the soil where children can be exposed.^[9,12] Children's playground equipment and artificial turf can also pose dangers, as these materials wear and tear over time, forming dust or flakes containing chemicals like lead at levels that can be detrimental.^[13,14]

One area of focus for advancing health through the Materials concept mandates emissions and content thresholds for building materials and products. This is particularly important for indoor air quality (IAQ) and health, especially for compounds known to be both hazardous and volatile under ambient conditions.^[15] Low-hazard cleaning products, the use of effective cleaning equipment, and design and furnishing guidelines that promote efficient cleaning practices also ensure good indoor air quality. To further mitigate environmental contamination and protect public health, WELL includes guidelines for the safe disposal and recycling of hazardous waste. Legacy chemicals must also be safely handled through protocols and best practice guidelines for abatement, in-place management and protective action during repair, renovation or demolition. The application of Integrated Pest Management (IPM) and use of low-hazard pesticides, along with signage and notice of application, further works to protect health. Soil, water and air contamination is also addressed through the testing and redevelopment of contaminated sites. Remediation of such sites removes toxic hazards and can work to support environmentally responsible growth and prevent sprawl.^[16] Outdoor structures that contribute to toxic leachates and soil and air contamination are addressed through

WELL, while new materials and products used outdoors must meet ingredient restrictions or thresholds. Lastly, third-party certification and labeling schemes serve to differentiate products with safer ingredients and help support consumer education and market demand for safer goods.

WELL promotes the identification, evaluation and management of hazardous ingredients across building materials, cleaning products, waste, outdoor spaces and landscaping. Through all of this, WELL aims to reduce risk of exposure, whether direct or through environmental contamination. Lastly, by enabling informed decision-making, WELL helps to bridge data gaps in the supply chain, supports innovation in green chemistry and advances market transformation.

X01 FUNDAMENTAL MATERIAL PRECAUTIONS | P

Intent: Reduce or eliminate human exposure to building materials known to be hazardous.

Summary: This WELL feature requires the restriction of hazardous ingredient components in newly installed building materials, specifically through the restriction of asbestos, mercury-containing lamps and lead in plumbing products and paint.

Issue:

Solutions: Restricting the use of asbestos reduces exposure risk to the substance in instances where it might be disturbed.^[24] Limiting the amount of heavy metals used across various building materials also limits chances for exposure. Eliminating the use of compact fluorescent light bulbs (CFLs) removes a potential pathway to direct exposure. In the case of lead in pipes and plumbing, the prevalence of lead in drinking water is linked with corrosion of the lead-containing materials that make up water distribution systems.^[27] Minimizing the lead threshold in plumbing materials can help prevent hazardous levels of the substance from leaching into drinking water. Reducing hazards associated with lead also necessitates minimizing lead in other building materials, including paints. Lastly, because there is no known safe level of lead exposure for children and because children are more vulnerable to lead exposure than adults, further precautions must be taken to limit exposure through furniture that might have parts containing lead.^[22]

Impact: Restriction of known hazardous ingredients found in building materials, specifically in those that are newly installed, aims to reduce risk of exposure, whether directly within the indoor environment or through environmental contamination. This also helps to push for reformulations of key building materials and products and promotes innovation in green chemistry.

Part 1 Restrict Asbestos

For All Spaces:

The following building materials contain asbestos less than 1% by weight:

- a. Thermal system insulation (applied to pipes, fittings, boilers, breeching, tanks, ducts or other like components to prevent heat loss or gain).^[28]
- b. Surfacing material (that is sprayed, troweled or otherwise applied to surfaces, for example acoustical plaster or fireproofing materials).^[28]
- c. Wallboard/millboard, resilient floor covering, roofing and siding shingles (including metal cladding) and construction mastics.^[28]

Note:

Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

Part 2 Limit Mercury

For All Spaces:

All newly installed products meet the following:

- a. Illuminated exit signs, thermostats, switches and electrical relays are mercury-free.^[29]
- b. Low-mercury or mercury-free lamp technology meets the following specifications:^[29]

Fluorescent Lamp	Maximum Mercury Content
Compact, integral ballast	3.5 mg
Compact, non-integral ballast	3.5 mg
T-5, circular	9 mg

T-5, linear	2.5 mg
T-8, eight-foot	10 mg
T-8, four-foot	3.5 mg
T-8, two- and three-foot	3.5 mg
T-8, U-bent	6 mg
High-Pressure Sodium Lamp	Maximum Mercury Content
400 W or less	10 mg
Over 400 W	32 mg

Part 3 Restrict Lead

For All Spaces:

All newly installed building materials meet the following materials composition requirements:

- a. Drinking water systems and plumbing products are lead-free as defined by the Safe Drinking Water Act (SDWA) and certified by an ANSI Accredited third-party certification body.^[30]
- b. Indoor paints and surface coatings contain less than 90 ppm total lead.^[31]

Note: Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

X02 HAZARDOUS MATERIAL ABATEMENT | P

Intent: Reduce or eliminate human exposure to hazardous material ingredient byproducts from renovation, repair or demolition work.

Summary: This WELL feature requires the application of protective practices during repair, renovation or maintenance to manage exposure risks of the hazardous building materials asbestos, lead and polychlorinated biphenyls (PCBs).

Issue: Over 100,000 people die globally each year from asbestos-related diseases.^[17] All known forms of the asbestos are carcinogenic to humans.^[18] Mesothelioma, a cancer of the lung lining, is almost exclusively linked to asbestos exposure.^[17,18] Non-cancer effects associated with asbestos exposure include asbestosis, which results in restricted lung function.^[18] The blood lead burden of today's population is about 500–1000 times greater than that of our pre-industrial counterparts.^[10] According to the Institute for Health Metrics and Evaluation (IHME), lead exposure, based on 2015 data, accounted for 494,550 deaths globally, with low- and middle-income countries carrying the highest burdens.^[32] Further, the Institute estimated that lead exposure for the same year was responsible for 12.4% of the global burden of developmental intellectual disability, 2.5% of the global burden of ischemic heart disease and 2.4% of the global burden of stroke.^[32] Studies examining adults in the general population have found that increased bone and blood lead levels are associated with hypertension (an increase in blood pressure). Exposure to lead, even at low levels, in early development is associated with negative impacts on intelligence quotient (IQ), learning, memory and behavior.^[22] Similarly pervasive and found in environmental media due to human activity, PCBs have been linked with cancer of the liver and biliary tract in occupational workers.^[33]

Solutions: Many cases of lead poisoning have resulted from do-it-yourself home renovations without a protocol to mitigate exposure risks.^[34] Proper containment and handling of materials like lead and asbestos limits exposure.^[24] Building materials such as caulking, elastic sealants and heat insulation are known to contain PCBs, as is electrical equipment such as fluorescent lights.^[33] Indoor exposure typically occurs through inhalation of contaminated air and dermal contact of materials containing PCBs.^[33] The use of safe work practices that minimize dust and contain contaminated waste ensure that lead, asbestos and PCB-containing building materials do not contaminate surrounding surfaces during repair, removal and/or disposal.^[24,34,35]

Impact: Repair, renovation or demolition of buildings that contain hazardous materials can disperse dust and other small particles known to compromise human health. Protocols for the abatement or remediation of hazardous materials prior to renovation, demolition or repair mitigate the risk of exposure for workers, residents and those who live and work nearby.

Part 1 Manage Asbestos Hazards

For All Spaces:

Asbestos

For renovation of buildings (as defined in 40 CFR 61.141) constructed prior to any applicable laws banning or restricting asbestos, asbestos evaluation and abatement is conducted in accordance with the following:

- a. An on-site investigation of the space conducted by a certified risk assessor or inspector technician to determine the presence of any asbestos-based hazards is conducted, including Category I and Category II non-friable ACM, per 40 CFR Part 61; Subpart M; §61.145, Standard for demolition and renovation.^[36]
- b. All spaces found to have asbestos hazards adhere to applicable protocol per 40 CFR Part 61; Subpart M; §61.145, Standard for demolition and renovation and 40 CFR Part 61; Subpart M; §61.150, Standard for waste disposal for manufacturing, fabricating, demolition, renovation and spraying operations.^[37]

Part 2 Manage Lead Hazards

For All Spaces:

For renovation or painting of buildings (as defined in 40 CFR 745.83) constructed prior to any applicable laws banning or restricting lead paint, lead paint evaluation and abatement is conducted in accordance with the following:

- a. An on-site investigation of the space conducted by a certified risk assessor or inspector technician to determine the presence of any lead-based hazards in paint, dust and soil using the definitions in 40 CFR Part 745; Subpart D;

§745.65, Lead-based paint hazards for residential dwellings or child-occupied facilities.^[38]

- b. All spaces found to have lead-based hazards must adhere to 40 CFR Part 745; Subpart L; §745.227, Work practice standards for conducting lead-based paint activities: target housing and child-occupied facilities, as outlined for multi-family dwellings and 40 CFR Part 745; Subpart E; Section §745.85, Work practice standards.^[39,40]

Part 3 Manage Polychlorinated Biphenyl (PCB) Hazards

For All Spaces:

For renovation work that disturbs PCB-containing building materials (e.g. common window replacements) in buildings constructed before the institution of any applicable laws banning or restricting PCBs, prepare an abatement strategy for PCB containing materials in accordance with the U.S. Environmental Protection Agency Steps to Safe PCB Abatement Activities that includes the following:

- a. Characterization and sampling.^[41]
- b. Protective measures for workers.^[41]
- c. Safe storage and disposal.^[41]
- d. Record keeping.^[41]

X03 OUTDOOR STRUCTURES | P

Intent: Mitigate environmental contamination and associated hazards resulting from treated outdoor structures and wood-plastic materials.

Summary: This WELL feature requires the restriction of wood preservatives and lead, including lead paint, in outdoor structures and provides guidelines for the remediation of lead-contaminated soil and selection of outdoor wood-based plastics.

Issue: All types of chemically treated wood release small amounts of preservative components into the environment, which can be detected in soil or sediment samples.^[12] Chromium (VI), applied in CCA and used as a biocide in chemically treated wood products and materials, is a known human carcinogen. Evidence links chromium (VI) most strongly to lung cancer, but positive associations have also been seen with cancer of the nose and nasal sinuses.^[69] Up to 75% of the lumber produced in the United States from the mid-1970s to 2004 was pressure treated with CCA, which can leach arsenic into the soil, where children, plants and pets can be exposed.^[9] The greatest hazard posed by arsenic-containing biocides is potential exposure to arsenic leachate.^[83] Inorganic arsenic is highly toxic; studies show that the compound can increase the risk of skin, liver, bladder and lung cancers.^[84] Lead dangers, particularly for children, include wear and tear or flaking of paint found on older playground equipment.^[13] This is especially troublesome since children who engage in the ingestion of nonfood items are especially prone to exposure.^[22] Maintenance of external metal structures requires lead paint be removed prior to repainting, which further contributes to soil contamination.^[85] Other lead-containing materials, such as synthetic turf, can also degrade from use and form dust-containing lead at levels that can pose risk.^[14] Exposure to lead is associated with increased blood pressure. Additionally, exposure to lead during early development, even at low levels, is associated with negative impacts on intelligence quotient (IQ), learning, memory, and behavior.^[22]

Solutions: Lead in dust and soil can come from weathering and chipping of lead-based paint from infrastructure (e.g. buildings and bridges) and degradation of other outdoor materials like synthetic turf. Assessing and remediating lead in outdoor structures and materials, including soil, can help mitigate risk of exposure. Studies suggest that applying coatings (e.g., oil-based semi-transparent stains) on a regular basis can reduce the migration of wood preservatives from CCA-treated wood and thereby reduce the risk of exposure.^[86,87] Alternatives to wood made from the least harmful plastics [e.g. high-density polyethylene (HDPE) and low-density polyethylene (LDPE)], with higher recycled content and high end-of-life recyclability are ideal and further reduce the use of treated wood and associated risks.

Impact: The restriction of toxic biocides for use on outdoor wood structures mitigates environmental contamination and associated exposure risks. Furthermore, guidelines for the use of wood-plastic materials promotes the use of high- and low- density polyethylene to create an effective closed-loop system of highly recyclable, environmentally preferable plastic products.

Part 1 Ensure Acceptable Structures

For All Spaces:

Projects fulfill the following (as applicable):

- a. Wood structures manufactured before the institution of any applicable laws banning or restricting CCA is tested. Wood structures containing CCA is replaced^[12] or remediated in accordance with the U.S. Environmental Protection Agency's (EPA) Chromated Copper Arsenate (CCA): Consumer Advice Related to CCA-Treated Wood, using penetrating (non-film-forming), oil-based, semi-transparent stains.^[86]
- b. Artificial turf is assessed and remediated per the following:^[14]
 1. Conduct a sample test if lead concentration of synthetic turf fibers is unknown.^[14]
 2. If the lead concentration of synthetic turf fibers is greater than 300 mg/kg, perform dust-wipe testing per EPA protocol for dust-wipe testing to determine the surface dust-lead loading.^[14]
 3. If the wipe-testing results show lead loadings greater than 40 µg/ft² replace with turf containing lead concentrations less than 300 mg/kg.^[14]
- c. All newly installed plastic lumber materials meet the following:
 1. Are made from high- or low-density polyethylene (HDPE or LDPE).^[88]

2. Do not contain: wood-plastic composites, multiple commingled recycled consumer plastics, fiberglass (for nonstructural applications), polystyrene or polyvinyl chloride (PVC).^[88]

Note: Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

Part 2 Manage Exterior Paint and Soil

For All Spaces:

Projects fulfill the following (as applicable):

- a. Lead soil hazard assessment, remediation or interim controls are applied based on sections of 40 CFR Part 745; Subpart L; §745.227, Work practice standards for conducting lead-based paint activities: target housing and child-occupied facilities, listed below.
 1. Risk assessment (d)(8-11).^[39]
 2. Abatement (e)(7).^[39]
 3. Determinations (h)(4).^[39]
- b. Industrial surface paints and coatings contain less than 0.1% by weight lead in the form of lead or lead compounds.^[92]

Student or childcare areas

Projects fulfill the following:

- a. Paint on playground equipment is assessed and, if necessary, remediated in accordance with guidelines set by the Consumer Product Safety Commission Staff Recommendations for Identifying and Controlling Lead Paint on Public Playground Equipment.^[13,31]

Note: Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

X04 WASTE MANAGEMENT | O (MAX: 1 PT)

Intent: Mitigate environmental contamination and associated exposures to hazardous waste.

Summary: This WELL feature requires safe disposal and recycling of hazardous wastes and adherence to sustainable building guidelines focused on the diversion and reuse of construction and demolition materials.

Issue: Hazardous waste is a threat to human health and the environment when handled, transported or disposed of in an unregulated or uncontrolled manner, creating exposure risk via soil, air and water.^[11] When discarded improperly, mercury-containing bulbs and batteries containing heavy metals can result in contamination of the local area, exposing people nearby to elevated toxic metals through soil, air and water.^[26] Leftover pesticides that have become obsolete or otherwise unusable, if not regulated, are often disposed in general-purpose dumps.^[44] Neoplasms have been reported in excess in populations residing near toxic waste dumps. Neurological disorders in children have also been found in populations who live close to hazardous waste sites.^[42] Hazardous chemicals that are disposed improperly, such as materials and equipment containing heavy metals like mercury, lead and cadmium, are associated with cardiovascular, respiratory, renal and central nervous system damage.^[20,22,43] Pesticides that are improperly disposed can result in physical injury, environmental pollution and land degradation.^[44]

Solutions: A protocol for handling hazardous wastes can help mitigate chemical pollution, which often results from the improper handling of hazardous waste streams that are frequently mixed in with municipal or solid wastes.^[48]

Although the amount of heavy metals used in a product—for example, mercury used in a bulb—is relatively small, the cumulative impacts can have a significant effect on environmental contamination.^[26]

Impact: A fully integrated approach to addressing chemical exposure risks must control risk across manufacture, use, recycling and waste. Hazardous waste management, is often an overlooked aspect to hazardous chemical management that can have meaningful benefits to the public.

Part 1 Manage Hazardous Waste (Max: 1 Pt)

For All Spaces:

Project addresses hazardous waste through the following:

- a. A waste stream plan addresses the management of the following hazardous wastes per U.S. Environmental Protection Agency 40 CFR Part 273 Standards for Universal Waste Management, Subpart B or C (as applicable):
 1. Batteries.^[49]
 2. Pesticides.^[49]
 3. Mercury-containing equipment and lamps.^[49]
- b. A waste stream plan includes the following:
 1. Waste receptacle access.
 2. Waste or source reduction (including prevention, minimization and reuse).
 3. Recycling and materials recovery (including batteries, pesticides, lamps and mercury-containing equipment).
 4. Disposal of waste.

X05 IN-PLACE MANAGEMENT | O (MAX: 2 PT)

Intent: Reduce or eliminate exposure to hazardous building material ingredients through in-place management of legacy contaminants.

Summary: This WELL feature requires the application of protocols for the in-place management of legacy building materials asbestos and lead, which are known to be hazardous.

Issue: According to the World Health Organization, over 100,000 people die globally each year from asbestos-related diseases.^[17] This includes mortality and morbidity from cancers related to asbestos exposure, including mesothelioma, a cancer of the lining around the lungs and abdomen.^[17,18] Non-cancer effects associated with asbestos exposure include asbestosis, a chronic inflammation of the lungs.^[18] According to the Institute for Health Metrics and Evaluation (IHME), lead exposure accounted for 494,550 deaths globally in 2015, with low and middle income countries carrying the highest burdens.^[32] Further, IHME estimated that lead exposure was responsible for 12.4% of the global burden of developmental intellectual disability, 2.5% of the global burden of ischaemic heart disease and 2.4% of the global burden of stroke in 2015.^[32] Studies examining adults in the general population have found that increased bone and blood lead levels are associated with hypertension. Exposure to lead in early development, frequently a result of lead paint (dust or flakes), even at low levels, is associated with negative impacts on intelligence quotient (IQ), learning, memory and behavior.^[22]

Solutions: The U.S. Environmental Protection Agency recommends "a pro-active, in-place management program whenever asbestos is discovered."^[11113] Removal of asbestos is typically not necessary unless the material is severely damaged or will be disturbed due to demolition or renovation. In-place management incurs minimal contaminant release, is less disruptive and is a more cost-effective solution to abatement.^[52] Similarly, controlling exposure risk to existing lead-based paint is a meaningful means of mitigating associated negative health impacts.^[39,53]

Impact: In-place management of lead and asbestos, where abatement is not feasible, mitigates exposure and health hazards associated with the wear and tear of building materials containing these hazardous substances.

Part 1 Manage Hazardous Materials (Max: 2 Pt)

For All Spaces:

Asbestos

For buildings constructed prior to any applicable laws banning or restricting asbestos, the following interim strategies for managing existing hazards are conducted and repeated every three years:

- Development, maintenance and update of an asbestos management plan in accordance with the Asbestos Hazard Emergency Response Act (AHERA), including all necessary actions to minimize asbestos hazards: repair, encapsulation, enclosure, maintenance and removal, following protocol detailed in the Asbestos-Containing Materials in Schools Rule, 40 CFR Part 763; Subpart E; §763.84-§763.95 or local equivalent.^[54]
- Asbestos inspection through an accredited professional per the Asbestos Model Accreditation Plan (MAP), National Standards for Hazardous Air Pollutants (NESHAP) or local equivalent.
- Post-abatement clearance for all projects is conducted in accordance with AHERA Asbestos-Containing Materials in Schools, 40 CFR Part 763; Subpart E; Appendix A, Mandatory transmission electron microscopy method.^[54]

Lead

For buildings constructed prior to any applicable laws banning or restricting lead paint, the following interim strategies for managing existing hazards are conducted and repeated every three years:

- Interim controls are applied per 24 CFR Part 35; Subpart R; §35.1330, Interim controls, from Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, for paint stabilization of deteriorated paint and treatments for friction and impact surfaces where levels of lead dust are above levels specified in §35.1320.^[53,55]
- Post-abatement clearance is conducted per 24 CFR Part 35; Subpart R; §35.1340, Clearance.^[55]
- A reevaluation is conducted and a report produced per 24 CFR Part 35; Subpart R; §35.1355(b), Ongoing lead-based paint maintenance and reevaluation activities.^[55]

- d. As provided by 24 CFR Part 35; Subpart B; §35.155, Minimum requirements, interim controls may be performed in combination with, or be replaced by, abatement methods provided by 35.1355, Ongoing lead-based paint maintenance and reevaluation activities.^[55]

Student or childcare areas

Facilities constructed prior to any applicable laws banning or restricting lead paint and serving children under age 6 apply the following:

- a. 24 CFR Part 35; Subpart R; 35.1355(d), Chewable surfaces.^[55]

X06 SITE REMEDIATION | O (MAX: 2 PT)

Intent: Mitigate the hazards of contaminated sites and associated human exposure risks.

Summary: This WELL feature requires site testing, remediation and redevelopment of contaminated sites.

Issue: Contaminated soil can leach toxic chemicals into nearby groundwater or surface waters, accumulate in sediments, volatilize and pose hazards to indoor air in buildings on the premises or be carried by wind-borne dust.^[58] When left unmanaged, contaminants from such sites can pose risks to those who live and work nearby through inhalation, ingestion or dermal contact.^[11069] The World Health Organization's ten chemicals of major public health concern in relation to soils include arsenic, asbestos, dioxin, pesticides and heavy metals (mercury, lead and cadmium).^[8] Exposure to inorganic arsenic over an extended period can lead to digestive, skin, heart, liver and neurological damage.^[8] Inorganic arsenic is known also to be carcinogenic.^[8] Asbestos, also a known human carcinogen, can lead to mesothelioma and asbestosis.^[18,19] Dioxins are a highly toxic class of chemicals linked to negative reproductive and developmental effects, immune system damage and cancer.^[8] Pesticides or herbicides derived from trinitrotoluene may also contain dioxin as an impurity, which can present similar hazards.^[8] Studies have shown that individuals with greater exposure to pesticides, for example landscapers and children from homes where pesticides are regularly applied, are at a greater risk for non-Hodgkin lymphoma.^[8] Increased risk for prostate cancer is associated with exposure to methyl bromide, a fumigant, and stomach cancer is associated with exposure to atrazine, an herbicide.^[8] Leukemia, especially in children, has also been linked with exposure to pesticides, as have kidney and pancreatic cancers.^[8] As most consumers tend to be exposed to a mix of pesticide chemicals at low, chronic levels, clear cause and effect of such exposures is not yet well established.^[8] Heavy metal contamination of soil, including by lead, mercury and cadmium, is linked to kidney disease.^[20] Exposure to mercury can also cause an increase in blood pressure and/or heart rate and is linked to disorders of the central nervous system.^[20] Similarly, exposure to lead is associated with increased blood pressure as well as having negative impacts on intelligence quotient (IQ), learning, memory and behavior.^[22] In addition to targeting and disrupting kidney function, cadmium is known to compromise lung and respiratory function.^[56,57]

Solutions: Site assessment and remediation can reduce risk of exposure to populations that live in proximity to contaminated sites. Further, investment in sustainable redevelopment can support smarter urban growth and help preserve greenfield land.

Impact: Cleanup of contaminated sites that can present environmental (e.g. air, water, soil) and human health hazards^[58] protects the public from associated hazards and encourages environmentally responsible growth.

Part 1 Implement Site Assessment and Cleanup (Max: 2 Pt)

For All Spaces:

Project sites used for past or present industrial activities [e.g. hazardous waste storage, fuel station, manufacturing plant, dry cleaners (on-site plant), automotive repair] undertake site assessment and remediation, prior to construction, per the following:

- a. Phase I Environmental Site Assessment as described in ASTM E1527-05.^[59]
- b. Phase II Environmental Site Assessment as described in ASTM E1903-97.^[59]
- c. ISO/PRF 18504, Soil Quality Guidance on Sustainable Remediation, ASTM E2893-16, Standard Guide for Greener Cleanups or an equivalent program. Sustainable remediation programs considered equivalent must include the following base criteria:^[60]
 1. Provide risk-based approach to sustainable remediation (risk assessment/risk-benefit analysis).
 2. Consider the three pillars of sustainability: social, environmental and economic.
 3. Apply a tiered approach to assessment and provide an appraisal of remediation options.
 4. Consider safe working practices for workers during remediation.
 5. Require record keeping of decision-making and assessment processes.
 6. Provide protocol for engaging stakeholders, including management of impacts on community.
 7. Adopt a long-term vision that ensures lasting results.

Note:

A Phase I Environmental Site Assessment (ESA) is intended to identify conditions suggestive of hazardous substance release through the visible examination of environmental conditions and historical uses of the site.

A Phase II ESA is intended to further evaluate conditions identified in the Phase I ESA, including sampling of media, chemical analysis, evaluating risk and determining extent and protocol for cleanup.

Existing projects can attain points by presenting documentation showing soil investigation and remediation was performed, per the listed standards, prior to development.

X07 PESTICIDE USE | O (MAX: 1 PT)

Intent: Reduce the presence of pests in buildings primarily through Integrative Pest Management (IPM) and when necessary the use of low-hazard pesticides.

Summary: This WELL feature requires the minimization of pesticide use through IPM and when necessary, the use of low-hazard pesticides accompanied by signage detailing pesticide information at the site of application.

Issue: Pesticides have been linked to a wide range of health problems.^[8,61,62] A study by researchers at the Harvard School of Public Health found that young children who were exposed to insecticides inside their homes were at higher risk for developing leukemia or lymphoma.^[61] In addition, there has been a consistent link between an increased risk of birth defects resulting from parental exposure to pesticides.^[8] Studies have also shown that individuals with greater exposure to pesticides, for example landscapers, are at a greater risk for non-Hodgkin lymphoma.^[8] Kidney and pancreatic cancers have been linked to pesticide exposure, while an increased risk for prostate cancer is associated with exposure to methyl bromide, a fumigant.^[8] Animal data and in-vitro work suggest chronic pesticide exposures might be associated with learning and behavioral problems [e.g. attention deficit hyperactivity disorder (ADHD) and other neuropsychological deficits].^[62] Mammalian studies of organophosphate pesticides, in particular chlorpyrifos, show evidence of neurotoxic effects at low dose/chronic exposures.^[62]

Solutions: Pesticide use, and associated risks, can be reduced through the application of IPM.^[63] Furthermore, "Tier 3" or low hazard pesticides, have been assessed and not found to contribute to cancer, endocrine disruption and reproductive toxicity, per the San Francisco's hazard tier system.^[64] These can be applied when and where necessary.^[64] The application of signage detailing pesticide information at the site of application, including in the case of a public health emergency where a non-low hazard tier pesticide is used, provides further protective measures.

Impact: Pest prevention through the application of an integrated pest management system reduces the need for pesticide use, which along with the use of low-hazard pesticides and notice of application, can meaningfully reduce the risk of exposure.

Part 1 Manage Pesticides (Max: 1 Pt)

For All Spaces:

Pesticide minimization

One of the following requirements is met:

- a. Outdoor pesticide use is eliminated.
- b. Hazards associated with pesticide use are minimized through the following:^[65]
 1. The creation of an Integrated Pest Management plan that incorporates elements detailed in Appendix X1.
 2. Use of outdoor pesticides with a Hazard Tier ranking of 3 (least hazardous) based on the Pesticide Research Institute's PestSmart tool or "Least Restricted" based on the Pesticide Product Evaluator tool, except in cases of emergency.^[66]

Pesticide application

Projects provide the following for planned and emergency application of pesticides:

- a. Planned use:
 1. Provide paper or digital notification to all building occupants on the protocol for pesticide use notification.
 2. Notify all building occupants via paper or digital means at least 24 hours prior to pesticide application.
 3. Post a notification sign at the site of application 24 hours prior to application and leave in place for at least 24 hours.^[67]
 4. Notification signs include the pesticide name, registration number, treatment location and date of application.^[67]
- b. Emergency use:
 1. Provide paper or digital notification to all building occupants on the protocol for pesticide use notification.

2. Notify all building occupants via paper or digital means within 24 hours of pesticide application.^[67]
3. Post a notification sign at the site of application within 24 hours and leave in place for at least 24 hours.^[67]
4. Notification signs include the pesticide name, registration number, treatment location and date of application.^[67]
5. Provide information on the type of emergency or reason for unplanned use.

Note:

Project teams should consider primary language(s) spoken by the local population when creating signage.

If a pesticide has not yet been evaluated by the Pesticide Research Institute, use the Guide to the San Francisco's Reduced Risk Pesticide List's Hazard Tier Review Process for evaluating pesticides.^[64]

Emergency application constitutes an urgent, non-routine situation that requires the use of a pesticide where:

- No effective compliant pesticides are available.
- No feasible alternative control practices are available.
- The situation involves the introduction of a new pest or will present significant risks to human health or the environment or will cause significant economic loss.

X08 HAZARDOUS MATERIAL REDUCTION | O (MAX: 1 PT)

Intent: Reduce or eliminate exposure to hazardous heavy metals and phthalates found in building materials.

Summary: This WELL feature requires the restriction of heavy metals in various building materials and products, including furniture and furnishings and electrical components.

Issue: Heavy metals (e.g. lead, mercury, cadmium, chromium IV and antimony) have a host of negative health outcomes. Exposure to lead is associated with increased blood pressure.^[22] Additionally, exposure to lead in the young or during early development, even at low levels, is associated with negative impacts on intelligence quotient (IQ), learning, memory and behavior.^[22] Exposure to mercury is also linked to increased blood pressure and/or heart rate, as well as disorders of the central nervous system.^[20] Cadmium and chromium IV are classified as human carcinogens.^[68,69] Cadmium principally targets and disrupts kidney function, and other impacts include compromise of lung and respiratory function,^[43] while chromium IV is most strongly linked to lung cancer.^[69] Antimony negatively impacts the respiratory tract, with the lungs as the primary target of toxicity.^[70] Antimony is suspected to negatively impact cardiovascular health.^[70] Antimony trioxide is categorized as “possibly carcinogenic to humans.”^[71]

Solutions: Restricting the use of heavy metals across various building materials is a step toward mitigating risk of exposure.

Impact: The restriction of heavy metals across key building materials and products, both indoor and outdoor, not only mitigates risk of exposure but also helps push the market toward safer alternatives.

Part 1 Limit Hazardous Materials (Max: 1 Pt)

For All Spaces:

Projects meet one of the following requirements and develop a purchasing plan for continued procurement:

- a. For all newly installed building materials, at minimum 20% by cost of the following building products and material types contain less than 100 ppm added lead:^[74]
 1. Doors and door hardware.
 2. Ductwork.
 3. Conduits.
 4. Metal studs.
 5. Mirrors/glass.
 6. Roofing or flashing.
 7. Brass cooler drains, pumps, motors and valves.
 8. Vinyl blinds or wallcovering.
- b. For all newly installed furnishings and furniture (including textiles, finishes and dyes), all components that constitute at least 5%, by weight, furniture or furnishing assembly meet the following thresholds for material content:
 1. Mercury less than 100 ppm.^[75]
 2. Cadmium less than 100 ppm.^[75]
 3. Antimony less than 100 ppm.^[75]
 4. Hexavalent chromium in plated finishes less than 1000 ppm.^[75]
- c. All newly installed electrical components: fire alarms, meters, sensors, thermostats and load break switches, meet the following maximum concentration value per listed substance:
 1. Lead (Pb): less than 1000 ppm.^[76]
 2. Mercury (Hg): less than 100 ppm.^[76]
 3. Cadmium (Cd): less than 100 ppm.^[76]
 4. Hexavalent Chromium: (Cr VI) less than 1000 ppm.^[76]

Note:

For the lead requirements in Part 1: Limit Hazardous MaterialsLimit Hazardous Materials, other product categories can also be suggested for inclusion in the cost calculation, provided evidence/documentation for added lead content is presented.

Wherever procurement of a product or a material type is not possible, the project is permitted to submit documentation demonstrating an attempt has been made: for each listed product or material type applicable to project, a petition or formal request is filed with at minimum three manufacturers who were unable to meet their needs.

Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

X09 CLEANING PRODUCTS AND PROTOCOL | O (MAX: 2 PT)

Intent: Reduce exposure to pathogens, allergens and hazardous cleaning chemicals.

Summary: This WELL feature requires the restriction of hazardous or harmful ingredients in soap, shampoos, cleaning, disinfection and sanitization products as well as program training for staff, a plan for the maintenance of a cleaning schedule and a protocol for entryway cleaning and maintenance.

Issue: Commercial cleaning products often contain ingredients suspected to be hazardous to human health and the environment.^[77] For example, alkylphenol ethoxylate, a common surfactant used in various cleaning products is associated with endocrine disruption in lab studies.^[78] Cleaning product ingredients can also contain vapors or gasses that irritate the nose, eyes, throat and lungs and can cause or trigger asthma attacks.^[79] Frequent use of household cleaning sprays is suspected to be a risk factor for adult asthma.^[80] A study of 329 custodians found dermal as well as upper and lower respiratory symptoms associated with increased commercial cleaning product use and exposure.^[77] Some ingredients can also be corrosive, causing burns to the eyes or skin during handling.^[79] Triclosan, one of the most well-studied biocides used in consumer hand hygiene products, is associated with cross-resistance to antibiotics in some laboratory studies.^[81] Although further studies are needed to determine efficacy and risks associated with biocides in consumer products, current findings have raised valid concerns on the use of biocides in consumer-facing products.^[81]

Solutions: The provision of safer alternatives to conventional cleaning products, which may otherwise contain hazardous ingredients, reduces the risk of exposure to potentially harmful chemicals.^[77] Training programs for staff, maintenance of a cleaning schedule and a protocol for entryway cleaning and maintenance further ensures safe and effective use of cleaning, disinfection and sanitization products.

Impact: Cleaning products can contain hazardous ingredients which compromise indoor air quality. Using products with ingredients that have been assessed for the most critical human health endpoints helps to improve indoor air quality and supports market demand for safer ingredients and improved product formulation.

Part 1 Ensure Acceptable Cleaning Ingredients (Max: 1 Pt)

For All Spaces:

Low hazard cleaning products

Cleaning products, soaps, shampoos, disinfection and sanitization products are not manufactured with ingredients classified under the Globally Harmonized System (GHS) for the following endpoints:

- a. Carcinogenic, mutagenic or reprotoxic substances:
 1. H340 (may cause genetic defects).
 2. H350 (may cause cancer).
 3. H360 (may damage fertility of the unborn child).
- b. Systemic toxicity/organ effects:
 1. H372 (causes damage to organs through prolonged or repeated exposure).
- c. Skin and respiratory irritation:
 1. H317 (may cause an allergic skin reaction).
 2. H334 (may cause allergy or asthma symptoms or breathing difficulties if inhaled).

OR-----

Cleaning product advocacy

The following requirements are met:

- a. Projects submit documentation demonstrating an attempt for procurement has been made for products free of ingredients classified under GHS hazard statements in Option 1. This includes a petition or formal request filed

with at minimum three manufacturers/labels (per product category) who were unable to meet their needs.

- b. Projects are permitted to use cleaning products compliant with Type 1 environmental labels as defined by ISO 14024:1999 and developed by a member of the Global Ecolabelling Network in place of products free of ingredients classified under GHS hazard statements in Option 1, except where required by health codes and other regulations (e.g., food service, health care requirements).

Part 2 Implement Acceptable Cleaning Practices (Max: 1 Pt)

For All Spaces:

Program training

Projects have an annual training program in place for facilities staff or providers that addresses the following requirements:

- a. Sequencing of cleaning steps and use of personal protective equipment.
- b. Use of cleaning products and materials and related equipment (e.g. cleaning chemical dispensing equipment).
- c. Instruction for purchasing personnel in selection of low hazard cleaning materials.

Cleaning protocol

Projects have a program in place that specifies the maintenance of a cleaning schedule per the following:

- a. Extent and frequency of cleaning, including dated cleaning logs.
- b. Protocol for disinfection is specified, including:
 - 1. Identification and maintenance of a list of high-touch surfaces.
 - 2. Limitation of disinfection to high-touch surfaces.

Product storage

Cleaning product storage meets the following requirements:

- a. Bleach and ammonia-based cleaning products are kept in separate bins.
- b. Any bins and bottles of bleach and ammonia-based cleaning products are affixed with large, color-coded labels indicating they are not to be mixed.

Note:

Trainings must include culturally appropriate and literacy level appropriate education. Trainings may be provided on-site, off-site or online; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other qualified practitioners.

X10 VOLATILE COMPOUND REDUCTION | O (MAX: 3 PT)

Intent: Minimize the impact of hazardous volatile and semi-volatile organic compounds (VOCs and SVOCs) on indoor air quality.

Summary: This WELL feature requires the restriction of hazardous VOC and SVOC compounds, halogenated flame retardants (HFRs), urea-formaldehyde and select phthalates commonly used in building materials and products.

Issue: Exposure to HFRs is thought to result from dust and leachates.^[97] Inhaled and ingested dust is a major route of exposure. Polybrominated biphenyl (PBB) flame retardants are classified as probable carcinogens.^[93] Animal studies have also shown some evidence of carcinogenicity for decabromodiphenyl ether (decaBDE), one of the most commonly used commercial polybrominated diphenyl ether (PBDE) flame retardants.^[93,94] Several human studies have linked phthalates with adverse reproductive and developmental effects. Data from the National Health and Nutrition Examination survey indicate extensive exposure of the general population to phthalates, including several types of phthalates in utero and from infancy to adult life.^[72] The effects of phthalates may be cumulative. Animal studies evaluating the effects of mixtures of several phthalates on testosterone production, fetal mortality and female and male reproductive development have demonstrated that all mixtures were cumulative for negative health effects.^[72] Routes of exposure to phthalates include inhalation, ingestion and dermal contact.^[73] Phthalates that are more volatile, such as diethyl phthalate (DEP), dimethyl phthalate (DMP) and dibutyl phthalate (DBP), tend to be found in higher concentrations in indoor air, while the heavier, less volatile phthalates, including Bis(2-ethylhexyl) phthalate (DEHP) and benzyl butyl phthalate (BBP), tend to be present on indoor surfaces and in dust.^[73] One of the most well-studied and widely used phthalate plasticizers, DEHP, is typically used at about 30% of the PVC product by weight in flooring products and is commonly present at levels many times higher in household dust.^[99] This presents a significant risk, particularly for infants and toddlers who test at higher levels of DEHP than any other subgroups.^[100] Formaldehyde is known to cause cancer of the nasopharynx and has also been shown to have a role in sinonasal cancer.^[95] Additionally, exposure to formaldehyde can cause eye, nose and throat irritation and respiratory sensitization.^[96] Lastly, there is some evidence for occupational asthma and asthma or asthma-like symptoms in children exposed to formaldehyde in the home.^[96]

Solutions: The restriction of materials and products containing halogenated flame retardants (HFRs) can help to minimize the amount found in indoor dust. For example, HFRs like Tris(1,3-dichloroisopropyl) phosphate and Firemaster 550 (a mix of halogenated and non-halogenated flame retardants) can migrate from upholstery foam into indoor dust.^[98] Similarly, phthalates can migrate from materials in which they are used and accumulate in indoor dust.^[73] The restriction of phthalates across building materials helps to minimize their presence in indoor dust and reduce the risk of exposure to occupants. Formaldehyde is one of the few indoor air pollutants for which a dose-response has been demonstrated.^[15] Indoor air is a main route of formaldehyde exposure for the general population, and major sources include furniture and furnishings, pressed wood materials and laminates, paints, wallpaper, fiberglass products and varnishes, among others.^[101,102] Formaldehyde emissions from newly installed building materials and products, especially those using formaldehyde resins and adhesives, typically emit at a high rate initially and decrease with time. Reducing indoor sources of formaldehyde helps to minimize the risk of exposure to the chemical. Differences in the age of the indoor environment, air exchange rate and other considerations such as humidity and temperature can significantly impact the level of the compound found indoors.^[102]

Impact: Restriction of select, well-studied VOCs and SVOCs commonly used in building materials and products limits their presence in indoor air and dust, thereby helping to mitigate associated exposure and health hazards.

Part 1 Manage Volatile Organic Compounds (Max: 2 Pt)

For All Spaces:

The following requirements are met:

- a. At minimum, 20% by cost of the following newly installed components contain halogenated flame retardants at less than 100 ppm or the extent allowable by local code:
 1. Furniture.
 2. Window and waterproofing membranes, door and window frames and siding.
 3. Flooring, ceiling tiles and wall coverings.

4. Piping and electrical cables, conduits and junction boxes.
 5. Sound and thermal insulation.
- b. At minimum, 20% by cost of the following newly installed components contain urea-formaldehyde at less than 100 ppm or the extent allowable by local code:
1. Composite wood products.
 2. Laminating adhesives and resins.
 3. Thermal insulation.

Note: Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

Part 2 Manage Semi-Volatile Organic Compounds (SVOCs) (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. At minimum, 20% by cost of the following newly installed components contain phthalates at less than 100 ppm or the extent allowable by local code:
 1. Flooring, including resilient and hard surface flooring and carpet.
 2. Wall coverings, window blinds and shades, shower curtains, furniture and upholstery.
 3. Plumbing pipes and moisture barriers.
- b. All newly installed electrical components contain phthalates at less than 1000 ppm or the extent allowable by local code in the following:
 1. Fire alarms, meters, sensors, thermostats and load break switches.

Note: Projects can disclose or report ingredients listed here using labels approved for use in Part 1: Promote Ingredient Disclosure in Feature X14: Material Transparency to earn points toward that feature.

Part 3 Purchase Compliant Products (Max: 1 Pt)

Note:

Projects may only receive points for this part if Part 1: Manage Volatile Organic Compounds or Part 2: Manage Semi-Volatile Organic Compounds (SVOCs) is also achieved.

For All Spaces:

Projects have a program in place that specifies the following:

- a. Future purchasing for repair, renovation or replacement of building materials and products that complies with requirements for 100% of components listed in Part 1: Manage Volatile Organic Compounds and Part 2: Manage Semi-Volatile Organic Compounds (SVOCs).

X11 LONG-TERM EMISSION CONTROL | O (MAX: 3 PT)

Intent: Minimize the impact of slow-emitting volatile organic compounds (VOCs) on indoor air quality.

Summary: This WELL feature requires testing and adherence to emission thresholds for newly purchased furniture and furnishings, flooring and insulation.

Issue: VOCs and semi-volatile organic compounds (SVOCs) have a wide range of health effects, from nose, eye and throat irritation, headaches and nausea to liver, kidney and central nervous system damage. Some select VOCs and SVOCs are known or suspected carcinogens.^[5] While high levels of some VOCs are detectable by smell, others have no odor.^[4,15]

Solutions: Indoor sources of VOCs include materials and products such as interior furnishings, flooring, insulation, wallpaper and composite wood products, among others.^[4,15] Unlike paints, adhesives, sealants and coatings, VOCs in furniture, flooring and insulation emit over a longer period of time. The use of building materials and furnishings with low-VOC emissions can help substantially improve indoor air quality, particularly over an extended period of time.^[15]

Impact: Restriction of source VOCs in building materials and products can limit their presence in indoor air and dust and help to mitigate exposure risks and health hazards.

Part 1 Manage Furniture and Furnishings Emissions (Max: 2 Pt)

For All Spaces:

Newly installed furniture and furnishings meet VOC emission thresholds set by one of the following programs, earning points based on the table below:

Percent Compliance by Cost	Points
50%	1
90%	2

- ANSI/BIFMA e3-2011 Furniture Sustainability Standard sections 7.6.2 or 7.6.3, tested in accordance with ANSI/BIFMA Standard Method M7.1-2011.^[103]
- California Department of Public Health (CDPH) Standard Method v.1.2-2017.^[103]

Note:

Wherever procurement of a product or a material type is not possible, the project is permitted to submit documentation demonstrating an attempt has been made: for each listed product or material type applicable to the project, a petition or formal request is filed with at minimum three manufacturers who were unable to meet its needs.

Part 2 Manage Flooring and Insulation Emissions (Max: 1 Pt)

For All Spaces:

All newly installed flooring and thermal and acoustic insulation inside the building meet the following VOC emission thresholds:

- California Department of Public Health (CDPH) Standard Method v.1.2-2017.^[103]

Note:

Wherever procurement of a product or a material type is not possible, the project is permitted to submit documentation demonstrating an attempt has been made: for each listed product or material type applicable to the project, a petition or formal request is filed with at minimum three manufacturers who were unable to meet its needs.

X12 SHORT-TERM EMISSION CONTROL | O (MAX: 3 PT)

Intent: Minimize the impact of rapidly emitting volatile organic compounds (VOCs) on indoor air quality.

Summary: This WELL feature requires testing and adherence to emission thresholds for newly applied adhesives, sealants, paints and coatings.

Issue: VOCs and semi-volatile organic compounds (SVOCs) have a wide range of health effects, from nose, eye and throat irritation, headaches and nausea to liver, kidney and central nervous system damage. Some select VOCs and SVOCs are known or suspected carcinogens.^[5] While high levels of some VOCs are detectable by smell, others have no odor.^[4]

Solutions: Indoor sources of VOCs include materials and products such as interior paints, coatings, adhesives, wallpaper, flooring and composite wood products, among others.^[4] Paints, sealants, adhesives and coatings tend to emit rapidly. The use of low-VOC products, particularly those that emit rapidly and tend to be replaced frequently, can help substantially improve indoor air quality.^[15]

Impact: Restriction of source VOCs in building materials and products can limit their presence in indoor air and dust and help to mitigate exposure risks and health hazards.

Part 1 Manage Product Emissions: Adhesives, Sealants, Paints and Coatings (Max: 3 Pt)

For All Spaces:

Newly applied adhesives, sealants, paints and coatings applied inside the building meet all VOC emission thresholds set by the following program, earning points based on the table below:

Percent Compliance by Volume	Points
50%	1
70%	2
90%	3

- California Department of Public Health (CDPH) Standard Method v.1.2-2017 for VOC emissions.^[103]

Part 2 Manage Product Content: Adhesives, Sealants, Paints and Coatings (Max: 2 Pt)

For All Spaces:

Newly applied adhesives, sealants, paints and coatings applied inside the building meet VOC content thresholds of one of the following (as applicable) earning points based on the table below:

Percent Compliance by Cost	Points
75%	1
90%	2

- California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings.^[103]
- Conduct testing of VOC content in accordance with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2, and meet thresholds of CARB 2007 or SCAQMD Rule 1113 June 3, 2011 or Rule 1168 amended October 6, 2017.^[103]

X13 ENHANCED MATERIAL PRECAUTION | O (MAX: 2 PT)

Intent: Minimize the impact of hazardous building material ingredients on indoor air quality, protect the environment and health of workers and help support the demand for safer chemical alternatives.

Summary: This WELL feature requires screening and labeling of products in accordance with programs that restrict the use of hazardous ingredient contents in materials and products.

Issue: The vast quantity and variety of chemicals flowing through the global economy makes the task of tracing possible environmental and human health impact extremely difficult. In response to growing concerns over hazardous material and product ingredients, a number of screening and certification schemes have been introduced to the market to help differentiate safer alternatives.

Solutions: Screening and certification schemes that restrict the use of hazardous ingredients in building materials—those that are environmental contaminants and/or pose human health hazards—can help improve indoor air quality and mitigate the risk of exposure to potentially harmful substances.

Impact: Screening and certification schemes that promote safe environmental and health attributes through the restriction of ingredients known to be environmental or health hazards help to increase the demand for safer alternatives, protect public health and enable market transformation.

Part 1 Select Optimized Materials (Max: 2 Pt)

For All Spaces:

All newly installed furnishings, built-in furniture, interior finishes and finish materials comply with some combination of the following programs, earning points based on the table below:

Percent Compliance by Cost	Points
15%	1
25%	2

- a. Declare: Living Building Challenge Red List Free, Declare: Living Building Challenge Compliant or Living Product Challenge label.
- b. No GreenScreen® Benchmark 1, List Translator 1 or List Translator Possible 1 substances over 1,000 ppm, as verified by a qualified Ph.D. toxicologist or Certified Industrial Hygienist.
- c. Cradle to Cradle™ Material Health Certified with a V2 Gold or Platinum or V3 Bronze, Silver, Gold or Platinum Material Health Score.

X14 MATERIAL TRANSPARENCY | O (MAX: 2 PT)

Intent: Promote material transparency across building material and product supply chain.

Summary: This WELL feature requires the compilation and availability of product descriptions, with ingredients evaluated and disclosed down to 1,000 ppm, through transparency labels.

Issue: The global supply chain for material production is multi-tiered and complex. The level of technical and chemical knowledge throughout the supply chain can also vary greatly. Due to a lack of robust data and transparency, the adoption of safer chemicals is not well understood or practiced in the industry. Building and construction materials are not required to have complete ingredient lists, which makes it difficult to make fully informed choices when selecting safer products.

Solutions: Growing scientific and public concern over chemical exposure has prompted the introduction of a number of screening and disclosure tools to help differentiate safer ingredients and products. Labels that promote material ingredient disclosure encourage supply chain transparency and work to bridge the information gap between manufacturers and users. Further, promoting awareness of and education on material ingredient content through product labeling can help enable informed decision making.

Impact: Consumer access to material ingredient content through product labeling can help educate consumers and drive market demand for safer ingredients, protect public health and enable market transformation.

Part 1 Promote Ingredient Disclosure (Max: 2 Pt)

For All Spaces:

Material information

All newly installed interior finishes and finish materials, furnishings (including workstations) and built-in furniture have some combination of the following material descriptions, with ingredients identified and disclosed to 1,000 ppm and earning points based on the table below:

Minimum Percent by Cost	Points
25% (by cost)	1
50% (by cost)	2

- Declare Label.
- Health Product Declaration.
- Any screening and hazard disclosure method accepted in USGBC's LEED v4 MR credit: Building Product Disclosure and Optimization - Material Ingredients, Option 1: material ingredient reporting.

Material library

The following is met:

- A digital or physical library is provided to occupants on compliant products as part of the resource library required through Feature C01: Health and Wellness Awareness. The library is prominently displayed and easily accessible to occupants.

APPENDIX X1:

The IPM plan used by the project should include the following:^[65]

IPM Policy Statement

Include statement of intent, protocol, incorporation of existing services and the education and involvement of stakeholders.

Stakeholders, Roles and Responsibilities

Identify the IPM coordinator. Specify stakeholder roles and responsibilities for the development, implementation and maintenance of an IPM program, including education and communication of responsibilities across all individual stakeholders.

Pest Management Objectives

Set pest management objectives and consider the pest tolerance across various indoor sites before establishing action threshold levels.

Pest Outlines

Provide IPM coordinator with characterizations or outlines of relevant pests (from a trained or authoritative source) as a guide to properly identify, set objectives for and manage specific pests.

Tolerance or Action Thresholds for Pest Activity

Determine the threshold or point at which action is initiated for a type of pest through examination of pest tolerance levels and associated public health risk.

Response Times

Determine response times to pest problems that are timely, consistent and effective. Include notification measures that make clear to stakeholders if and when a given pest problem becomes critical and requires emergency response different from regular protocol.

Periodic Inspection, Monitoring and Reporting System

Establish periodic inspection protocols to determine effectiveness of control methods. Determine means for reporting pest problems, and use pest sighting reports as part of monitoring practice.

Evaluating and Record Keeping

Conduct evaluations of inspections to inform routine and critical updates across the entire IPM plan. Evaluations must be documented and record keeping accurate in order to correlate actions with states of pest population.

REFERENCES

- 1: Pacheco-Torgal F, Jalali S, Fucic A. Toxicity of Building Materials. Sawston, Cambridge: Woodhead Publishing Limited; 2012.
- 2: United Nations Environment Programme. Global Chemicals Outlook. United Nations Press; 2013.
- 3: Wilson MP, Schwarzman MR. Toward a new U.S. chemicals policy: rebuilding the foundation to advance new science, green chemistry, and environmental health. *Env Heal Perspect.* 2009;117(8):1202-1209. doi:10.1289/ehp.0800404
- 4: Levin H. National Programs to Assess IEQ Effects of Building Materials and Products. 2010. [Reference](#). Accessed February 4, 2018.
- 5: U.S. Environmental Protection Agency. Volatile Organic Compounds' Impact on Indoor Air Quality. [Reference](#). Accessed February 3, 2018.
- 6: Occupational Safety and Health Administration. Lead in Construction. Washington, DC; 2004.
- 7: U.S. Environmental Protection Agency. Preventing Exposure to PCBs in Caulking Material. 2009. [Reference](#). Accessed November 6, 2017.
- 8: Science for Environment Policy. Soil Contamination: Impacts on Human Health Science for Environment Policy. 2013. [Reference](#). Accessed November 6, 2017.
- 9: de Koff J, Lee BD, Schwab P. Avoiding Arsenic Exposure from Treated Lumber Around the Home. [Reference](#). Published 2007.
- 10: Tong S, Von Schirnding YE, Prapamontol T. Environmental lead exposure: a public health problem of global dimensions. *Bull World Health Organ.* 2000;78(9). [Reference](#). Accessed November 5, 2017.
- 11: U.S. Environmental Protection Agency. Resource Conservation and Recovery Act (RCRA). 2014. [Reference](#).
- 12: U.S. Department of Agriculture. Preservative-Treated Wood and Alternative Products in the Forest Service. Washington, DC: United States Forest Service; 2006. [Reference](#).
- 13: U.S. Consumer Product Safety Commission (USCPSC). Consumer Product Safety Commision Staff Recommendations for Identifying and Controlling Lead Paint on Public Playground Equipment. 1996;2016(May 12). [Reference](#). Accessed November 5, 2017.
- 14: Ulirsch G, Gleason K, Gerstenberger S, et al. Evaluating and regulating lead in synthetic turf. *Environ Health Perspect.* 2010;118(10):1345-1349. doi:10.1289/ehp.1002239
- 15: American Industrial Hygiene Association. Volatile Organic Compounds (VOC) Criteria for New Construction. White Paper. 2017. [Reference](#) Accessed February 4, 2018.
- 16: Science for Environment Policy. Brownfield Regeneration. 2013. [Reference](#). Accessed February 14, 2018.
- 17: World Health Organization. The Human and Financial Burden of Asbestos in the WHO European Region. 2012. [Reference](#). Accessed February 14, 2018.
- 18: International Agency for Research on Cancer. Asbestos (Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite and Anthophyllite). In: IARC Monographs - Arsenic, Metals, Fibres and Dusts. Volume 100C. 2012. [Reference](#). Accessed January 1, 2015.
- 19: New York City Department of Health and Mental Hygiene. World Trade Center: Final Technical Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settled Surface Dust in Residential Areas of Lower Manhattan. 2002. [Reference](#). Accessed February 1, 2018.
- 20: Agency for Toxic Substances and Disease Registry. Toxicological Profile for Mercury. 1999. [Reference](#). Accessed February 1, 2018.
- 21: U.S. Environmental Protection Agency. Mercury Compounds: Hazard Summary. [Reference](#).
- 22: Agency for Toxic Substances and Disease Registry. Toxicological Profile for Lead. 2007. [Reference](#). Accessed January 1, 2018.

- 23: U.S. Environmental Protection Agency. Lead Compounds: Hazard Summary. 2011. [Reference](#).
- 24: Agency for Toxic Substances and Disease Registry. Toxicological Profile for Asbestos. [Reference](#). Accessed November 5, 2017.
- 25: Agency for Toxic Substances and Disease. Public Health Statement: Mercury. [Reference](#). Published 1999. Accessed November 5, 2017.
- 26: World Health Organization. Guidance for Identifying Populations at Risk From Mercury Exposure. 2008. [Reference](#). Accessed November 5, 2017.
- 27: Agency for Toxic Substances and Disease Registry. Case Studies in Environmental Medicine (CSEM): Lead Toxicity. 2017. [Reference](#). Accessed November 5, 2017.
- 28: Occupational Safety and Health Administration. 29 CFR Subtitle B; Chapter XVII; Part 1926; Subpart Z; §1926.1101, Asbestos. [Reference](#). Accessed February 14, 2018.
- 29:
U.S. Green Building Council. LEED BD+C: Healthcare v4 - LEED v4, PBT source reduction - mercury. [Reference](#). Accessed February 1, 2018.
- 30: U.S. Environmental Protection Agency. Safe Drinking Water Act (SDWA) Section 1417.
- 31:
U.S. Congress. Consumer Product Safety Improvement Act of 2008. United States of America, ed. 122 STAT 3016 Public Law 110-314. Code of Federal Regulations; 2008. [Reference](#).
- 32: Institute for Health Metrics and Evaluation. GBD Compare: Lead. [Reference](#). Published 2018.
- 33: Agency for Toxic Substances and Disease Registry. Toxicological Profile for Polychlorinated Biphenyls (PCBs). 2000. [Reference](#). Accessed February 2, 2018.
- 34: Agency for Toxic Substances and Disease Registry. Public Health Statement: Lead. 2007. [Reference](#). Accessed November 5, 2017.
- 35: U.S. Environmental Protection Agency. PCBs in Building Materials - Questions and Answers. 2015. [Reference](#). Accessed November 5, 2017.
- 36: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter C; Part 61; Subpart M; §61.145, Standard for demolition and renovation. 1991. [Reference](#). Accessed February 2, 2018.
- 37: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter C; Part 61; Subpart M; §61.150, Standard for waste disposal for manufacturing, fabricating, demolition, renovation and spraying operations. 1991. [Reference](#). Accessed February 2, 2018.
- 38: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter R; Part 745; Subpart D; §745.65, Lead-based paint hazards. 2010. [Reference](#). Accessed February 2, 2018.
- 39: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter R; Part 745; Subpart L; §745.227, Work practice standards for conducting lead-based paint activities: target housing and child-occupied facilities. 1996.
- 40: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter R; Part 745; Subpart E; Section §745.85, Work practice standards. 2008. [Reference](#). Accessed February 2, 2018.
- 41: U.S. Environmental Protection Agency. Steps to Safe Polychlorinated Biphenyls (PCB) Abatement Activities. [Reference](#). Accessed November 5, 2017.
- 42:
World Health Organization. Waste and Human Health: Evidence and Needs. Bonn, Germany; 2015. [Reference](#). Accessed February 25, 2018.
- 43: Agency for Toxic Substances and Disease Registry. Toxicological Profile for Cadmium. 2012. [Reference](#). Accessed February 1, 2018.
- 44: United Nations Development Programme. Chemicals and Waste Management for Sustainable Development. 2015.
- 45: U.S. Environmental Protection Agency. Construction and Demolition Debris Generation in the United States. 2016.

[Reference](#). Accessed January 8, 2018.

46: Eurostat. Waste Statistics. [Reference](#). Published 2017. Accessed January 8, 2018.

47: Mark Hyman, Brandon Turner, Ainhoa Carpintero. Guidelines for National Waste Management Strategies. 2013. [Reference](#). Accessed January 8, 2018.

48: Barra R, Portas P, Watkinson RV, et al. Global Environmental Outlook -5 (GEO-5). Chapter 6: Chemicals and Wastes. 2012. [Reference](#). Accessed January 8, 2018.

49: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter I; Part 273, Standards for universal waste management. [Reference](#). Published 1995. Accessed February 1, 2018.

50:

U.S. Green Building Council. LEED BD+C: New Construction v3 - LEED 2009, Construction and demolition waste management. [Reference](#). Accessed February 20, 2018.

51: World Health Organization. WHO Library Cataloguing-in-Publication Data: Crysotile Asbestos. 2014. [Reference](#).

52: U.S. Environmental Protection Agency. Managing Asbestos In Place A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials. 1990. [Reference](#). Accessed November 7, 2017.

53: U.S. Department of Housing and Urban Development. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing. 2012.

54: U.S. Environmental Protection Agency. 40 CFR Chapter I; Subchapter R; Part 763; Subpart E, Asbestos-containing materials in schools. 1987. [Reference](#). Accessed February 2, 2018.

55:

U.S. Department of Housing and Urban Development. 24 CFR Subtitle A; Part 35; Subpart R, Methods and standards for lead-paint hazard evaluation and hazard reduction activities. 1999. [Reference](#). Accessed February 2, 2018.

56:

World Health Organization. Preventing Disease Through Healthy Environments. Exposure To Cadmium: A Major Public Health Concern. 2010. [Reference](#).

57: International Programme on Chemical Safety. Environmental Health Criteria for Cadmium. 1992. [Reference](#).

58: U.S. Environmental Protection Agency. EPA's Report on the Environment (ROE): Contaminated Land. [Reference](#).

59: U.S. Green Building Council. LEED BD+C: Schools v3 - LEED 2009, Environmental site assessment. [Reference](#). Accessed March 13, 2018.

60:

Rizzo E, Bardos P, Pizzol L, et al. Comparison of International Approaches to Sustainable Remediation. J Environ Manage. 2016;Volume 184(1):Pages 4-17. [Reference](#) Rem Review final draft.pdf. Accessed February 2, 2018.

61: Chen M, Chang C-H, Tao L, Lu C. Residential Exposure to Pesticide During Childhood and Childhood Cancers: A Meta-Analysis. 2018;136(4):719-729. doi:10.1542/peds.2015-0006

62: Ashley P, Nishioka M, Maureen Wooton BA, Jennifer Zewatsky B, Joanna Gaitens B. Healthy Homes Issues: Pesticides --Use, Hazards, and Integrated Pest Management. 2006. [Reference](#). Accessed November 6, 2017.

63: Food and Agriculture Organization of the United Nations. International Code of Conduct on the Distribution and Use of Pesticides. Guidance on Pest and Pesticide Management Policy Development.; 2010. [Reference](#). Accessed January 8, 2018.

64: San Francisco Environment. Guide to San Francisco's Reduced Risk Pesticide List. 2013. [Reference](#).

65: Illinois Department of Public Health. Developing and Implementing an Integrated Pest Management Program in Schools and Day Care Centers. 2009. [Reference](#). Accessed February 2, 2018.

66: Pesticide Research Institute. Pesticide Research Institute. [Reference](#).

67: U.S. Green Building Council. LEED O+M: Existing Buildings v4- Integrated pest management. [Reference](#). Accessed February 2, 2018.

68: International Agency for Research on Cancer. Evaluation of Carcinogenic Risks to Humans. Beryllium, Cadmium, Mercury and Exposure in the Glass Manufacturing Industry.; 1993. [Reference](#). Accessed February 1, 2018.

- 69: International Agency for Research on Cancer. Chromium (VI) Compounds.; 2012. [Reference](#). Accessed February 1, 2018.
- 70: Agency for Toxic Substances and Disease Registry. Toxicological Profile for Antimony and Compounds Draft for Public Comment.; 2017. [Reference](#). Accessed November 7, 2017.
- 71: International Agency for Research on Cancer. Antimony Trioxide and Antimony Trisulfide.; 1989. [Reference](#). Accessed November 7, 2017.
- 72: U.S. Environmental Protection Agency. Phthalates Action Plan. 2012. [Reference](#). Accessed January 9, 2018.
- 73: Liu Z, Little J. Toxicity of Building Materials: Materials Responsible for Formaldehyde and Volatile Organic Compound (VOC) Emissions. In: Pacheco-Torgal F, Jalali S, Fucic A, eds. Toxicity of Building Materials. Sawston, Cambridge: Woodhead Publishing Limited; 2012:76-110.
- 74: U.S. Green Building Council. LEED ID+C: Commercial Interiors v3 - LEED 2009 Avoidance of chemicals of concern. [Reference](#). Accessed March 13, 2018.
- 75: U.S. Green Building Council. LEED BD+C: Healthcare v4 - Furniture and medical furnishings. [Reference](#). Accessed February 3, 2018.
- 76: The Restriction of Hazardous Substances Directive. RoHS Compliance Guide: RoHS 10 Restricted Substances. [Reference](#). Accessed December 16, 2017.
- 77: Garza JL, Jennifer Cavallari ĀM, Wakai S, et al. Traditional and Environmentally Preferable Cleaning Product Exposure and Health Symptoms in Custodians. *Am J Ind Med*. 2015;58:988–995. doi:10.1002/ajim.22484
- 78: U.S. Environmental Protection Agency. Greening Your Purchase of Cleaning Products: A Guide For Federal Purchasers. [Reference](#). Accessed March 13, 2018.
- 79: Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health. Protecting Workers Who Use Cleaning Chemicals. [Reference](#). Accessed March 14, 2018.
- 80: Zock J-P, Plana E, Jarvis D, et al. The use of household cleaning sprays and adult asthma: an international longitudinal study. *Am J Respir Crit Care Med*. 2007;176(8):735-741. doi:10.1164/rccm.200612-1793OC
- 81: Aiello AE, Larson EL, Levy SB. Consumer Antibacterial Soaps: Effective or Just Risky? *Clin Infect Dis*. 2007;45(Supplement_2):S137-S147. doi:10.1086/519255
- 82: European Commission. Towards the Establishment of a Priority List of Substances for Further Evaluation of Their Role in Endocrine Disruption.; 2000. [Reference](#). Accessed March 14, 2018.
- 83: Agency for Toxic Substances and Disease Registry. CCA Treated Wood Factsheet. [Reference](#).
- 84: Agency for Toxic Substances and Disease. Toxicological Profile for Arsenic.; 2007. [Reference](#). Accessed February 3, 2018.
- 85: Gottesfeld P. Time to Ban Lead in Industrial Paints and Coatings. *Front Public Heal*. 2015;3(May):3-6. doi:10.3389/fpubh.2015.00144
- 86: Dickey P. Identifying Effective Sealants for CCA-Treated Wood. :1-24.
- 87: U.S. Environmental Protection Agency. Evaluation of the Effectiveness of Coatings in Reducing Dislodgeable Arsenic, Chromium, and Copper from CCA Treated Wood.; 2005.
- 88: Platt B, Lent T, Walsh B. The Healthy Building Network's Guide to Plastic Lumbar. 2005. [Reference](#). Accessed December 13, 2017.
- 89: Schiopu N, Tiruta-Barna L. Toxicity of Building Materials: Wood Preservatives. In: Pacheco-Torgal F, Jalali S, Fucic A, eds. Toxicity of Building Materials. France: Woodhead Publishing. Retrieved Sep; 2012:138-161.
- 90: National Park Service – Pacific West Region. Environmental Considerations of Treated Wood. [Reference](#). Accessed May 18, 2016.
- 91: United States Steel Corporation. Technichal Bulletin Construction- ACQ Pressure Treated Lumber Effect On Sheet Steel. 2012. [Reference](#) Treated Lumber Construction Bulletin.pdf.
- 92: National Industrial Chemicals Notification and Assessment Scheme (NICNAS). Priority Existing Chemical

Assessment Report No. 29. Lead Compounds In Industrial Surface Coatings and Inks.; 2007.

93: International Agency for Research on Cancer. IARC Monographs: Polychlorinated Biphenyls and Polybrominated Biphenyls. 2016. [Reference](#). Accessed February 3, 2018.

94: U.S. Environmental Protection Agency. Technical Fact Sheet: Polybrominated Diphenyl Ethers (PBDEs). 2017. [Reference](#). Accessed February 3, 2018.

95: International Agency for Research on Cancer. IARC Monographs: Formaldehyde.; 2012. [Reference](#). Accessed February 3, 2018.

96: Agency for Toxic Substances and Disease. Public Health Statement: Formaldehyde. 2008. [Reference](#). Accessed February 3, 2018.

97: Centers for Disease Control and Prevention. Biomonitoring Summary: Polybrominated Diphenyl Ethers and 2,2',4,4',5,5'-Hexabromobiphenyl (BB-153).

98: Shaw SD, Blum A, Weber R, Kannan K, Rich D, Lucas D, Koshland CP, Dobraca D, Hanson S BL. Halogenated Flame Retardants: Do the Fire Safety Benefits Justify the Risks? Rev Environ Health. 25(4). [Reference](#).

99: Bornehag C-G, Lundgren B, Weschler CJ, et al. Phthalates in Indoor Dust and Their Association with Building. Environ Health Perspect. 2005;113(10):1399–1404. doi:10.1289/EHP.7809

100: Center for the Evaluation of Risks to Human Reproduction (CERHR). NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Di(2-Ethylhexyl) Phthalate (DEHP).; 2006. [Reference](#). Accessed February 3, 2018.

101: Agency for Toxic Substances and Disease. Toxicological Profile for Formaldehyde.; 1999. [Reference](#). Accessed February 3, 2018.

102: National Center for Environmental Health (NCEH). Possible Health Implications from Exposure to Formaldehyde Emitted From Laminate Flooring Samples Tested by the Consumer Product Safety Commission.; 2016. [Reference](#). Accessed February 3, 2018.

103: U.S. Green Building Council. LEED BD+C: Schools v4- Low Emitting Materials. [Reference](#). Accessed February 4, 2018.

MIND

The WELL Mind concept promotes mental health through policy, program and design strategies that seek to address the diverse factors that influence cognitive and emotional well-being.

Mental health is a fundamental component of human health across all stages of life and is vital for the physical and social well-being of all individuals, communities and societies.^[1] Mental health is not simply the absence of a mental health condition.^[1] Rather, it is a state of well-being in which individuals are able to live to their fullest potential, cope with the normal stresses of life, work productively and contribute to their community.^[1] Mental health is determined by a range of socioeconomic, biological and environmental factors, such as work conditions, lifestyle and health behaviors and genetic components that influence chemicals in the brain.^[1] Through a diverse set of interventions, the WELL Mind concept seeks to address and support these drivers of mental health with the goal of improving the cognitive and emotional health and well-being of those living, working, learning and spending time in WELL spaces.

Mental health and substance use conditions are a widespread global health concern. Collectively, they account for 13% of the global burden of disease and an estimated 32% of years lived with disability.^[2] Alcohol and drug use contribute significantly to the global burden of premature death and disability, with alcohol alone accounting for 3.3 million deaths per year (or 6% of all deaths) and 5% of the global burden of disease.^[3] Depression and anxiety disorders are among the leading causes of global burden of disease, ranking second and seventh, respectively.^[2] Depression alone accounts for 4% of the global burden of disease and is considered to be among the largest causes of disability worldwide.^[4]

An estimated 18% of adults will experience a common mental health condition, such as anxiety, depression or substance abuse, over a 12-month period, and over 30% of adults will experience a mental health condition during their lifetime.^[5] Approximately two-thirds of individuals experiencing common mental health conditions are employed.^[5] The impact of mental health in the workplace is profound, with depression and anxiety alone costing the global economy an estimated USD \$1 trillion due to lost productivity.^[6] Despite its enormous global impact, worldwide spending on mental health is less than USD \$2 per person.^[5] Although treatments for these conditions exist, they are often unavailable or vastly underutilized. In high-income countries, 35–50% of people living with mental health conditions receive no care or treatment.^[1] This gap widens in low- and middle-income countries, where 76–85% of people living with mental health conditions do not receive necessary treatment.^[1]

If left unmanaged, mental health conditions – especially depression – can place an individual at risk for suicidal thoughts, attempted suicide and completed suicide. Suicide results in a tragic and preventable death, accounting for more than 800,000 deaths per year worldwide.^[3] Young adults and adolescents are particularly at risk: globally, mental health conditions are among the leading causes of disability in youth, and suicide is the second leading cause of death among adolescents and young adults (15–29 years old).^[2,3]

It is increasingly recognized that a complex relationship exists between the mind and the body and that this interplay can significantly impact health and well-being. Mental and physical health impact each other across some of the most common chronic diseases, including HIV, cardiovascular disease and diabetes.^[2] Furthermore, states of chronic stress are associated with increased risk of numerous adverse health consequences, such as depression, cardiovascular disease, diabetes and upper respiratory infection.^[1] Depression alone is associated with increased risk of disease, including diabetes, cancer, cardiovascular disease and asthma.^[1]

Additionally, individuals with mental health conditions are at higher risk for engaging in adverse health behaviors, including tobacco and substance use, physical inactivity and poor diet.^[7] In turn, these behaviors contribute to the high rates of chronic medical conditions among people with poor mental health, such as cardiovascular disease, diabetes, HIV and cancer.^[4,7] Unfortunately, these diseases are at higher risk of going unaddressed or not being sufficiently treated among individuals living with mental health conditions.^[4,7] Due to the numerous ways in which mental health impacts physical health, people with mental health conditions experience a mortality rate 2.2 times higher than the general population and a median of 10 years of potential life lost.^[7] It is estimated that 14.3% of deaths worldwide (approximately 8 million people per year) are attributable to mental health conditions.^[7]

The built environment serves as a powerful tool to help mitigate these adverse mental health outcomes through policies, programs and design. Given the high prevalence of mental health conditions among the working population, the workplace is increasingly being seen as an important target for mental health promotion, prevention and interventions.^[8] Broad strategies for mental health promotion and prevention of poor mental health include the following: improvements to mental health literacy and efforts to reduce stigma; provision of healthy living and working conditions for all, including organizational improvements to promote positive work environments and provision of stress management programs; and strategies that address gaps in access to and use of care by supporting access to mental health, substance use and addiction services and treatment.^[4] Additionally, improving opportunities for restoration through mindfulness programming, restorative spaces and support of optimal sleep, can have marked impact on physical and mental well-being, including relief from negative symptoms associated with anxiety, depression, pain and stress, as well as enhancements in overall perceived health.^[9,10] Lastly, design strategies, such as access to indoor nature, as well as design that supports productivity and focus can help relieve workplace stress and anxiety, reduce absences and enhance overall perceived health status.^[11,12,13,14,15,16]

WELL implements design, policy and programmatic strategies that support cognitive and emotional health through a variety of prevention and treatment efforts. In combination, these interventions have the potential to positively impact the short- and long-term mental health and well-being of individuals of diverse backgrounds throughout a community.

M01 MENTAL HEALTH PROMOTION | P

Intent: Promote mental health and well-being through a commitment to mental health education, programming and initiatives.

Summary: This WELL feature requires projects to promote mental health by integrating it into their commitment to overall health as well as provide basic education and resources on management of mental health, common mental health conditions and services within the local community.

Issue: The impact of mental health in the workplace is profound, with depression and anxiety alone costing the global economy an estimated USD \$1 trillion due to lost productivity.^[6] Unfortunately, support for investment in resources to support mental health is not commensurate with mental health's impact on the workplace and, more broadly, the global burden of disease.^[5,17] Recent estimates indicate that common mental health conditions (e.g., anxiety, depression, substance use) are experienced by 18% of adults over a 12 month period, and 30% of adults over the lifetime, and it is estimated that by 2020, depression will be the second leading cause of disability in the world.^[4,5,6,17] Despite the prevalence of mental health conditions worldwide, global annual spending on mental health is less than USD \$2 per person. In addition to its impact on productivity, failure to address mental health in the workplace can contribute to high turnover; presenteeism and absenteeism; repetitive recruitment and training costs; increased use of drug plans, disability claims, sick leave, employee assistance plans (EAPs) and other costly supports and increased accidents and injuries.^[17,18] Unfortunately, many individuals suffering from mental health conditions do not get the help they need.^[17] This problem is due to numerous factors, including poor mental health literacy and fear of stigma.^[17,19] Surveys show that many people are unable to correctly recognize mental disorders in themselves or others.^[17] Additionally, fear of stigma is shown to be a contributing factor toward underutilization of mental healthcare services available in the workplace.^[8]

Solutions: Given the high prevalence of mental health conditions among the working population, the workplace is increasingly seen as an important target for mental health promotion, prevention and intervention.^[8] These strategies include enhancement of mental health literacy, increased organizational support and reduction of stigma, which have been shown to help people recognize signs of poor mental health and encourage help-seeking behavior.^[8,20]

Impact: Addressing mental health can have a major impact on individuals and communities. By promoting and normalizing the discussion of mental health, projects can help relieve stigma associated with mental health, enhance mental health knowledge and better support a mentally healthy workplace.

Part 1 Commit to Mental Health Promotion

For All Spaces:

A narrative outlines how projects or organizations are committed to supporting occupant mental health and well-being, describing the following:

- a. At least three current or future mental health promotion programs or initiatives (e.g., education or awareness efforts, offering mental health screenings, stress management programs, trainings offered by a qualified in-house or contracted professional).^[21,22]
- b. How these efforts are promoted to occupants (e.g., organization-wide email reminders, posters).
- c. How these efforts are tailored to the culture and needs of the target population (e.g., why a focus on stress management, sleep or nature incorporation) as established by at least one of the following sources:^[21,22]
 1. Local or national mental health data, research or trends.
 2. Occupant survey responses.
 3. Occupant interviews or focus groups.

Part 2 Promote Mental Health Literacy

For All Spaces:

All employees are offered education and resources that address mental health literacy, including the following:

- a. Information about mental health and common mental health conditions, including, at minimum: causes, signs

and symptoms of stress, depression, anxiety and substance abuse and addiction.^[20,22]

- b. Strategies for supporting personal mental health and well-being, covering, at minimum: regular self-care practices, positive coping skills, and behaviors that influence mental health and well-being (e.g., sleep, nutrition, physical activity).^[17,22,23]
- c. Local mental health organizations, self-help groups and help and crisis lines (call, text and chat).^[18]

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 2: Promote Mental Health Literacy are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

M02 ACCESS TO NATURE | P

Intent: Support occupant well-being by incorporating the natural environment through interior and exterior design.

Summary: This WELL feature requires the integration of nature into the project's interior and exterior through design elements that support direct access with nature using plants, water, light and views, and indirect access to nature using natural materials, patterns, colors or images.

Issue: Through incorporation of nature, the built environment serves as a powerful tool to help relieve stress and mental fatigue, support focus and encourage overall mental well-being.^[24] Increasing nature contact at work may offer a simple, population-based approach to enhance workplace health promotion efforts.^[13] Exposure to plants and other natural elements has been linked with decreased levels of diastolic blood pressure, depression and anxiety; increased attentional capacity; better recovery from job stress and illness; increased psychological well-being; and increased pain tolerance.^[26,25] Additionally, the incorporation of plants in the work environment is linked with improved employee morale, decreased absenteeism and increased worker efficiency and job satisfaction.^[24,25] The presence of water, natural light and nature views can also impact health and well-being. The incorporation of water into built spaces can relieve stress, promote satisfaction and enhance performance.^[28] Exposure to natural light has a substantial impact on mood, circadian health and productivity.^[29,30] Finally, research links exposure to green or natural views with various positive emotional and cognitive health outcomes, including stress reduction, memory recall and other aspects of cognitive performance.^[24,31]

Solutions: The benefits of nature access can be achieved through numerous pathways, including direct (e.g., plants in the office), indirect (e.g., window views) or representational (e.g., photographs) exposure to natural elements.^[25] While all are effective at enhancing mood, research suggests that contact with actual, living nature has a stronger effect than representational or pictorial methods.^[32] The quantity of exposure to nature also matters. A dose-response relationship has been found with exposure to indoor nature, with research finding that as workday nature contact increased, perceived job stress, subjective health complaints and sickness absence decreased.^[11,12,13] Other research has found that both perceived and actual productivity increased for occupants in an office space with nature incorporated as compared to those in a more minimalist office space, further highlighting nature's role in benefiting the needs of both employee and employer.^[33]

Impact: Providing access to nature in built spaces can play a key role in supporting healthy environments by mitigating stressors and positively impacting cognitive and emotional health, focus, productivity and overall well-being.

Part 1 Provide Access to Nature

For All Spaces:

A narrative describes how projects integrate and encourage occupant access to nature within the building and project site (external to the building) through the following:

- a. Direct connection to nature through at least two of the below:
 1. Plants.^[28,34]
 2. Water.^[28,34]
 3. Light.^[28,34]
 4. Nature scenes (e.g., scenic views, nature views).^[31,35]
- b. Indirect connection to nature through use of natural materials, patterns, colors or images.^[34,28]
- c. Space layout, addressing placement of natural elements along common circulation routes, shared seating areas and rooms (e.g., conference rooms, common spaces) and workstations (as applicable) to enhance occupant exposure.

M03 MENTAL HEALTH SUPPORT | O (MAX: 3 PT)

Intent: Increase availability of and access to mental health support services and care.

Summary: This WELL feature requires projects to provide occupants with access to essential mental health services as well as offer supportive accommodations for those living with mental health conditions.

Issue: It is estimated that as many as 70% of people experiencing mental health conditions do not receive the help they need.^[8] Compared to other illnesses, those with mental health conditions have longer delays in treatment onset.^[23,36] The median delays for seeking help range from 1–14 years for mood disorders, 3–30 years for anxiety disorders and 6–18 years for substance use disorders.^[17] Many complex factors contribute to this gap: inadequate public health and human resources available, a lack of mental health promotion and the stigma associated with mental health conditions.^[4] This lack of treatment has enormous public health and economic consequences: individuals with depression miss an average of 4.8 workdays and experience 11.5 days of reduced productivity in a three-month period, and people living with mental health conditions are overall less likely to receive preventive health services (e.g., immunizations, cancer screening, tobacco cessation support) and receive overall lower quality of medical care.^[7,37]

Solutions: Although it has been shown that treatment for common mental health conditions can be effective up to 80% of the time, only 33% of those who need help seek it.^[37] Equitable access to screening, care facilities and mental health services can help mitigate poor mental health outcomes by promoting care utilization, supporting early diagnosis and improving receipt of adequate mental health care.^[4] Additionally, enhanced social support and adjustments to the work environment can help enable a successful return for employees coming back from leave due to a mental health condition.^[38,39]

Impact: Evidence suggests that mental health screening can produce cost-effectiveness ratios similar to those of other commonly performed preventive services, such as screening mammography in women older than 50 years of age or treatment of mild to moderate hypertension.^[40] Findings from 21 studies assessing the efficacy of corporate health and productivity programs found that Employee Assistance Plans have returns on investment ranging from USD \$1.49–\$13.00 per dollar spent, with programs supporting mental health showing one of the highest ROIs.^[41] By supporting employees in accessing mental health services, workplaces can both reduce costs and enhance employee health and well-being.

Part 1 Provide Mental Health Screening (Max: 1 Pt)

For All Spaces:

At least one of the following mental health screening options is provided to all eligible employees at no cost:

- a. Online or paper self-assessment or screening tool for common mental health conditions addressing, at minimum, stress, depression, anxiety and substance use. Assessment or tool used must be evaluated and approved by a mental health professional, include guidance on interpretation of results and outline next steps for occupants who screen positive or at-risk.^[22,43]
- b. Clinical screening for common mental health conditions, addressing, at minimum, depression, anxiety, stress and substance use), followed by directed feedback and clinical referral when appropriate. Screening may be provided either directly through projects or indirectly through health insurance offerings.^[22,43]

Part 2 Provide Mental Health Coverage (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Mental health services are available to all eligible employees at no cost or subsidized by at least 50%, including coverage for the services below, at minimum:
 1. Referrals to qualified mental health professionals and support resources.
 2. Inpatient coverage (e.g., hospitalization).^[22]
 3. Outpatient treatment (e.g., therapy, medical management).^[22]
 4. Prescription medication coverage that allows for proper use of prescribed medications.^[22]

- b. Clear information on benefits coverage and how to access care services or community resources is easily and confidentially available (e.g., via a health portal or employee website).^[22]
- c. Confidential benefits consultation is available for all occupants with a benefits counselor, human resources representative or other benefits support staff.
- d. Commitment to mental health parity.^[22]

Part 3 Provide Workplace Support (Max: 1 Pt)

For All Spaces:

A policy is in place allowing the following for all eligible employees:

- a. Use of sick or paid time and adjustment of work schedule for treatment, appointments or other mental health needs.^[39,40,45]
- b. Individualized adjustment of the physical environment to support mental health needs (e.g., moving a workstation to a busier or a quieter area, providing a quiet space for breaks, providing earplugs or headphones, increasing personal space, providing the ability to work from home).^[39,40,45]
- c. Use of short- or long-term leave or disability for mental health needs, with option of:
 - 1. Phased return to work after returning from leave.^[45,46]
 - 2. Increased interpersonal support (e.g., manager support with prioritizing and managing workloads, increased frequency of one-on-one check-ins).^[39]

M04 MENTAL HEALTH EDUCATION | O (MAX: 2 PT)

Intent: Promote mental health awareness and education through the provision of mental health-focused trainings or education offerings.

Summary: This WELL feature requires projects to provide education and training to employees and managers to help them better understand how to manage their own mental health and support others.

Issue: Many people with mental health conditions delay seeking help; however, they are more likely to receive professional help when it is suggested by someone in their social network.^[46] Unfortunately, many individuals lack the skills to facilitate early intervention.^[46] Additionally, although recent studies indicate improvements in mental health literacy among the public, there still is a need for increased knowledge regarding causes and recognition of different types of mental health conditions, beliefs about treatment for mental disorders and reduction in stigma against those with mental health conditions.^[47,48] Combined, these factors lead to delays in recognition and help-seeking, hinder public acceptance of evidence-based mental health care and deny those with mental health conditions appropriate support from their communities.^[48]

Solutions: Education and anti-stigma interventions can have a significant impact on employees' knowledge about mental health and reduce stigmatizing attitudes toward people with mental health conditions.^[8] These interventions have been shown to increase supportive behavior toward those with mental health conditions, such as: enhancing perceived confidence and self-efficacy in identifying and dealing with a person with a mental illness, increased likelihood of advising those in need to seek professional help and greater readiness to provide help in a mental health situation.^[8] Additionally, certain education interventions have shown signs of having a positive impact on participants' own general mental health and help-seeking behavior.^[8] A systematic review of Mental Health First Aid training demonstrated that it increases participants' knowledge regarding mental health, decreases negative attitudes, increases supportive behavior and confidence in helping others and has been shown to be highly acceptable in a workplace setting.^[49,50]

Impact: Workplace mental health education interventions can help create a more supportive work environment by reducing stigmatizing attitudes and discrimination, lead to enhanced knowledge and awareness and improve employee mental health via increased and potentially earlier help-seeking.^[8]

Part 1 Offer Mental Health Education (Max: 1 Pt)

For All Spaces:

All employees are offered trainings available quarterly, at minimum, addressing at least two of the following:

- Managing personal mental health and well-being, covering topics such as developing mentally healthy habits, fostering relationships, self-care and managing mental health at work.^[22]
- Education on common mental health conditions or concerns, covering, at minimum, depression, anxiety, stress and substance use.
- Signs and symptoms of mental health distress, including how to identify emotional distress and appropriately respond (e.g., Mental Health First Aid).^[22]

Note:

Trainings must be culturally appropriate and literacy level appropriate. Trainings may be in the form of education seminars, workshops or classes. Trainings may be provided on-site, off-site or online; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other qualified practitioners (e.g., Mental Health First Aid).^[43]

Projects that meet Part 1: Offer Mental Health Education have met the requirements for Feature M01: Mental Health Promotion, Part 2: Promote Mental Health Literacy.

Part 2 Offer Mental Health Education for Managers (Max: 1 Pt)

For All Spaces:

All managers undergo formal mental health training annually. Trainings must be offered quarterly, at minimum, and address at least three of the following:

- a. Identifying and reducing workplace stress–related issues (e.g., training on conducting performance reviews, effective communication skills, personnel management, assertiveness, time management, conflict resolution).^[43]
- b. Recognizing common mental health conditions or concerns, covering, at minimum, stress and burnout, depression, anxiety and substance use.^[43]
- c. Supporting employees through strategies to prevent burnout, low motivation, fatigue, poor work-life balance and other work-related stress issues.^[52]
- d. Recognizing employee mental health concerns or crises, including increasing awareness of workplace and community resources available to employees.^[43]

Note:

Trainings must be culturally appropriate and literacy level appropriate. Trainings may be in the form of education seminars, workshops or classes. Trainings may be provided on-site, off-site or online; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other qualified practitioners (e.g., Mental Health First Aid).^[43]

M05 STRESS SUPPORT | O (MAX: 2 PT)

Intent: Identify and manage areas of workplace stress and provide programs that support stress management .

Summary: This WELL feature requires projects to assess causes of stress within the organization, create a plan for relieving stress and provide training and education to support employees in managing personal stress.

Issue: Stress is a pervasive global public health concern and workplace hazard that is linked to numerous negative physical and mental health consequences, including autoimmune disease, obesity, high cholesterol, coronary heart disease, hypertension, stroke, muscle tension and backache, migraines and chronic headaches and poor recovery from illness.^[52,53,54] Exposure to stressful workplace conditions and job strain is linked to and is a predictor of numerous adverse mental health outcomes, including depression, anxiety, substance use, suicide, poor concentration, emotional exhaustion and burnout.^[53,54,55] Stress also influences an individual's ability to engage in other key health behaviors, including smoking cessation, healthful eating and being physically active.^[53] Employee stress is incredibly common, with recent studies reporting that 80% of workers feel stress on the job and 25% report work as their number one stressor.^[53] Overall, employees who experience stress are more likely to miss work, resulting in an estimated one millions worker absences per day due to stress.^[53] Additionally, stressed employees are more likely to quit, be involved in an accident, experience reduced performance and incur an average of nearly 50% higher health care expenditures compared to less stressed peers.^[53] In the European Union alone, it is estimated that work-related stress negatively affects at least 40 million workers, costing 20 billion euros annually.^[45]

Solutions: Numerous factors increase the likelihood that workplace stress will occur. These include low support from supervisors and colleagues, little control over work processes, unmanageable and high demands, concern over little job security and low opportunity for advancement or professional development.^[53] Day-to-day operations, including understaffing, overly compressed schedules and malfunctioning equipment, also contribute to stress.^[53] However, stress and its associated risks can be reduced through interventions that adjust job stressors, such as changes in operations, increases in co-worker and supervisor support and training employees in developing resilience to withstand job stressors.^[54,55]

Impact: By preventing or reducing exposure to job stressors and improving resilience to workplace stress, employers can prevent a substantial proportion of common mental health problems as well as the negative physical health outcomes associated with stress.^[54]

Part 1 Develop Stress Management Plan (Max: 1 Pt)

For All Spaces:

Projects complete the following:

- a. Evaluate at least four of the organization- or project-wide metrics below:
 1. Frequency of absenteeism.
 2. Use of paid time off, sick days and personal days.
 3. Frequency of leave due to disability or illness.
 4. Frequency of performance issues.
 5. Employee retention and turnover rates.
 6. Employee survey responses.
- b. Provide a stress management plan based on the evaluation of organization- or project-wide metrics, outlining opportunities to address employee stress through organizational policies and operations, covering the topics below:
 1. Opportunities for organizational change to address employee stress (e.g., work processes and environment, business travel policies, management of work demands, work-life balance).^[43]
 2. Opportunities for employee participation in organizational decisions regarding workplace issues that may affect job stress (e.g., work processes, environment, schedules).^[43]
 3. Plan for implementation, describing support from key management or leadership,^[54] who is leading the initiative, what is to be completed, where in the organization it will be occur, who will be impacted, and

when and how it will be implemented.^[21]

Part 2 Support Stress Management Programs (Max: 1 Pt)

For All Spaces:

A narrative describes how projects support employee stress management through the following:

- a. Stress management training or education, covering issues such as stress management at work and work-life balance.^[43] Training or education must be tailored to employee need, reviewed by a qualified professional and offered quarterly, at minimum.
- b. At least three additional health and wellness offerings associated with stress reduction or management (e.g., fitness opportunities, childcare support, mindfulness training).^[22] Offerings may include other features pursued by projects and in concepts outside of the WELL Mind concept.

Note:

Trainings and/or education must be culturally appropriate and literacy level appropriate. Trainings may be in the form of education seminars, workshops or classes. Trainings may be provided in-person or online; on-site or off-site; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other practitioners.

M06 RESTORATIVE OPPORTUNITIES | O (MAX: 1 PT)

Intent: Support employee well-being by providing opportunities for recovery and restoration through micro- and macro-breaks from the workplace.

Summary: This WELL feature requires projects to implement policies that support recovery and restoration from work and encourage a healthy work-life balance, such as breaks throughout the workday and sufficient paid time off.

Issue: Long working hours and insufficient opportunities for recovery have been found to be associated with cardiovascular and immunologic reactions, reduced sleep duration and negatively impacted circadian rhythm, gastrointestinal issues, unhealthy lifestyle (e.g., excessive alcohol use, poor diet) and adverse health outcomes such as cardiovascular disease, diabetes, subjective health complaints, fatigue, depression and reduced cognitive function.^[45,56] While long hours can be managed for short-term periods, sustained pressure and inadequate work-life balance can quickly lead to stress and burnout, reducing levels of employee productivity, efficiency, performance, creativity and morale.^[45,57] Additionally, research shows that working over weekends inhibits recovery from work-related stress, engaging in work-related activities during evening hours after work relates to lower well-being and use of technology in the evening for work is connected with reduced sleep quality.^[10] Many individuals do not use their vacation time, and when they do, just one-in-four employees (27%) indicate truly unplugging from work while on vacation.^[58] While the health promoting effects of vacations do fade with time, research indicates that ongoing periods without vacation have adverse health effects, including increased cardiovascular risk, indicating that regular vacations may have a protective effect against chronic work stress.^[10]

Solutions: Time away from work is crucial for recovery and maintenance of long-term health and well-being. Research findings across all types of breaks away from work, such as vacations, weekends, evenings and short periods during the workday, indicate that mentally distancing oneself from work and engaging in restorative activities is linked to employee well-being, specifically higher life satisfaction and mood, maintained workplace performance, lower burnout and fewer health complaints.^[10] Research indicates that vacations have positive effects on health and well-being by providing a sustained period of relief from daily stressors, demands and routines, and offering opportunities to engage in restorative and recovering activities, such as social contact with family and friends, hobbies or other interests and physical activity.^[59,60] In addition to engaging in longer recovery breaks such as vacations, research indicates that unwinding from work on a day-to-day basis is critical.^[10] It is key for employers to allow sufficient opportunities for employees to psychologically detach and recover over non-work hours, such as weekends, vacations and evenings.^[10]

Impact: By creating opportunities for both micro- and macro-restoration, employers can help support and foster an engaged workforce that feels rested, valued and motivated, which can have lasting impact on long-term health and engagement.^[58]

Part 1 Provide Micro- and Macro-Breaks (Max: 1 Pt)

For All Spaces:

A narrative describes how the workplace encourages micro-breaks and macro-breaks among all eligible employees, including the following:

- a. Policy on overtime or working beyond the typical workdays and workday length/assigned daily hours.^[52]
- b. Opportunities for micro-breaks during the workday, outlining:
 1. Designated time to break for a meal built into the workday.^[10]
 2. Encouragement of breaks away from the workstation throughout the workday.^[10]
 3. Description of areas available to take micro-breaks within the project boundary or within 300 m [1,000 ft] walk distance from the project boundary.
- c. Paid time off policy for all eligible employees, with a minimum of 20 days per calendar year (not including standard paid holidays), outlining:
 1. How workplace culture encourages employee use of paid time off, including modeling from managers and leadership.^[58]

2. How occupants are discouraged from engaging in work-related email, phone calls or other work during paid-time off (including weekends).^[10]
3. Clearly defined policies on sick, vacation, floating holiday, personal and rollover days (addressing accrual policy, cap on rollover days allowed and date by when rollover days must be used).

M07 RESTORATIVE SPACES | O (MAX: 1 PT)

Intent: Support access to spaces that promote restoration and relief from mental fatigue or stress.

Summary: This WELL feature requires projects to provide spaces that promote a restorative environment and encourage relief from mental fatigue and stress.

Issue: Work-induced fatigue is common among office workers, with research indicating that over 20% of the workforce experiences prolonged fatigue.^[61,62] During the workday, individuals experience fatigue caused by a depletion of physical and mental resources, resulting in an accumulated need to recover from mental fatigue and stress.^[61] The experience of prolonged fatigue combined with a high need for mental recovery is strongly associated with psychological distress, including decreased mental acuity, deficits in motivation and irritability caused by prolonged exposure to stress.^[61,62]

Solutions: By providing restorative spaces for individuals to step away from the stress of the office environment, recharge and refocus, employers can help alleviate the negative effects associated with workplace fatigue or mental depletion. Through incorporation of nature, among other restorative elements, these spaces can help relieve stress and mental fatigue, support focus and encourage overall mental well-being.^[24] Exposure to plants and other natural elements has been linked with decreased levels of diastolic blood pressure, depression and anxiety; increased attentional capacity; better recovery from job stress; increased psychological well-being.^[26,25] Nature interaction has also been shown to support recovery from illness and increase pain tolerance.^[26,25] Similarly, outdoor spaces can be used to promote calm and encourage restorative activities. Both indoor and outdoor spaces can also be used for individuals with a wide variety of beliefs, religions and traditions, including prayer and meditation.

Impact: Mentally distancing oneself from work and engaging in restorative activities is linked to employee well-being, specifically higher life satisfaction and mood, maintained workplace performance, lower burnout and fewer health complaints.^[10] Offering a space for employees to meditate, pray or think can empower employees to manage their own stress and well-being in a way that feels most comfortable to them.

Part 1 Provide Restorative Indoor Spaces (Max: 1 Pt)

For All Spaces:

Designated indoor space is available to all regular building occupants to support restorative practices. This may be a single space or several spaces that meets the following requirements:

- a. Designated exclusively for contemplation, relaxation and restoration (not to be used for work).
- b. Is a minimum of 7 m² [75 ft²] plus 0.1 m² [1 ft²] per regular building occupant, up to a maximum of 74 m² [800 ft²]. Room may be broken up into multiple smaller rooms that total the required amount.
- c. A design plan and accompanying narrative describes elements that encourage contemplation, relaxation and restoration, and in consideration of the design criteria below:
 1. Accessible design.
 2. Lighting (e.g., dimmable light levels).
 3. Intrusive noise and sound masking (e.g., water feature, natural sounds).^[63]
 4. Thermal comfort.
 5. Seating arrangements that accommodate a range of user preferences and activities (e.g., movable lightweight chairs, cushions, mats).^[63]
 6. Nature incorporation.^[63]
 7. Calming colors, textures and forms.^[63]
 8. Visual privacy.^[63]
- d. Is maintained on a weekly basis, at minimum.
- e. Education materials or resources are available to occupants explaining the purpose of the space and how to make use of it.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

Part 2 Provide Restorative Outdoor Spaces (Max: 1 Pt)

For All Spaces:

Designated outdoor space within projects is available to all regular building occupants. This may be a single space or several spaces that meets the following requirements:

- a. Is designated exclusively for contemplation, relaxation and restoration (not to be used for work).
- b. Is a minimum of 7 m² [75 ft²] plus 0.1 m² [1 ft²] per regular building occupant, up to a maximum of 74 m² [800 ft²]. Space may be broken up into multiple smaller spaces that total the required amount.
- c. A design plan and accompanying narrative describe how the space includes elements that encourage contemplation, relaxation and restoration, and in consideration of the below:
 1. Accessible design.
 2. Intrusive noise and sound masking (e.g., water feature, wind chimes).^[63]
 3. Thermal comfort (e.g., availability of both sun-exposed and shaded areas).^[63]
 4. Seating arrangements that accommodate a range of user preferences and activities (e.g., movable lightweight chairs, outdoor or weatherproof cushions, mats).^[63]
 5. Nature incorporation.^[63]
 6. Visual privacy.^[63]
 7. Calming colors, textures and forms.^[63]
 8. Maintenance.
- d. Is maintained on a weekly basis, at minimum.
- e. Education materials or resources are available to occupants explaining the purpose of the space(s) and how to make use of it.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters, and/or other written or online information.

M08 RESTORATIVE PROGRAMMING | O (MAX: 1 PT)

Intent: Support access to programs that promote restoration and relief from mental fatigue or stress.

Summary: This WELL feature requires projects to develop ongoing programming for occupants that is focused on restoration and relaxation, such as mindfulness meditation or mindful movement.

Issue: Workplace stress is incredibly common, with four out of five employees reporting that they experience work-related stress, and one in four reporting work as their number one stressor.^[53] Exposure to stressful work conditions is associated with poor mental and physical health.^[63] Highly stressed employees are at risk for numerous negative outcomes, including decreased productivity, greater absenteeism, increased occupational injury, and higher overall medical expenditures.^[63]

Solutions: Meditation includes a number of practices in which the individual works to calm the mind in order to garner benefit or achieve inner peace or harmony.^[64] While the scientific literature lacks consensus on the definition of meditation, it generally implies a form of mental training that requires either stilling or emptying the mind.^[64] Introducing mindfulness into the workplace has been shown to lower employee stress, as well as improve focus, clarity of thinking, decision-making and emotional intelligence.^[63,65] For example, meditation interventions targeting workers have been found to be effective at reducing work-associated stress, depression and anxiety among full-time Australian workers.^[63] Mindfulness training also reduced burnout, mood disturbances and stress among health care providers and showed improvements in mood and sleep quality among teachers.^[63] A recent systematic review concluded that mindfulness meditation reduced negative dimensions of psychological stress, including improving anxiety, depression, pain, stress and overall mental health.^[9] There are numerous types of mindfulness training. Mindfulness-based stress reduction, a widely disseminated and frequently used practice, has been shown to reduce symptoms of stress, depression and anxiety, and enhance self-esteem, body image, mood and coping with other health problems, such as chronic pain, fatigue, stress and insomnia.^[52,64,66]

Impact: Mindfulness-based practices, whether formal or informal, can help improve employee focus and productivity, support stress management and reduce employer costs through improvements to overall health and well-being.^[63,65]

Part 1 Provide Restorative Programming (Max: 1 Pt)

For All Spaces:

At least two of the following programs focused on relaxation and restoration, such as mindfulness meditation or mindful movement (e.g., yoga, tai chi), are offered to all eligible employees at no cost or subsidized by at least 50%:

- a. Training courses (e.g., eight-week mindfulness-based stress reduction course) offered in-person, on-site, in a quiet and calm space and scheduled during a convenient time based on the average employee schedule (e.g., after work, during lunch). The training course must be offered at least twice a year.
- b. On-going programming (e.g., guided meditation, yoga) offered in-person, on-site, in a quiet and calm space and scheduled during a convenient time based on average employee schedule (e.g., after work, during lunch). Programming must be offered at least once a week.
- c. On-going digital offerings (e.g., guided meditation application). Employees must have unlimited access to at least one digital offering as well as ongoing access to a quiet, calm space within the project to practice.

Note:

Trainings, programming and digital offerings must be culturally appropriate and literacy level appropriate.

M09 ENHANCED ACCESS TO NATURE | O (MAX: 1 PT)

Intent: Support access to nature beyond M02: Access to Nature by further incorporating nature through interior and exterior design, nature views and access to nearby nature.

Summary: This WELL feature requires the integration of nature and natural elements into the interior and exterior of the project, as well as the provision of nature views and nearby nature, such as green and blue spaces.

Issue: Access to nature plays a key role in helping relieve stress and mental fatigue, support focus and encourage overall mental well-being.^[24] Increasing nature contact at work may offer a simple, population-based approach to enhance workplace health promotion efforts.^[13] Exposure to plants and other natural elements has been linked with decreased levels of diastolic blood pressure, depression and anxiety; increased attentional capacity; better recovery from job stress and illness; increased psychological well-being; and increased pain tolerance.^[26,25] The incorporation of plants in the work environment is linked with improved employee morale, decreased absenteeism and increased worker efficiency and job satisfaction.^[24,25] Additionally, incorporation of water into built spaces can relieve stress, promote satisfaction and enhance performance.^[28] Research also links exposure to green or natural views is associated with various positive emotional and cognitive health outcomes, including stress reduction, memory recall and other aspects of cognitive performance.^[24,31] Lastly, access to outdoor green spaces is associated with a range of short- and long-term mental health benefits for individuals across the life span, from children to older adults.^[68,69,71] The many associated benefits include lower levels of anxiety and depression as well as improved mental recovery from stress and fatigue.^[72]

Solutions: The benefits of nature access can be achieved through numerous pathways, such as direct (e.g., plants in the office) and indirect (e.g., window views) access.^[25] The quantity of exposure to nature also has an impact: a dose-response relationship has been found with exposure to indoor nature, with research finding that as workday nature contact increased, perceived job stress, subjective health complaints and sickness absence decreased.^[11,12,13] Additionally, researchers hypothesize that access to outdoor green spaces impacts mental health and wellbeing through cognitive restoration, and that physiological and emotional changes take place when individuals are exposed to natural settings.^[73] The benefits of nature access have been found across diverse age groups, and supporting access to outdoor green and natural spaces can support the health and well-being of a wide range of individuals within a built community.^[74]

Impact: Providing access to nature in built spaces can play a key role in supporting healthy environments by mitigating stressors and positively impacting cognitive and emotional health, focus, productivity and overall well-being.

Part 1 Provide Enhanced Access to Nature (Max: 1 Pt)

For All Spaces:

Projects complete at least two of the following:

- a. Outdoor nature access facilitated by the conditions below:
 1. At least 25% of the exterior project site area consists of either landscaped grounds, rooftop gardens or other natural elements open to regular building occupants.
 2. Consists of at least 70% plants or natural elements, including tree canopies (within the 25% specified above).
 3. A narrative that describes how the design of the exterior project site encourages occupant access to nature.
- b. Indoor nature access facilitated by the conditions below:
 1. Any combination of indoor plants (e.g., potted plants, plant beds, plant walls) and/or water feature(s) are within a direct line of sight of at least 75% of workstations and seats within conference rooms, lecture halls or classrooms.
 2. All water features (if included), use ultraviolet sanitation or other technology to address water safety.
 3. A narrative that describes how the design of the interior project site and placement of indoor nature encourage occupant access to nature.
- c. Nature views (e.g., scenic views or nature scenes) facilitated by the conditions below:

1. Exterior nature views are available within a direct line of sight of at least 75% of workstations and seats within conference rooms, lecture halls or classrooms.^[76] Views must comprise natural areas or landscapes, such as green spaces (e.g., park, forest) or blue spaces (e.g., ocean, lake, river).
 2. A narrative that describes how the design of the interior project site encourages occupant access to nature.
- d. Nearby nature access facilitated by the conditions below:
1. At least one green space or blue space is within 300 m [1,000 ft] walk distance from the project and available to all regular building occupants during open hours of the space(s). Green spaces must be a minimum of 0.5 hectare [1.25 acre].^[75]
 2. A narrative that describes how occupants are encouraged to access nearby nature (e.g., presence of signage or maps; availability of breaks during the workday).

M10 FOCUS SUPPORT | O (MAX: 1 PT)

Intent: Reduce distractions and enable focused work by integrating a stimuli management program within the building.

Summary: This WELL feature requires projects to assess an organization's work style, type of work, processes and space utilization to optimize employee satisfaction and productivity through workplace program and design.

Issue: The physical work environment can make a profound difference on an employee's ability to focus and manage work-related stress.^[14,15,16] Despite improvements on worker communication and ease of interaction, research has found that employees experience lower satisfaction and productivity, increased distraction and concentration difficulties, poorer health and overall decline in workspace satisfaction in open-plan offices compared to traditional, private offices.^[14,76,77,78] Many of these negative effects can be attributed to the impact of increased background noise and distraction on working memory, a brain process that is of critical importance when working on complex tasks and that declines when competing with background noise. The effects of office type are more pronounced depending on an individual's need for concentration to complete their work, with individuals in need of high concentration experiencing greater distraction and more cognitive distress in open offices compared to cell or flex offices.^[79] Additionally, even in offices in which employees have high perceived privacy, irrelevant speech contributes to mental workload, poor performance, stress and fatigue.^[15] A lack of privacy and control over the work environment has been found to have negative impacts, as individuals experience psychological comfort from feelings of belonging, ownership and control over their workspace.^[14,16,78]

Solutions: Office layout can influence employee perceptions of and attitudes toward the organizational culture and work environment.^[80] While private offices are ideal for productivity, concentration, reduced stress and overall health, it is often infeasible to offer them to employees. However, workplaces that have an open-plan design can support employee health and well-being through innovative programs and design solutions.^[16] These strategies include design that allows individuals to adjust the environment according to personal preference and task requirements, thereby optimizing comfort and reducing the potential impact of environmental workspace stressors.^[16]

Impact: The work environment can have a significant impact on work performance and concentration by providing a variety of working environments that allow for both concentration and privacy, as well as collaboration and interaction.

Part 1 Assess Work Environment (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. A narrative describes how the organization's work processes and space utilization support focus and productivity among employees, incorporating at least one of the sources below:
 1. Occupant survey responses.
 2. Occupant interviews and/or focus groups.
 3. Observational research.
- b. To support opportunities for focus at least two of the below are in place for all eligible employees:
 1. Process for requesting alternate workspace arrangements if assigned workstation does not meet occupant stimuli needs (e.g., too busy, loud or quiet).^[45] If physical or organizational constraints do not permit moving station, occupants are offered flexible working arrangements or work from home options.
 2. Designated quiet hours, zones or rooms during the workday.
 3. Stipend for or provision of noise-cancelling or noise-reducing headphones and/or earplugs.^[45]
 4. Day(s) of the week on which formal meetings are discouraged.
 5. Visual communication system to indicate do-not-disturb time (e.g., flag system).

Part 2 Integrate Space Management (Max: 1 Pt)

For All Spaces:

Seating and spatial layouts

Projects meet the following requirements to ensure that seating and spatial layouts are organized into separate workplace zones and provide differing degrees of sensory engagement:

- a. Annotated floor plans establish work zones that support a variety of work functions (e.g., quiet work, collaborative work).
- b. Designated quiet zones are provided as enclosable (e.g., small conference rooms, single-occupancy phone booths) or semi-enclosable (e.g., carrels) rooms with no more than three seats per room.
- c. Designated collaboration zones are provided as enclosable or semi-enclosable rooms with no less than three seats and, at minimum, one visual vertical surface area for communicating ideas or work.
- d. A system is in place for booking or reserving enclosable quiet and collaboration zones.

Personal storage and organization

Storage is provided to minimize clutter and support an organized environment through one or a combination of the following:

- a. A workstation cabinet at a minimum volume of 0.1 m^3 [4 ft³] for each regular occupant with a permanent, designated workstation.
- b. A personal locker at a minimum volume of 0.1 m^3 [4 ft³] for each regular occupant without a permanent workstation (e.g., offices with rotating desks or free address policies).

M11 SLEEP SUPPORT | O (MAX: 2 PT)

Intent: Support healthy, restorative and consistent sleep habits among occupants.

Summary: This WELL feature requires projects to support employee sleep through policies, education and resources to improve sleep hygiene as well as provide opportunities to take short naps during the day.

Issue: Adults should sleep seven or more hours per night on a regular basis to promote optimal health.^[81] Unfortunately, many adults are not getting the sleep they need. For example, over 30% of employed U.S. adults reported an average sleep duration of six or fewer hours per day, a risk that rises to 44% among night-shift workers.^[82] Regularly sleeping fewer than seven hours per night is associated with a number of chronic, adverse health outcomes, including weight gain and obesity, diabetes, hypertension, heart disease, stroke and depression.^[81,83] Additionally, insufficient sleep is associated with impaired immune function, increased pain and anxiety, impaired performance and productivity, increased errors and greater risk of accidents.^[81,84] The fatigue associated with insufficient sleep (six or fewer hours per 24-hour period) puts individuals at risk for drowsy driving, which is linked to an estimated 20% of vehicle crashes and 6,000 fatal crashes per year in the U.S. alone.^[82,85] The factors contributing to poor and insufficient sleep are diverse and include both occupational (e.g., overnight shift work, long working hours) and lifestyle or behavioral (e.g., use of technology in the evening, inconsistent bedtimes, lack of exercise, caffeine and alcohol intake, eating habits) influences.^[82,86,87]

Solutions: Engaging in work-related activities during evening hours after work, especially through the use of technology, can impact sleep quality.^[10] Targeted interventions, such as sleep training programs and education as well as limits on working hours and schedule, can help support individuals in achieving sufficient and high quality sleep.^[82,88] Additionally, short (less than 30 minute duration) afternoon naps may lead to benefits in mood, alertness and cognitive performance, such as productivity and learning.^[89,90]

Impact: Sleep is a fundamental element of human health. By prioritizing good sleep, employers can make a significant impact on the short- and long-term health, well-being and productivity of employees.

Part 1 Provide Workplace Sleep Support (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Eligible employees are allowed to engage in a minimum of one 20 - 30 minute nap during the day.^[91]
- b. Educational materials are available on daytime napping (e.g., optimal time of day, strategies for minimization of nighttime sleep distribution).
- c. At least one of the furniture options below is provided per 100 eligible employees and placed in a calm, quiet and low-light environment:
 1. Bed or daybed.
 2. Couch.
 3. Cushioned roll-out mat.
 4. Sleep pod.
 5. Fully reclining chair.
 6. Hammock.
- d. A program or policy is in place to promote healthy sleep habits among employees who engage in shift work, including:
 1. Protocol to avoid unplanned changes to shift schedule, including providing minimum advance notice of schedule changes.
 2. Educational materials on strategies to minimize fatigue, maintain good sleep hygiene and manage sleep problems associated with shift work.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings,

brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 1: Provide Workplace Sleep Support are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

Part 2 Provide Non-Workplace Sleep Support (Max: 1 Pt)

For All Spaces:

Employee sleep support

The following requirements are met:

- a. Projects implement the following policies to support employees in achieving a minimum seven hours of sleep:
 1. For non-shift work, an organizational cap is in place that sets expectations that work and communications be limited to the project or organization's business hours in the local time zone.
 2. For shift work, work and communications are expected only for the duration of the employee's shift.
- b. All eligible employees have access to software, applications or other tools that monitor sleep influencing behavior, covering, at minimum, sleep schedule, physical activity and eating patterns (including caffeine and alcohol consumption). Projects provide one of the following:
 1. Paid monitoring tools at no cost or subsidized by at least 50%.
 2. Easily accessible list of free monitoring tools.
- c. Provide occupants with education materials on environmental and behavioral determinants of sleep quality and duration, covering, at minimum, sleep schedule, sleep environment, physical activity, nutrition (including caffeine and alcohol), light exposure, and use of technology.

Student start times

The following requirement is met:

- a. For students in secondary schools, the school day starts no earlier than 8:30 a.m.^[92]

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 2: Provide Non-Workplace Sleep Support are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

M12 BUSINESS TRAVEL | O (MAX: 1 PT)

Intent: Minimize disruptions to employee sleep schedules, stress levels, healthy habits and personal relationships through supportive travel policies.

Summary: This WELL feature requires projects to implement policies that counter the adverse health impacts associated with business travel, especially as they pertain to stress, sleep, personal relationships and overall health goals.

Issue: Business travel is linked to a host of challenges to engagement in optimal health behaviors, including insufficient sleep, poor dietary choices, higher alcohol consumption and increased sedentary behavior.^[93,94] Compared to light business travelers (1–6 days/month), frequent business travelers, especially those who travel more than 20 days/month, are at higher risk for a number of adverse health behaviors and consequences including sedentary behavior, trouble sleeping, tobacco use, alcohol dependence, symptoms of anxiety and depression, higher body mass index, obesity, cardiovascular disease and overall poorer self-rated health.^[94,95] Additionally, business travelers, especially those on long trips, are at risk of experiencing higher levels of stress.^[96] This is in part due to social and emotional challenges, such as the impact of travel on family and feelings of isolation, as well as workload demands upon returning from travel.^[96] These challenges, in addition to poor sleep patterns, higher alcohol use and greater sedentary behavior, may put business travelers at increased risk for poor mental health.^[93] Compared to those who do not travel at all, light travelers tend to have more favorable health risk profiles.^[93] However, it is essential for all travelers, especially those with increasingly demanding schedules, to develop and maintain positive health behaviors during travel to support long-term health.^[93]

Solutions: Employer-provided programs can help employees manage stress and maintain health while traveling for work.^[95] Such offerings should include policies and education that support healthy habits while traveling, such as teaching coping mechanisms, supporting employees with realistic workloads and offering time to recover.^[93] Combined, these strategies can help employees manage the challenges and stressors associated with travel.^[93]

Impact: Supporting employees in managing the challenges that often accompany business travel can help protect short- and long-term health and preserve productivity.^[93]

Part 1 Provide Business Travel Support (Max: 1 Pt)

For All Spaces:

Projects address at least two of the following requirements:

- a. Employers promote the protocols below for all eligible employees:
 1. When flying less than seven hours, employees are provided the option of a non–red eye flight.
 2. When flying more than seven hours, employees are provided at least one of the following options: non-red eye flight, fully reclining airplane seat, or the option to arrive a day early (when flying out) and take a recovery day (when flying back) to support time zone adjustment.
 3. Employees are not required to take business trips for which the total, round-trip travel time (including layovers, wait times and travel to and from terminals) exceeds 25% of the total trip duration (trips with a duration of less than five hours are exempt).
 4. Employees are provided with education on how to establish healthy sleep habits and manage time zone changes during and after travel.^[92]
- b. Employers implement protocols to support employee workload while away. Protocols may be adjusted as needed for different teams or departments within an organization based on business needs and must cover at least three of the options below:
 1. Establishing preferred communications channels for contacting the employee while away, including consideration of time zone differences.^[92]
 2. Reallocation of work among other non-traveling employees while traveler is away.^[92]
 3. Routine scheduling of time to catch up on work upon return.^[92]
 4. Flexible return arrangements (e.g., work from home option on day after return).^[92]

c. Employers implement the options below as protocol:

1. Employees are booked at hotels with free fitness centers or reimbursed for fitness classes or gym access fees incurred during travel.^[93]
2. Employees are provided with meal stipends that allow for the purchase of healthy food options.^[93]
3. Employees are provided with education on maintaining healthy habits while traveling, covering, at minimum, physical activity and nutrition (including alcohol consumption).^[92]

d. Employers implement at least two of the options below as protocol:

1. During business trips longer than three weeks, employees are given the time off and a budget to fly home or to fly a friend or family member to meet them for at least 48 hours (total round-trip travel time for visitor, including layovers, wait times and travel to and from terminals, may not exceed 25% of the total trip duration).
2. During business trips longer than two weeks, financial support is provided for employees with dependents at home (including pets) to subsidize costs of caretaking while employee is traveling for business.
3. Employees are provided with education covering how to cope with time away from family while traveling.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 1: Provide Business Travel Support are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

M13 TOBACCO PREVENTION AND CESSATION | O (MAX: 3 PT)

Intent: Reduce the use of tobacco through interventions that prevent tobacco use and support tobacco cessation among current tobacco users.

Summary: This WELL feature requires employee access to tobacco cessation support programs such as counseling, prescription, over-the-counter tobacco cessation medications and nicotine replacement products. It also promotes prevention programs, such as a ban on the sale of tobacco within the project boundary and education on the health consequences of tobacco use.

Issue: The World Health Organization estimates that globally over 1.1 billion people smoked tobacco in 2015.^[97] Tobacco remains the only legal drug that can cause death when used as intended by manufacturers, is responsible globally for an estimated six million deaths per year among direct users, and serves as the cause of death for up to half of its users.^[98,101] In addition to those deaths caused by direct use, an estimated 890,000 annual deaths can be attributed to non-user exposure to second-hand smoke.^[98] By 2020, it is predicted that tobacco will account for 10% of all deaths worldwide, yet national comprehensive health services that fully or partially cover services to support tobacco cessation are available in only 24 countries, benefiting just 15% of the world's population.^[98,104] In the workplace, employees that smoke incur greater absences, take more sick days and have higher health care costs than non-smoking employees.^[102] Additionally, 76.5 hours per year are lost in work productivity for smokers, compared to 42.8 hours for those who do not smoke, due to time taken for smoking breaks and smoking related illnesses.^[103]

Solutions: Employers can play a key role in supporting employee tobacco cessation. Although 70% of U.S. adult smokers are interested in quitting and 40% of smokers attempt to quit each year, only 8% of smoking employees report that their workplace offers smoking cessation assistance.^[103] However, 74% of employees report the support of their employer was useful in their smoking cessation efforts.^[103] Research indicates that the majority of people do not know the specific health risks of tobacco use.^[98] For example, a 2009 survey in China indicated that only 38% of smokers knew that smoking causes coronary heart disease, and only 27% knew that it raises risk for strokes, underscoring the need for improved education regarding the risks of tobacco use, as awareness increases a current smoker's desire to quit.^[98] Among those who attempt to quit, counseling and medication more than double the chance of quitting success.^[98] Another influencing factor on tobacco use is an individual's proximity to outlets where it is sold.^[99] Restricting the sale of tobacco on-site is a key strategy for preventing or curbing use of tobacco products as well as providing support to those trying to quit.^[99,100]

Impact: Preventing initiation of tobacco use and supporting cessation among current users is critical in alleviating the significant burden of disease caused by tobacco. Combined, these strategies can play a key role in benefitting the short- and long-term health, well-being and productivity of employees.

Part 1 Promote Tobacco Prevention (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. The sale of tobacco products on project property is banned (e.g., through on-site vendors).^[43]
- b. Education on the health consequences of tobacco is provided to all employees.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 2: Promote Tobacco Use Prevention are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

Part 2 Support Tobacco Cessation (Max: 2 Pt)

For All Spaces:

Information is available for all eligible employees about available programming, counseling and coverage related to tobacco cessation, including clear information about how to access these resources,^[43] in addition to at least four of the following requirements:

- a. Resources referring tobacco users to tobacco cessation telephone quit lines or online quitting resources.^[43]
- b. Tobacco cessation counseling covered at no cost or subsidized by at least 50%. Programs may be provided on- or off-site; in group or individual settings; and through vendors, on-site staff, health insurance plans or programs, community groups or other qualified practitioners.^[43]
- c. Prescription tobacco cessation medications and nicotine replacement products (e.g., inhalers, nasal sprays, bupropion, varenicline) covered at no cost or subsidized by at least 50%.^[43]
- d. Nationally-approved, over-the-counter nicotine replacement products (e.g., gum, patches, lozenges) covered at no cost or subsidized by at least 50%.^[43]
- e. Incentive program for current tobacco users actively trying to quit.^[43]

M14 SUBSTANCE USE EDUCATION AND SERVICES | O

(MAX: 3 PT)

Intent: Increase availability and access to addiction support services, resources and care and prevent the development of substance abuse and addiction among occupants.

Summary: This WELL feature requires projects to outline policies regarding drug and alcohol use in the workplace, provide education on substance use and addiction and support access to substance use services.

Issue: Alcohol and drug use contribute significantly to the global burden of premature death and disability.^[17] Harmful use of alcohol is a leading global risk factor, accounting for 3.3 million deaths per year (or 5.9% of all deaths) and 5.1% of the global burden of disease.^[3] Alcohol consumption has a causal relationship with over 200 health and injury conditions, including alcohol dependence, liver cirrhosis, cardiovascular disease, numerous cancers and intentional and unintentional injuries.^[105] Factors in the work environment such as work culture and stress increase the risk of alcohol use disorders.^[106,107] Within the workplace, alcohol use is a significant risk factor for absenteeism, presenteeism, accidents and employee turnover.^[106,107] Furthermore, it is estimated that approximately half of the overall social costs of alcohol are due to lost productivity.^[106] In addition to alcohol, illicit drug use remains a serious global public health concern: in 2013, 246 million people between 15 and 64 years of age used illicit drugs, of which one in ten suffered from a drug use disorder or dependency.^[108]

Solutions: Prevention programs that address substance use through education and workplace policy, as well as available and affordable screening and treatment offerings have been shown to be effective methods of preventing unhealthy substance use habits and supporting those struggling with substance abuse and addiction.^[106,107,109] Providing parity for mental health and substance use services substantially expands financial access to a wider array of necessary behavioral health services.^[110] The return on investment in offering substance use treatment and prevention services is known. For example, for each USD \$1 invested in screening and brief counseling interventions saves approximately USD \$4 in health care costs.^[111] Offering prevention, education and support services provides an opportunity to reduce the costs companies face as a result of undiagnosed and untreated substance abuse.^[111]

Impact: Programs that seek to prevent substance abuse as well as policies that support individuals in accessing help and treatment are key strategies to help mitigate the health risks and social costs of alcohol and substance use and abuse.

Part 1 Promote Substance Abuse Prevention and Education (Max: 1 Pt)

For All Spaces:

Project policy

The following requirement is met:

- a. A policy is in place regarding the use of alcohol and drugs on-site and is clearly communicated to all employees.^[111]

Substance use and addiction education

All employees receive education addressing substance use and addiction, focused on increasing awareness of the following:

- a. Management of personal substance use, covering, at minimum:
 1. Healthy substance use habits.^[22,112]
 2. Risks and signs of dependency or addiction.^[22,112]
 3. Short- and long-term health and productivity hazards of excessive substance use.^[112]
- b. Prescription opioid education, covering, at minimum:
 1. Questions to ask at point of prescribing.^[112]
 2. Safe use (e.g., storage, disposal, driving while using).^[112]
 3. Signs of dependency or addiction.^[112]

c. How to appropriately respond to a peer struggling with substance use, covering, at minimum:

1. How to support a peer's recovery efforts.^[22]
2. What to do in the case of a substance use emergency (e.g., withdrawal, overdose).^[22]

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

If the requirements of Part 1: Promote Substance Abuse Prevention are met through the provision of educational materials, then these can be counted toward Part 2: Promote Health and Wellness Education in Feature C01: Health and Wellness Awareness.

Part 2 Provide Access to Substance Use Services (Max: 2 Pt)

For All Spaces:

Substance use and addiction support services are made available to all eligible employees at no cost or subsidized by at least 50%, including the following:

- a. Ability to use sick time or take leave for substance use and addiction treatment or needs.
- b. Materials or information for accessing substance use and addiction services and community resources, including clear information provided to employees about their benefits coverage and how to access care services.^[22]
Resources must be made available to all employees in a confidential manner that can be independently accessed (e.g., via a health portal or employee website) so as to ease accessibility and minimize stress or fear of stigma in seeking information.^[111]
- c. Insurance or employee assistance plans offering coverage for at least five of the services below:
 1. Confidential substance abuse screening and resource referral.
 2. Brief interventions (e.g., brief therapies).^[111]
 3. Outpatient and inpatient treatment.^[111]
 4. Medication-assisted treatment (e.g., methadone treatment).^[111]
 5. Peer support groups.^[111]
 6. Counseling services (e.g., behavioral therapies).^[111]
 7. Follow-up services during treatment and recovery.^[111]
- d. Commitment to mental health parity, including substance use and addiction services.^[22]

M15 OPIOID EMERGENCY RESPONSE PLAN | O (MAX: 3 PT)

Intent: Have a plan in place and resources available in the case of an acute opioid emergency.

Summary: This WELL feature requires projects to have a plan in place and resources available in case of an individual experiencing an opioid overdose, including emergency response training for occupants and the availability of an opioid emergency kit containing naloxone, a medication that can be used to reverse the life-threatening effects of an opioid overdose.

Issue: Drug overdose is not only the leading cause of accidental death in the U.S., but it is also the leading cause of death among Americans under 50 years of age, with overdose from opioids driving the epidemic.^[113] From 1999-2014, the rate of deaths from drug overdoses in the U.S. tripled, with over half a million Americans dying due to drug overdoses between 2000-2015.^[114,115] Of these deaths, over 60% involved an opioid.^[114] Deaths from opioids (prescription and illicit) have more than quadrupled since 1999, with approximately 91 Americans dying every day due to opioid overdose.^[115] Overprescribing, drug misuse and overdose of opioids (including prescription) are impacting the workplace, as workplace injuries are often a gateway to opioid abuse and addiction, with 65-85% of workers receiving narcotic painkillers after a workplace injury.^[116] Roughly 21-29% of patients prescribed opioids for chronic pain misuse them, and between 8-12% develop an opioid use disorder. Often, painkillers serve as a gateway for dangerous drug use, with about 80% of people who use heroin having first misused prescription opioids.^[117] In 2007, estimates of U.S. societal costs of prescription opioid abuse were \$55.7 billion, of which \$25.6 billion were workplace costs driven largely by lost earnings due to premature death (\$11.2 billion) and reduced compensations or lost employment (\$7.9 billion).^[118] Given the rapid rise of opioid addiction and death, 2015 estimates indicate the societal cost of prescription and illicit opioid use to be as high as \$504 billion, the majority of which is composed of lost earnings due to opioid-related fatality.^[119]

Solutions: Naloxone is a treatment that can be used to reverse the life-threatening effects of an opioid overdose.^[120] Bystanders trained in recognizing the signs of an opioid overdose and instructed on how to administer naloxone can safely and effectively administer it to an individual in need.^[120] Increasing the availability of naloxone is a critical component of reducing opioid-related overdose deaths, with evidence suggesting that when naloxone and overdose education are available to community members, overdose deaths decrease in those communities.^[121]

Impact: Through emergency rescue kits and proper training, projects can provide a means of reducing the life-threatening impact of an opioid overdose in a way that is safe, cost-effective, and critically important for those at risk.

Part 1 Provide Opioid Emergency Response Kits and Training (Max: 3 Pt)

For All Spaces:

Opioid response kits

The following requirements are met:

- a. All emergency preparedness or first aid kits include:
 1. Naloxone rescue kits. Projects may choose a single dose nasal spray, a multi-step nasal spray, a single step injection or a multi-step injection.
 2. Instructions for how to prepare and administer naloxone, as well as immediate next steps after administration.
 3. A list of who on-site has received opioid response training.
- b. Protocol is in place for follow-up after an opioid emergency event, including plan for:
 1. Debriefing for those affected.
 2. Immediate replacement of naloxone kit following use.
- c. A schedule is in place for checking expiration dates of the kit.

Opioid response training

The following requirements are met:

- a. Employees and employers receive opioid emergency training (in-person by a qualified provider or through video)

covering:

1. General information about opioid use and naloxone.
2. Recognizing the signs of an overdose and immediate steps to take.
3. How to safely administer naloxone and what steps to take following administration.

REFERENCES

- 1: World Health Organization. Mental health: strengthening our response. WHO. [Reference](#). Published 2016. Accessed January 11, 2018.
- 2: Vigo D, Thornicroft G, Atun R. Estimating the true global burden of mental illness. *The Lancet Psychiatry*. 2016;3(2):171-178. doi:10.1016/S2215-0366(15)00505-2.
- 3: World Health Organization. Global Status Report on Alcohol and Health. Geneva, Switzerland; 2014. doi:/entity/substance_abuse/publications/global_alcohol_report/en/index.html.
- 4: World Health Organization. Mental Health Action Plan 2013-2020. Geneva, Switzerland; 2013. doi:ISBN 978 92 4 150602 1.
- 5: Jarman L, Martin A, Venn A, et al. Workplace health promotion and mental health: Three-year findings from partnering Healthy@Work. *PLoS One*. 2016;11(8):1-14. doi:10.1371/journal.pone.0156791.
- 6: World Health Organization. Mental health in the workplace. WHO. [Reference](#). Published 2017. Accessed January 10, 2018.
- 7: Reisinger E, McGee R, Druss B. Mortality in Mental Disorders and Global Disease Burden Implications: A Systematic Review and Meta-analysis. *JAMA Psychiatry*. 2015;72(4):334-341. doi:10.1001/jamapsychiatry.2014.2502.Mortality.
- 8: Hanisch SE, Twomey CD, Szeto ACH, Birner UW, Nowak D, Sabariego C. The effectiveness of interventions targeting the stigma of mental illness at the workplace: a systematic review. *BMC Psychiatry*. 2016;16(1):1. doi:10.1186/s12888-015-0706-4.
- 9: Goyal M, Singh S, Sibinga EMS, et al. Meditation programs for psychological stress and well-being: A systematic review and meta-analysis. *JAMA Intern Med*. 2014;174(3):357-368. doi:10.1001/jamainternmed.2013.13018.Meditation.
- 10: Fritz C, Ellis AM, Demsky CA., Lin BC, Guros F. Embracing work breaks: Recovery from work stress. *Organ Dyn*. 2013;42(January):274-280. doi:10.1016/j.orgdyn.2013.07.005.
- 11: Bjornstad S, Patil GG, Raanaas RK. Nature contact and organizational support during office working hours: Benefits relating to stress reduction, subjective health complaints, and sick leave. *Work*. 2016. doi:10.3233/WOR-152211.
- 12: Fjeld T, Veiersted B, Sandvik L, Riise G, Levy F. The Effect of Indoor Foliage Plants on Health and Discomfort Symptoms among Office Workers. *Indoor Built Environ*. 1998;7(4):204-209. [Reference](#).
- 13: Largo-Wight E, Chen WW, Dodd V, Weiler R. Healthy Workplaces : The Effects of Nature Contact at Work on Employee Stress and Health. *Public Health Rep*. 2011;126:124-131. doi:10.2307/41639273.
- 14: Jahncke H, Hygge S, Halin N, Green AM, Dimberg K. Open-plan office noise: Cognitive performance and restoration. *J Environ Psychol*. 2011;31(4):373-382. doi:[Reference](#).
- 15: Smith-Jackson TL, Klein KW. Open-plan offices: Task performance and mental workload. *J Environ Psychol*. 2009;29(2):279-289. doi:[Reference](#).
- 16: Vischer JC. The effects of the physical environment on job performance: Towards a theoretical model of workspace stress. *Stress Heal*. 2007;23(3):175-184. doi:10.1002/smi.1134.
- 17: Jorm AF. Mental health literacy; empowering the community to take action for better mental health. *Am Psychol*. 2012;67(3):231-243. doi:10.1037/a0025957.
- 18: Mood Disorders Society of Canada. Workplace Mental Health. Canada; 2014.
- 19: Brijnath B, Protheroe J, Mahtani KR, Antoniadis J. Do Web-based Mental Health Literacy Interventions Improve the Mental Health Literacy of Adult Consumers? Results From a Systematic Review. Eysenbach G, ed. *J Med Internet Res*. 2016;18(6):e165. doi:10.2196/jmir.5463.
- 20: Altweck L, Marshall TC, Ferenczi N, Lefringhausen K. Mental health literacy: a cross-cultural approach to knowledge and beliefs about depression, schizophrenia and generalized anxiety disorder. *Front Psychol*. 2015;6(September). doi:10.3389/fpsyg.2015.01272.
- 21: Knifton L, Watson V, Gründemann R, Dijkman A, den Besten H, ten Have K. A Guide for Employers. To Promote Mental Health in the Workplace. Hoofddorp, Netherlands; 2011. [Reference](#).

- 22: National Alliance on Mental Illness-NYC, Northeast Business Group on Health, Partnership for Workplace Mental Health/American Psychiatric Association Foundation, PricewaterhouseCoopers, The Kennedy Forum. Working Well: Leading a Mentally Healthy Business. New York City; 2016.
- 23: Melbourne School of Population and Global Health. Workplace Prevention of Mental Health Problems: Guidelines for Organisations.; 2013.
- 24: Kant I, Beurskens a JHM, Amelsvoort LGPM Van, Swaen GMH. An epidemiological approach to study fatigue in the working population: the Maastricht Cohort Study. 2003;32-39.
- 25: Larsen L, Adams J, Deal B, Kweon B-S, Tyler E. Plants in the workplace the effects of plant density on productivity, attitudes, and perceptions. *Environ Behav*. 1998;30(3):261-281.
- 26: Wolf K, Krueger S, Flora K. Work and Learning - A Literature Review. Green Cities Good Heal. 2014. [Reference](#). Accessed January 12, 2018.
- 27: An M, Colarelli SM, O'Brien K, Boyajian ME. Why we need more nature at work: Effects of natural elements and sunlight on employee mental health and work attitudes. *PLoS One*. 2016;11(5):1-17. doi:10.1371/journal.pone.0155614.
- 28: Kellert SR and Calabrese EF. The Practice of Biophilic Design. 2015. [Reference](#)
- 29: Boubekri M, Cheung IN, Reid KJ, Wang C-H, Zee PC. Impact of Windows and Daylight Exposure on Overall Health and Sleep Quality of Office Workers: A Case-Control Pilot Study. *J Clin Sleep Med*. 2014;10(6):603-611.
- 30: Amundadottir ML, Rockcastle S, Sarey Khanie M, Andersen M. A human-centric approach to assess daylight in buildings for non-visual health potential, visual interest and gaze behavior. *Build Environ*. 2017;113:5-21. doi:10.1016/j.buildenv.2016.09.033.
- 31: Brown DK, Barton JL, Gladwell VF. Viewing nature scenes positively affects recovery of autonomic function following acute-mental stress. *Environ Sci Technol*. 2013;47(11):5562-5569. doi:10.1021/es305019p.
- 32: Spengler J, Africa J. The Natural Environments Initiative: Illustrative Review and Workshop Statement. 2015:1-48.
- 33: Brooks AM, Ottley KM, Arbuthnott KD, Sevigny P. Nature-related mood effects: Season and type of nature contact. *J Environ Psychol*. 2017;54:91-102. doi:[Reference](#).
- 34: Browning W, Ryan C, Clancy J. 14 Patterns of Biophilic Design. Terrapin Bright Green, LLC. 2014:1-60.
- 35: Berto R. The Role of Nature in Coping with Psycho-Physiological Stress: A Literature Review on Restorativeness. *Behav Sci (Basel)*. 2014;4(4):394-409. doi:10.3390/bs4040394.
- 36: Wang PS, Berglund P, Olsson M, Pincus HA, Wells KB, Kessler RC. Failure and delay in initial treatment contact after first onset of mental disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):603-613. doi:10.1001/archpsyc.62.6.603.
- 37: McGorry PD, Purcell R, Goldstone S, Amminger GP. Age of onset and timing of treatment for mental and substance use disorders: implications for preventive intervention strategies and models of care. *Curr Opin Psychiatry*. 2011;24(4):301-306. doi:10.1097/YCO.0b013e3283477a09.
- 38: Veitch JA. Workplace design contributions to mental health and well-being. *Healthc Pap*. 2011;11(SPEC. ISSUE):38-46. doi:10.12927/hcpap.2011.22409.
- 39: Mind. Guide for Employees: Wellness Action Plans (WAPs): How to Support Your Mental Health at Work. London, United Kingdom.
- 40: World Health Organization. Mental Health Policies and Programmes in the Workplace. Geneva, Switzerland; 2005. [Reference](#) programs in workplace_WEB_07.pdf.
- 41: Pignone M, Gaynes B, Rushton J, Et A. Screening for depression in adults: A summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2002;136(10):765-776. [Reference](#).
- 42: National Safety Council. The Proactive Role Employers Can Take: Opioids in the Workplace. Illinois, USA; 2014.
- 43: Centers for Disease Control and Prevention. The CDC Worksite Health ScoreCard: An Assessment Tool for Employers to Prevent Heart Disease, Stroke, and Related Health Conditions. Atlanta, GA; 2014. [Reference](#).
- 44: National Business Group on Health. An Employer's Guide to Behavioral Health Services: A Roadmap and

Recommendations for Evaluating, Designing and Implementing Behavioral Health Services. Washington, DC; 2005. [Reference](#).

45: Rethink Mental Illness. What's Reasonable at Work? England; 2012.

46: American Psychiatric Foundation. ICU Program Implementation Guide. Washington, D.C.; 2011.

47: Kitchener BA, Jorm AF. Mental health first aid: An international programme for early intervention. *Early Interv Psychiatry*. 2008;2(1):55-61. doi:10.1111/j.1751-7893.2007.00056.x.

48: Svensson B, Hansson L. Effectiveness of mental health first aid training in Sweden. A randomized controlled trial with a six-month and two-year follow-up. *PLoS One*. 2014;9(6). doi:10.1371/journal.pone.0100911.

49: Kitchener BA, Jorm AF. Mental health first aid training for the public: evaluation of effects on knowledge, attitudes and helping behavior. *BMC Psychiatry*. 2002;2:10. doi:10.1186/1471-244X-2-10.

50: Kitchener BA, Jorm AF. Mental health first aid training in a workplace setting: A randomized controlled trial [ISRCTN13249129]. *BMC Psychiatry*. 2004;4:1-8. doi:10.1186/1471-244X-4-23.

51: Hadlaczky G, Hökby S, Mkrtchian A, Carli V, Wasserman D. Mental Health First Aid is an effective public health intervention for improving knowledge, attitudes, and behaviour: A meta-analysis. *Int Rev Psychiatry*. 2014;26(4):467-475. doi:10.3109/09540261.2014.924910.

52: Higgins C, Lyons S, Duxbury L. Reducing Work–Life Conflict: What Works? What Doesn't?

53: Sharma M, Rush SE. Mindfulness-Based Stress Reduction as a Stress Management Intervention for Healthy Individuals. *J Evid Based Complementary Altern Med*. 2014;19(4):271-286. doi:10.1177/2156587214543143.

54: Institute for Health and Productivity Studies. From Evidence to Practice: Workplace Wellness that Works. 2015. [Reference](#).

55: LaMontagne AD, Martin A, Page KM, et al. Workplace mental health: developing an integrated intervention approach. *BMC Psychiatry*. 2014;14(1):131. doi:10.1186/1471-244X-14-131.

56: Snow DL, Swan SC, Wilton LEO. A Workplace Coping-skills Intervention to Prevent Alcohol Abuse. In: Bennet JB, Lehman WEK, eds. Preventing Workplace Substance Abuse: Beyond Drug Testing to Wellness. American Psychological Association; 2003.

57: Virtanen M, Singh-Manoux A, Ferrie JE, et al. Long working hours and cognitive function: The Whitehall II study. *Am J Epidemiol*. 2009;169(5):596-605. doi:10.1093/aje/kwn382.

58: Mind. How to Promote Wellbeing and Tackle the Causes of Work-Related Mental Health Problems. London, United Kingdom; 2013.

59: Project: Time Off. The Tethered Vacation. Washington, D.C; 2017.

60: Gump BB, Matthews KA. Are Vacations Good for Your Health? The 9-Year Mortality Experience After the Multiple Risk Factor Intervention Trial. *Psychosom Med*. 2000;612:608-612.

61: de Bloom J, Kompier M, Geurts S, de Weerth C, Taris T, Sonnentag S. Do we recover from vacation? Meta-analysis of vacation effects on health and well-being. *J Occup Health*. 2009;51(1):13-25. doi:10.1539/joh.K8004.

62: Smolders KCHJ, de Kort YAW, Tenner AD, Kaiser FG. Need for recovery in offices: Behavior-based assessment. *J Environ Psychol*. 2012;32(2):126-134. doi:[Reference](#).

63: Furgeson M. Healing Gardens. [Reference](#). Accessed June 9, 2017.

64: Kachan D, Olano H, Tannenbaum SL, et al. Prevalence of Mindfulness Practices in the US Workforce: National Health Interview Survey. *Prev Chronic Dis*. 2017;14:160034. doi:10.5888/pcd14.160034.

65: Chen KW, Berger CC, Manheimer E, et al. Meditative therapies for reducing anxiety: A systematic review and meta-analysis of randomized controlled trials. *Depress Anxiety*. 2012;29(7):545-562. doi:10.1002/da.21964. Meditative.

66: Schaufenbuel K. Bringing Mindfulness to the Workplace. 2014:1-13. [Reference](#).

67: Goldin PR, Gross JJ. Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. *Emotion*. 2010;10(1):83-91. doi:10.1037/a0018441.

68: Pearson DG, Craig T. The great outdoors? Exploring the mental health benefits of natural environments. *Front Psychol*.

2014;5:1178. [Reference](#).

69: Aggio D, Smith L, Fisher A, Hamer M. Mothers' perceived proximity to green space is associated with TV viewing time in children: The Growing Up in Scotland Study. *Prev Med*. 2015;70:46-49.

70: Nieuwenhuis M, Knight C, Postmes T, Haslam S. The relative benefits of green versus lean office space: Three field experiments. *J Exp Psychol*. 2014;20(3):199-214.

71: Wu YT, Prina AM, Jones A, et al. Older people, the natural environment and common mental disorders: cross-sectional results from the Cognitive Function and Ageing Study. *BMJ Open*. 2015;5(9):e007936. [Reference](#).

72: Beyer KM, Kaltenbach A, Szabo A, et al. Exposure to neighborhood green space and mental health: evidence from the survey of the health of Wisconsin. *Int J Environ Res Public Health*. 2014;11(3):3453-3472. [Reference](#).

73: Staats H, Jahncke H, Herzog TR, Hartig T. Urban Options for Psychological Restoration: Common Strategies in Everyday Situations. *PLoS One*. 2016;11(1):e0146213. [Reference](#).

74:

Alcock I, White MP, Wheeler BW, Fleming LE, Depledge MH. Longitudinal effects on mental health of moving to greener and less green urban areas. *Environ Sci Technol*. 2014;48(2):1247-1255. [Reference](#).

75:

World Health Organization. Urban green spaces and health. Copenhagen: WHO Regional Office for Europe;2016. [Reference](#)

76: Human Spaces. Biophilic Design in the Workplace. LaGrange, GA.

77: Seddigh A, Stenfors C, Berntsson E, Bååth R, Sikström S, Westerlund H. The association between office design and performance on demanding cognitive tasks. *J Environ Psychol*. 2015;42:172-181. doi:10.1016/j.jenvp.2015.05.001.

78: Vassie K, Richardson M. Effect of self-adjustable masking noise on open-plan office worker's concentration, task performance and attitudes. *Appl Acoust*. 2017;119:119-127. doi:10.1016/j.apacoust.2016.12.011.

79: Kim J, de Dear R. Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *J Environ Psychol*. 2013;36:18-26. doi:10.1016/j.jenvp.2013.06.007.

80: Seddigh A, Berntson E, Bodin Danielson C, Westerlund H. Concentration requirements modify the effect of office type on indicators of health and performance. *J Environ Psychol*. 2014;38:167-174. doi:[Reference](#).

81: Zerella S, von Treuer K, Albrecht SL. The influence of office layout features on employee perception of organizational culture. *J Environ Psychol*. 2017;54:1-10. doi:[Reference](#).

82: Watson NF, Badr MS, Belenck G, Bliwise DL. Recommended amount of sleep for a healthy adult. *Am Acad Sleep Med Sleep Res Soc*. 2015;38(6):843-844. doi:10.5665/sleep.4716.

83: Centers for Disease Control and Prevention. Short sleep duration among workers - United States, 2010. *Morb Mortal Wkly Rep*. 2012;61(16).

84: Centers for Disease Control and Prevention. Sleep and Chronic Disease. [Reference](#). Accessed January 10, 2018.

85: Strine TW, Chapman DP. Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Med*. 2018;6(1):23-27. doi:10.1016/j.sleep.2004.06.003.

86: Centers for Disease Control and Prevention. Drowsy Driving- Sleep and Sleep Disorders. [Reference](#). Accessed January 10, 2018.

87: American Academy of Sleep Medicine. Healthy Sleep Habits and Good Sleep Hygiene. [Reference](#). Accessed January 11, 2018.

88: Centers for Disease Control and Prevention. Sleep Hygiene Tips - Sleep and Sleep Disorders. [Reference](#). Accessed January 11, 2018.

89: Centers for Disease Control and Prevention. 1 in 3 adults don't get enough sleep. [Reference](#). Accessed January 10, 2018.

90: Milner CE, Cote KA. Benefits of napping in healthy adults: Impact of nap length, time of day, age, and experience with napping. *J Sleep Res*. 2009;18(2):272-281. doi:10.1111/j.1365-2869.2008.00718.x.

- 91:** Dhand R, Sohal H. Good sleep, bad sleep! The role of daytime naps in healthy adults. *Curr Opin Pulm Med*. 2006;12(6). [Reference](#).
- 92:** American Academy of Pediatrics. School Start Times for Adolescents. *Pediatrics*. 2014;134(3):642-649. doi:10.1542/peds.2014-1697.
- 93:** Burkholder JD, Joines R, Cunningham-Hill M, Xu B. Health and well-being factors associated with international business travel. *J Travel Med*. 2010;17(5):329-333. doi:10.1111/j.1708-8305.2010.00441.x.
- 94:** Richards CA, Rundle AG. Business Travel and Self-rated Health, Obesity, and Cardiovascular Disease Risk Factors. *J Occup Environ Med*. 2011;53(4). [Reference](#).
- 95:** Rundle AG, Revenson TA, Friedman M. Business travel and behavioral and mental health. *J Occup Environ Med*. December 2017;1. doi:10.1097/JOM.0000000000001262.
- 96:** Striker J, Luippold RS, Nagy L, Liese B, Bigelow C, Mundt KA. Risk factors for psychological stress among international business travellers. *Occup Environ Med*. 1999;56(4):245-252. doi:10.1136/oem.56.4.245.
- 97:** World Health Organization. Prevalence of tobacco smoking. [Reference](#). Published 2016. Accessed January 9, 2018.
- 98:** World Health Organization. Tobacco. [Reference](#). Published 2017. Accessed January 9, 2018.
- 99:**
Reitzel LR, Cromley EK, Li Y, et al. The effect of tobacco outlet density and proximity on smoking cessation. *Am J Public Health*. 2011;101(2):315-320. doi:10.2105/AJPH.2010.191676.
- 100:**
Polinski JM, Howell B, Brennan TA, Shrank WH. Impact of the CVS tobacco sales removal on smoking cessation: when CVS Health quit tobacco, many smokers quit, too. 2015:0-3.
- 101:** World Health Organization. WHO global report on trends in prevalence of tobacco smoking 2015. *WHO Mag*. 2015;1-359. doi:978 92 4 156492 2.
- 102:** Smith DR. Workplace tobacco control: The nexus of public and occupational health. *Public Health*. 2009;123(12):817-819. doi:10.1016/j.puhe.2009.10.014.
- 103:** Berman M, Crane R, Seiber E, Munur M. Estimating the cost of a smoking employee. *Tob Control*. 2014;23(5):428-433. doi:10.1136/tobaccocontrol-2012-050888.
- 104:** World Health Organization. Global status report on noncommunicable diseases 2010. *World Heal Organ*. 2011;176. doi:ISBN 978 92 4 156422 9.
- 105:** World Health Organization. Global Strategy to Reduce the Harmful Use of Alcohol. Geneva, Switzerland; 2010. [Reference](#).
- 106:** Anderson P. Alcohol and the workplace: a report on the impact of work place policies and programmes to reduce the harm done by alcohol to the economy. 2010;(June):1-16.
- 107:** Bennett JB, Reynolds GS, Lehman WEK. Understanding employee alcohol and other drug use: Toward a multilevel approach. *Prev Work Subst Abus Beyond drug Test to wellness*. 2003;29-56. [Reference](#).
- 108:** United Nations Office on Drugs and Crime. World Drug Report 2015. Vol 53. Geneva, Switzerland: Research and Trend Analysis Branch, Division for Policy Analysis and Public Affairs, United Nations Office on Drugs and Crime,; 2015. doi:10.1017/CBO9781107415324.004.
- 109:** World Health Organization. Alcohol. [Reference](#). Published 2017. Accessed January 10, 2018.
- 110:** Knickman J, Krishnan R, Pincus H. Improving Access to Effective Care for People With Mental Health and Substance Use Disorders. *Jama*. 2016;316(16):1647. doi:10.1001/jama.2016.13639.
- 111:** Slavitt WI, Reagin A, Finch RA. An Employer's Guide to Workplace Substance Abuse: Strategies and Treatment Recommendations. Washington, D.C; 2009. [Reference](#).
- 112:** Teater D. The Proactive Role Employers Can Take: Opioids in the Workplace. 2014:16.
- 113:** American Society of Addiction Medicine. Opioid Addiction 2016 Facts and Figures. Chevy Chase, MD; 2016. doi:10.1016/j.drugalcdep.2013.01.007.
- 114:** Rudd RA, Seth P, David F, Scholl L. Increases in Drug and Opioid-Involved Overdose Deaths — United States,

2010–2015. MMWR Morb Mortal Wkly Rep. 2016;65(5051):1445–1452. doi:10.15585/mmwr.mm655051e1.

115: Centers for Disease Control and Prevention. Understanding the Epidemic. [Reference](#). Published 2017. Accessed January 10, 2018.

116: Wesch W. Notes On: Breaking the Vicious Opioid Cycle in the Workplace. 2015:266–270.

117: National Institute on Drug Abuse. Opioid Overdose Crisis. [Reference](#). Published 2018. Accessed September 1, 2018.

118: Birnbaum HG, White AG, Schiller M, et al. Societal Costs of Opioid Abuse, Dependence and Misuse in The United States. Value Heal. 2010;13(3):A111. doi:10.1016/S1098-3015(10)72532-8.

119: The Council of Economic Advisers. The Underestimated Cost of the Opioid Crisis. 2017;(November). [Reference](#) Underestimated Cost of the Opioid Crisis.pdf.

120: Kerensky T, Walley AY. Opioid overdose prevention and naloxone rescue kits: what we know and what we don't know. Addict Sci Clin Pract. 2017;12(1):4. doi:10.1186/s13722-016-0068-3.

121: U.S. Department of Health and Human Services. Surgeon General's Advisory on Naloxone and Opioid Overdose. [Reference](#). Accessed April 12, 2018.

COMMUNITY

The WELL Community concept aims to support access to essential healthcare, workplace health promotion and accommodations for new parents while establishing an inclusive, integrated community through social equity, civic engagement and accessible design.

Communities are characterized by groups of people with diverse characteristics who are linked by social ties, share common perspectives and engage in joint action and experiences in shared settings or locations.^[1] Within every built space there exists a unique community, one where people live, age, work, socialize, play and learn. These communities develop social networks, cultural norms and organizational structures. The global, national and local conditions that surround an individual are known as the social determinants of health, which include physical determinants, or the physical and built conditions that impact the health of an individual.^[2,3] Addressing these determinants of health can have a profound influence on the health and well-being of not just individuals but also communities at large. This includes addressing health disparities, which are the differences in health status between population groups resulting from unequal distribution of power and resources as a function of gender, race, ethnicity or socio-economic status.^[3] Designing built spaces in a way that enables all individuals to access, participate and thrive within the systems and structures of each community is essential to shaping individual and collective health outcomes.

Supporting the health and well-being of the community in a building must begin with addressing the fundamental factors that influence health and well-being, such as access to health services, protection and promotion of health and equitable spaces and employment conditions.^[10] Individuals who have a reliable source of healthcare experience better health outcomes, fewer health disparities and lower overall healthcare costs.^[4] Yet many people around the world still struggle with access to basic health services, and access varies based on race, ethnicity, socioeconomic status, age, sex, disability status, sexual orientation, gender identity and residential location.^[4] Much of the global population also lacks sufficient health knowledge and skills, leading to lower health literacy, which contributes to greater health disparities.^[5,6] Moreover, though support systems for caregivers—such as adequate paid parental leave, breastfeeding support and policies to support eldercare—also form a key pillar of inclusive environments, these services are not universally provided.^[7,8]

Workplaces have the potential to promote health and encourage healthy behaviors through policies and programs.^[11] Successful workplace health promotion programs can improve job satisfaction, sense of well-being, self-esteem and overall health status, while also reducing health risks.^[12,13] Organizational benefits include lower healthcare costs and absenteeism and improved productivity, recruitment, retention, culture and employee morale.^[12,13] For example, immunization programs can minimize health costs and productivity loss caused by seasonal influenza and other vaccine-preventable diseases.^[14] Health risk assessments combined with education can lower medical claims costs, reduce absenteeism and enhance productivity.^[15] Furthermore, supporting working caregivers through offerings like flexible scheduling, child- and eldercare support, and spaces for breastfeeding can provide numerous benefits. Paid parental leave, for example, is associated with higher rates of breastfeeding, long-term achievement for children, reduced infant mortality and maternal postpartum depression and decreased risk of low birthweight infants.^[16,17,18,19,20,21] Companies that foster civic engagement can help increase employee attraction and retention while enabling individuals to make positive contributions in their local community.^[22]

In addition to policies and programs that support healthy, equitable environments, it is key for project teams to consider design approaches that address the physical determinants of health and well-being by making buildings inclusive, accessible and safe for all. Accessible spaces are not just compliant with code but also incorporate universal design principles that support diverse ability and mobility and encourage people of all backgrounds to use a space.^[9]

WELL implements strategies that address public health issues through a social determinants framework, focusing on the social components that drive and shape health to form built spaces that truly create a foundation for equitable, inclusive and healthy environments.

C01 HEALTH AND WELLNESS AWARENESS | P

Intent: Promote a deeper understanding of factors that impact human health and well-being.

Summary: This WELL feature requires projects to provide a guide to occupants that highlights the relationship between health and buildings, a description of the WELL features pursued by the project, educational materials on a variety of health topics and annual communications about available health resources and programs.

Issue: Health literacy is influenced by a host of personal, sociocultural and system-level factors. These include age, socioeconomic status, mental health, cultural background, language and communication abilities, prior health experiences and how healthcare delivery and education systems deliver care, health information and health education.^[6,23] The link between health literacy and health outcomes has been documented at a global scale and is considered one of the key factors contributing to health disparities.^[5,6] Low health literacy has been linked to lower use of preventive care (e.g., flu shots), poor management of chronic conditions (e.g., high blood pressure) and lower self-reported health.^[6,24] These adverse outcomes have enormous economic implications. It is estimated that low health literacy costs the U.S. economy \$100-240 billion each year.^[6]

Solutions: In order to help address health literacy factors, when creating educational materials that communicate health information it is critical to consider the population the materials are intended to serve. Projects should engage with their audience in the sourcing or creation of these resources to gain a better understanding of occupant needs. Providing easily accessible educational materials on diverse, locally relevant health and well-being topics, including how a project will pursue WELL features, can help individuals engage in better health behaviors and support employee health, well-being and comfort.^[5,6]

Impact: By supporting awareness of health and wellness programs and policies and enhancing health literacy, projects can encourage engagement in WELL features and support overall health and well-being.

Part 1 Provide WELL Feature Guide

For All Spaces:

Materials and communications are provided to allow occupants to familiarize themselves with and benefit from features that are achieved by the project, including:

- a. A guide (prominently displayed and/or made widely available to all occupants) describing the WELL features pursued by the project.
- b. Information that explains the impact of the built environment and other environmental factors on occupant health, well-being and comfort.
- c. Annual communications (e.g., emails, modules, trainings) to occupants about available health education, resources and policies available to them through WELL features pursued by the project.

Part 2 Promote Health and Wellness Education

For All Spaces:

All occupants are offered a digital and/or physical library of health and wellness educational materials that meets the following requirements:^[25]

- a. Covers ten unique evidence-based health topics.
- b. Topics are tailored to the health concerns of building occupants (based on available regional, local and building-level demographic and health-related data) and should focus on primary prevention. Topics can include any aspect of health and wellness covered in WELL in addition to any other health topic relevant to the occupant population.
- c. If physical, library is open during regular business hours.

Note:

Projects should use Appendix C1 for guidance on which unique evidence-based health topics may be covered in the educational materials.

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information. All educational materials must be checked annually to confirm information is relevant and up-to-date.

C02 INTEGRATIVE DESIGN | P

Intent: Facilitate a collaborative development process and ensure adherence to collective wellness goals.

Summary: This WELL feature requires projects to facilitate a collaborative design and development process from commencement to completion of WELL Certification.

Issue: Many communities face an array of challenges due to the exclusion of local residents from planning and development decision-making processes. Projects that do not consult residents often either do not serve community needs or may even negatively impact the health and well-being of local populations.^[26] In particular, low-income, minority and tribal populations are most often excluded from development discussions and are disproportionately impacted by resulting problems such as poor health conditions, lower community engagement, lack of access to opportunities and services, rising costs of living, increased displacement and higher levels of pollution and crime.^[26]

Solutions: Engaging stakeholders from project onset creates the opportunity for dialogue between key decision-makers, planners and occupants. Through this dialogue, projects can foster the development of a collective vision that benefits the widest range of constituents.^[26] In reaching for this collective vision, projects should focus on identifying a common set of activities and communication strategies to help promote and maintain stakeholder buy-in and activation.^[27,28] Orienting stakeholders to how the project will adhere to WELL can help individuals remain engaged in the space and empower them to utilize all WELL programs and policies made available.

Impact: Collecting stakeholder input can help the project identify and address the essential components of a WELL project, including the ten concepts of WELL, while celebrating local culture and place, which reinforces a project's unique culture and identity and enriches the space for occupants and visitors. A stakeholder input process supports the project as it develops and progresses toward its health and well-being goals, creating a space that meets the needs of all stakeholders.^[26]

Part 1 Facilitate Stakeholder Charrette

For All Spaces:

Projects engage stakeholders upon point of registration in project design and development and conduct the following activities:

- a. Identify project stakeholder groups, including (as applicable) the owner, manager, facilities management team, architects, engineers, occupants, residents and human resources and workplace wellness staff.
- b. Perform a values assessment and alignment exercise with the team to inform any project goals or strategies to meet stakeholder expectations.
- c. Engage new stakeholders who join the process after the initial meeting, such as contractors, sub-contractors, anticipated users of the space or new hires to the project's leadership team (as applicable).
- d. Set future meetings to stay focused on the project goals, develop a plan of response to stakeholder feedback and maintain a record of response.

Part 2 Integrate Beauty and Design

For All Spaces:

Projects develop a written narrative to address the following:

- a. Celebration of culture (e.g., culture of occupants, workplace, surrounding community).
- b. Celebration of place (e.g., local architecture, materials, flora, artists).
- c. Integration of public art.
- d. Human delight.

Part 3 Promote Health-Oriented Mission

For All Spaces:

A written document detailing the project's health-oriented mission is produced in consultation with all stakeholders, meeting the following requirements:

- a. Outlines objectives for health promotion.^[25]
- b. Connects supporting and improving occupant health to the organizational objectives or mission statement.^[25]
- c. Accounts for building site selection and/or conditions, including site factors that impact occupant health and wellness.
- d. Incorporates the ten WELL concepts: Air, Water, Nourishment, Light, Movement, Thermal Comfort, Sound, Materials, Mind and Community.
- e. Integrates operations and maintenance plans for facility managers and personnel managing policy requirements related to health and well-being.
- f. Document is included in the WELL Feature Guide established in Part 1: Provide WELL Feature Guide in Feature C01: Health and Wellness Awareness.

Part 4 Facilitate Stakeholder Orientation

For All Spaces:

Upon project completion, all stakeholders, including at minimum (as applicable) the owner, manager, facilities management team, architects, engineers, occupants, residents and human resources and workplace wellness staff:

- a. Tour the building as a group and make tours available to all interested occupants.
- b. Discuss how building operations, maintenance, programs and policy will support adherence to WELL.
- c. Communicate with stakeholders (including building occupants) the planned or existing operations, maintenance and policies that support adherence to WELL.

C03 OCCUPANT SURVEY | P

Intent: Establish minimum standards for the evaluation of experience and self-reported health and well-being of building occupants.

Summary: This WELL feature requires projects to collect feedback from building users on their health and well-being and on topics related to WELL.

Issue: Given the diversity in the operation and design of built spaces, it is difficult to prescribe a comprehensive set of features that are effective across all settings. For example, decision-makers and users of the space often experience things differently.^[33] Surveys that ask a representative sample of building users about their level of satisfaction with indoor environmental quality, access to nature, wellness policies and their health provide valuable insight into whether or not the people who live and work in the building are satisfied with their conditions.

Solutions: Surveys are an established tool for understanding and evaluating people’s perceptions of indoor environmental conditions, wellness policies and their health and well-being.^[101-103] Psychometrically validated surveys and questions, especially for measuring health, well-being and productivity, ensure that sensitive questions are framed appropriately and that they measure what they are intended to measure.^[34,104] Combined with environmental satisfaction questions, psychometrically validated surveys are an effective way to capture high-quality data. Tracking a person's experience and satisfaction with a space provides invaluable information for projects on what is working well and areas for improvement. Decision-makers can then use survey results to measure progress, identify priority areas for change and implement plans to make the space safer, healthier and more productive.^[33]

Impact: Giving building users the ability to offer feedback helps identify problems and evaluate the effectiveness of interventions aimed at improving health and well-being for that particular population, and presents an opportunity to create a healthier environment.

Part 1 Select Project Survey

For All Spaces:
Third-party survey

The following requirement is met for projects with ten or more eligible employees:

- a. A survey is administered annually (unless otherwise noted) by a survey provider approved by IWBI and listed on IWBI's website (<https://v2.wellcertified.com/resources/preapproved-programs>).

OR-----

Custom survey

For projects with ten or more eligible employees, a survey is administered annually (unless otherwise noted) that covers at least the following topics:

- a. General building and occupancy information including job type or time spent in the building.
- b. Indoor environmental quality of air, water, light, sound and thermal comfort (thermal comfort questions must be administered at least twice a year, once during the cooling season and once during the heating season).
- c. Ergonomics, layout and aesthetics.
- d. Maintenance and cleanliness.
- e. Amenities: access to nature, views and nourishment options.
- f. Workplace wellness initiatives or offerings.
- g. Healthy behavior and amenities to support changes in behavior, physical activity and healthy eating.
- h. Productivity and engagement though measures of hours worked, motivation or absenteeism.
- i. Self-rated health and well-being.
- j. Standard sociodemographic information (age and gender at minimum).

Part 2 Administer Survey and Report Results

For All Spaces:

The following requirements are met:

- a. All eligible employees are invited to participate in the survey.
- b. Regular reminders are sent to eligible employees to complete the survey.
- c. Survey protects all participant-identifying data through appropriate protective measures such as anonymous reporting; any communication of results should be on an aggregated basis such that no participant can be identified.
- d. Analysis of responses is conducted by qualified personnel or a qualified third party.
- e. Aggregate results from the survey are reported annually and submitted through WELL Online.

Note:

Projects that fulfill Feature C04: Enhanced Occupant Survey automatically meet this precondition. For non-office projects, projects may submit an equivalent survey. Submissions should include, at minimum:

- a. Description of the population and how it differs from office workers.
- b. Submission of alternate questions appropriate for the building type where the above questions are not appropriate.

C04 ENHANCED OCCUPANT SURVEY | O (MAX: 3 PT)

Intent: Evaluate comfort, satisfaction, behavior change, self-reported health and other robust factors related to the well-being of occupants in buildings.

Summary: This WELL feature requires projects to collect and respond to an exhaustive spread of information from building users on their health and well-being and on topics related to WELL, both before and during occupancy.

Issue: Given the diversity in programs, policies and design of built environments, it is difficult to prescribe a comprehensive set of features that are effective across all settings. For example, decision-makers and building users often experience the organization and work environment differently.^[33] Surveys that ask a representative sample of occupants about their level of satisfaction with indoor environmental quality, access to nature, workplace wellness policies and other building features linked to well-being provide valuable insight into whether or not the building and policies are successful for the people that live and work in them.

Solutions: Psychometrically validated surveys are an effective way to understand and evaluate building users' experience, perception and satisfaction. Psychometrically validated surveys and questions, especially for measuring health, well-being and productivity, ensure that sensitive questions are framed appropriately and that they measure what they are intended to measure.^[34,104] Tracking how people in buildings experience a space and their level of satisfaction with health and well-being initiatives provides invaluable information on what is working well and on areas for improvement.^[101-103] Occupancy surveys allow projects to measure the extent to which a building is effectively promoting and protecting the health and comfort needs of its users. Interviews and focus groups have also been found to provide key insights into people's experiences of a space that are not always captured in surveys while strengthening the evidence by using a mixed-methods approach.^[105] A mixed-methods approach to data gathering is particularly important when evaluating complex environments, such as a workplace, with many variables that may influence each other.^[106,107] Providing people with the opportunity to provide feedback, when combined with an action plan to address dissatisfaction, can improve morale and employee retention. Stakeholders can use survey and/or interview results to identify priority areas for change and plan interventions to make spaces safer, healthier and more productive.^[33]

Impact: Providing individuals the ability to offer feedback helps identify problems and evaluate the effectiveness of interventions aimed at improving building user health and well-being, while presenting an opportunity to create a healthier environment for all. Including additional survey questions that cover more topic areas and/or utilizing interviews and focus groups can provide a more comprehensive picture of how the building and policies are impacting building user health, well-being and productivity. Including a pre- and post-occupancy survey, when possible, can be effective for understanding exactly which intervention has an impact on building users' experiences, satisfaction, and health and well-being. This information is invaluable: even a small increase in productivity and engagement could have huge impacts on a business's bottom line.

Part 1 Select Enhanced Survey (Max: 1 Pt)

For Office Spaces:

Survey content

For projects with ten or more eligible employees, one of the following requirements is met:

- a. Use one of the pre-approved surveys in Part 1: Select Project Survey in Feature C03: Occupant Survey, with one to three additional modules specific to WELL offered by one of the approved survey providers listed on IWBI's website.
- b. Working with a qualified third party, use one of the pre-approved surveys in Part 1: Select Project Survey in Feature C03: Occupant Survey and address three to six additional topics from the following list:
 1. Comparison to previous building.
 2. Mode of transportation to and from work and distance traveled.
 3. Individual work style, patterns, processes and space utilization to assess need for focus or collaboration.
 4. Water access and consumption.

5. Safety and security.
6. Access to nature.
7. Health promotion programs (including physical activity promotion).
8. Leadership investment in employee health.
9. Social equity.
10. Sleep satisfaction.
11. Hours of physical activity per day.
12. Number of breaks taken per day.
13. Smoking habits.
14. Hours worked (expected and actual over a four-week period).
15. Workload and stress.
16. Creative thinking.
17. Sick building symptoms.
18. Sociodemographics (e.g. education, ethnicity, income).

Survey administration

The following requirements are met:

- a. In addition to survey reporting requirements for Part 1: Select Enhanced Survey, aggregate results from the survey are reported annually through WELL Online and made available to employees upon request.
- b. If a project chooses additional survey topics that are one and the same as the topics covered by the selected pre-approved survey, those topics are expanded upon to ensure the overall survey is enhanced beyond the requirements of Part 1: Select Project Survey in Feature C03: Occupant Survey.

Note:

For non-office spaces, project may submit an equivalent survey for the building population. Submission should include, at minimum:

- a. Description of the population and how it differs from office workers.
- b. Submission of alternate questions appropriate for your building type where the above questions are not appropriate.

Part 2 Administer Pre-Occupancy Survey and Report Results (Max: 1 Pt)

For All Spaces:

For all spaces with ten or more eligible employees, projects administer a pre-occupancy survey that meets the following requirements:

- a. The survey is the same pre-approved survey used by the project for compliance with Part 1: Select Project Survey in Feature C03: Occupancy Survey or with Part 1: Select Enhanced Survey in Feature C04: Enhanced Occupant Survey.
- b. All eligible employees are invited to participate in the survey.
- c. Survey protects all participant-identifying data through appropriate measures such as anonymous reporting; any communication of results should be on an aggregated basis such that no participant can be identified.
- d. Regular reminders are dispatched to all eligible employees to complete the survey.
- e. Analysis of responses is conducted by qualified personnel or a qualified third party.
- f. Aggregate results from the survey are reported through WELL Online and made available to employees upon request at a minimum.
- g. Results are compared against results of the post-occupancy survey, and the results of comparison are included in an annual report submitted through WELL Online and made available to employees upon request at a minimum.

Part 3 Monitor Survey Responses (Max: 1 Pt)

For All Spaces:

For all spaces with ten or more eligible employees, projects create a plan that addresses the following:

- a. Target satisfaction thresholds for survey responses.
- b. Strategies for improving unmet satisfaction thresholds.

Part 4 Facilitate Interviews and Focus Groups (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Annually conduct stakeholder interviews or focus groups to discuss building features and wellness initiatives and their impacts on occupant health and well-being.
- b. Interviews and/or focus groups are conducted by qualified personnel or a qualified third party.
- c. Interviews and/or focus groups protect participant identities around sensitive information.
- d. Analysis is conducted by qualified personnel or a qualified third party with aggregate results submitted annually through WELL Online and made available to participants upon request.

C05 HEALTH SERVICES AND BENEFITS | O (MAX: 3 PT)

Intent: Support the overall health and well-being of individuals and their families by adopting comprehensive health policies.

Summary: This WELL feature requires projects to provide access to essential health services, screenings and assessments and offer on-demand health services.

Issue: Access to basic healthcare services is one of five key pillars that form the social determinants of health.^[3] Access includes physical or geographic access, affordability, and quality or acceptability of care.^[29] Unfortunately, many people around the world struggle with access to primary care services, and access varies based on race, ethnicity, socioeconomic status, age, sex, disability status, sexual orientation, gender identity and residential location.^[4] Individuals that lack adequate coverage for health services are unable to get the care they need, while individuals with reliable healthcare access experience better health outcomes, fewer health disparities and lower overall healthcare costs.^[4] Delays between identifying a need for care and actually receiving services can increase emotional distress, complications, treatment costs and hospitalization.^[4]

Solutions: Basic healthcare services include essential primary care and preventive services such as medical, dental, vision, mental health, substance use, preventive screenings, disease management and biometric assessments.^[4] Providing timely access to health services can relieve both actual and perceived barriers to care.^[4] Studies demonstrate that the overwhelming majority of employees, aside from wanting basic health services, also want added flexibility to select and opt into coverage that fits their unique health needs.^[30] Projects offering benefits consultation and on-demand health services can support flexible healthcare coverage and maximize employee engagement in health benefit programs.

Impact: Enhancing access to essential healthcare can impact the quality of life and physical, social and mental health of each individual.^[4]

Part 1 Promote Health Benefits (Max: 2 Pt)

For All Spaces:

The following requirements are met:

- a. Health benefits are available to all eligible employees and their dependents, at no cost or subsidized by at least 50%, that include:
 1. Coverage for medical, dental, vision care, mental health, substance use and sexual and reproductive health services.
 2. Coverage for preventive screening and biometric assessments.
 3. Access to medication/prescription coverage.
 4. Disease management for existing conditions (e.g., diabetes).
 5. Essential immunizations based on region.
 6. Tobacco cessation programs.
- b. Benefits consultation is available for all employees with a benefits counselor, human resources representative or other benefits support staff.

Part 2 Offer On-Demand Health Services (Max: 1 Pt)

For All Spaces:

Health services that meet the following requirements are provided for all eligible employees at no cost or subsidized by at least 50%, on-site, within 800 m [0.5 mi] of the project or through a digital provider or platform:

- a. Experienced and qualified healthcare providers (e.g., physician, nurse practitioner, physician assistant) are available to provide confidential medical treatment for episodic, recurrent, urgent or other illnesses before, during and/or after typical business hours.
- b. A scheduling system allows for drop-ins and/or appointment booking. If services are only available during regular

business hours, then eligible employees are allowed to use services during the workday.

C06 HEALTH PROMOTION | O (MAX: 3 PT)

Intent: Cultivate a culture that prioritizes the health and well-being of all individuals.

Summary: This WELL feature requires projects to cultivate a culture of health through various health promotion strategies, including communications, stakeholder involvement and health risk assessments.

Issue: Workplaces have the potential to promote and encourage healthy behaviors.^[11] However, if employees are unaware of the health promotion opportunities available to them, they are unlikely to participate.^[32]

Solutions: The Robert Wood Johnson Foundation defines a culture of health as "a society that gives all individuals an equal opportunity to live the healthiest lives possible, whatever their ethnic, geographic, racial, socioeconomic or physical circumstances happen to be."^[119] Research shows that organizations can build an internal culture of health through health promotion programs that are customized to an organization's unique needs, integrated into their operations and business strategy, promoted through consistent communications, championed by leadership at all levels, given dedicated resources and supported by high employee engagement.^[33,35] Communication campaigns can effectively increase awareness about workplace or community health programs, opportunities and services.^[32] Furthermore, building incentives into wellness programs can help raise employee participation and motivate behavior change such as weight loss and smoking cessation.^[31] Health risk assessments, combined with employee education on assessment results, are a cost-saving component of workplace health promotion that can effectively address a range of health factors, including tobacco use, alcohol use, seat belt non-use, dietary fat intake, blood pressure, cholesterol, absenteeism and healthcare services use.^[15]

Impact: Employer-based wellness initiatives, such as programs that offer access to immunization, health risk assessments, health education resources and caregiver support, can both improve employee health and also result in substantial employer savings over the short- and long-term. Research finds that medical and absenteeism costs fall by about USD \$3.27 and USD \$2.73, respectively, for every dollar spent on workplace health programs.^[31] Successful workplace health promotion programs can improve job satisfaction, sense of well-being, self-esteem and overall health status, and reduce stress and health risks.^[12,13] Organizational benefits include lower healthcare costs and absenteeism and improved productivity, recruitment, retention, culture and employee morale.^[12,13]

Part 1 Promote Culture of Health (Max: 2 Pt)

For All Spaces:

Health promotion strategies

A narrative describes how occupant health is promoted through at least two of the following:

- Posters, signage or digital communication that reinforce the project's culture of health and market health promotion programs to employees.^[25]
- A program that highlights employees who exemplify the building's health culture.^[25]
- Incentive programs to increase participation in health promotion initiatives and programs (e.g., health risk assessments). Incentives could include gift certificates, cash, paid time off, product or service discounts, reduced health insurance premiums, employee recognition or other prizes.^[25]
- Competition programs combined with incentives to support engagement in health behaviors (e.g., walking, bringing healthy lunch to work).^[25]

Health promotion leaders

A narrative describes how at least two of the following are present in the workplace:

- Health promotion committee or group that meets at least quarterly, is actively involved in planning and implementing health promotion programs and seeks to cultivate a culture of health in the project.^[25]
- Paid health promotion or workplace wellness coordinator to plan and implement health promotion programs. Individual may work full- or part-time depending on project necessity. Coordinator's entire job does not have to involve workplace wellness but it must be included in the job description/requirements and/or job performance expectations.^[25]

- c. Involvement of organizational leadership in health promotion programs or initiatives (e.g., documented participation in fitness activities, support groups, health screenings, health risk assessments, immunization programs).^[25]

Note: Projects should consider primary language(s) spoken by the local population when creating signage.

Part 2 Offer Health Risk Assessments (Max: 1 Pt)

For All Spaces:

Individualized health risk assessments (HRAs) are made available to all employees, at no cost or subsidized by at least 50%, on-site through vendors, on-site staff or health plans. HRAs can come through written reports, letters or one-on-one counseling. All HRAs must cover at least the following:

- a. Preventive screening and biometric assessments.
- b. Education to inform employees on interpretation and understanding of results (e.g., what is a healthy blood pressure) and required next steps to improve health.
- c. Support in accessing follow-up services, resources or programs (e.g., lifestyle management for diabetes, smoking cessation tools and support groups).

C07 COMMUNITY IMMUNITY | O (MAX: 2 PT)

Intent: Protect the overall health and well-being of the building community through seasonal influenza prevention and other immunization efforts.

Summary: This WELL feature requires the provision of annual influenza (flu) immunizations, flu prevention campaigns and support in accessing other necessary vaccines.

Issue: Immunization prevents illness, disability and death from vaccine-preventable diseases, averting an estimated 2-3 million deaths every year.^[36] Seasonal flu is a widespread public health concern that causes severe illness and death in high-risk populations, costing the U.S. alone \$10.4 billion in healthcare costs each year and \$6.2 billion in lost productivity.^[37,38] Flu-like illness is responsible for 45% of workdays lost and 49% of low productivity days among working adults.^[38] 53% of adults have missed work to care for flu-ill children.^[39,40] Vaccinations are essential components of a healthy community, as unvaccinated individuals pose a risk to vulnerable individuals such as infants, older adults and those with compromised immune systems.^[39]

Solutions: Vaccination is the most effective way to prevent the flu.^[37] Providing on-site, free and actively-promoted flu vaccines is a highly effective method of increasing vaccination rates and reducing seasonal flu cases.^[14] Employer-sponsored vaccination programs are relatively inexpensive, cost-saving and effective, as simply reducing out-of-pocket costs alone can improve vaccination rates.^[41,42] Additionally, providing education on good health habits, such as hand hygiene and cough etiquette, can help stop the spread of germs and prevent illnesses like the flu.^[43] Beyond the flu, other essential immunizations are recommended based on a variety of factors including age, lifestyle and medical history.

Impact: By reducing common barriers to vaccination and providing vaccine education, immunization programs can minimize the many health and productivity costs of vaccine-preventable diseases while supporting the health of individuals and the wider community.

Part 1 Promote Seasonal Flu Prevention (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Projects provide one of the following vaccine programs:
 1. Annual on-site seasonal influenza (flu) vaccine at no cost or subsidized by at least 50% to eligible employees and students (as applicable) starting at least one month prior to peak flu season in the project region.^[43]
 2. Health insurance coverage or voucher for flu vaccination at no cost or subsidized by at least 50%, including paid time during the workday to receive immunization for seasonal influenza.^[25]
- b. Vaccine program is accompanied by a seasonal flu prevention campaign that covers the following:^[25]
 1. Alerts eligible employees and students (as applicable) regarding the availability of on-site flu vaccine clinic, coverage or vouchers and encourages or incentivizes individuals to receive the vaccine.^[43]
 2. Provides education for eligible employees and students (as applicable) on the health reasons to receive the vaccine, good hand hygiene and cough etiquette.^[43]
 3. Encourages eligible employees and students (as applicable) with flu-like symptoms to stay home through communications from leadership and managers, and provides teleworking options and/or designated sick leave time.^[43]

Note:

On-site immunization may be provided through a temporary vaccine clinic run by an outside organization, internal occupational health staff or other arrangement.^[25]

Prevention campaign must be culturally appropriate and literacy level appropriate. Campaign materials can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information.

Part 2 Implement Immunization Schedule (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. Policy requires that one of the following immunization schedules is fulfilled for all eligible employees and students (as applicable):
 1. The U.S. Centers for Disease Control and Prevention Recommended Immunization Schedule per age group as appropriate.^[44]
 2. The World Health Organization's Recommendations for Routine Immunization.^[45]
- b. If full immunization schedule has not been fulfilled, eligible employees and students or guardians are provided education on the specific immunization(s) of need and direction on where to go to receive the immunization(s).

C08 NEW PARENT SUPPORT | O (MAX: 3 PT)

Intent: Ensure new parents can properly care for themselves and their children.

Summary: This WELL feature requires paid parental leave, supportive services for parents returning to work and resources to ensure workplace support and inclusion.

Issue: Despite infant care being a universal need, adequate paid parental leave is not guaranteed in all parts of the world. Although most countries guarantee a minimum paid maternity leave, many do not offer paid partner leave, and when they do it is often significantly shorter in duration.^[7] Maintaining an infant's health in its first months of life is crucial to the baby's long-term health, and paid leave policies can help support this critical period of infant behavioral and neurological development.

Solutions: The International Labour Organization recommends a minimum of 18 weeks of parental leave, with research indicating that 40 weeks of paid leave results in the greatest overall reduction of risk for infant mortality.^[16,46] Longer parental leave periods are associated with a decline in school dropout rates and increased earnings for children later in life.^[20] Moreover, research shows that parental leave of up to a year (52 weeks) can help improve job continuity for women even years after childbirth.^[120] The World Health Organization recommends the exclusive breastfeeding of infants up to six months of age (and continued breastfeeding up to two years and beyond), which offers extensive health benefits to both infant and mother, including reduced rates of asthma, allergies, and ear infections among children, decreased rates of maternal depression and overall improved self-reported maternal health.^[16,47] Offering paid leave helps facilitate exclusive breastfeeding and in turn promotes the health of mothers and children.^[47]

Impact: Paid parental leave is associated with numerous health benefits, including higher rates of breastfeeding, reduced infant mortality and maternal postpartum depression, decreased risk of low birthweight infants, higher paternal involvement, and long-term achievement for children, including reduced school drop-out rates and increased medical appointment attendance.^[16-21] In addition to offering health and social benefits, organizational support for new parents increases employee retention and company loyalty.^[48]

Part 1 Offer New Parent Leave (Max: 3 Pt)

For All Spaces:

Projects provide a policy for all eligible employees that meets the following requirements:

- a. At least 40 weeks of parental leave are offered during any 12-month period to use during pregnancy or within the first three years of a child's life.^[50]
- b. At least some portion of the parental leave is paid per the table below. Paid parental leave is offered to all primary caregivers during any 12-month period during pregnancy, after birth, or for the adoption or fostering of a child, as shown in the table below. Paid leave must be separate from other types of leave (e.g., sick leave, annual leave, vacation time), paid at employee's full salary or wages, and cover benefits, and may be used during pregnancy or within the first three years of a child's life.^[25]

Weeks of Paid Leave	Points
18-29 weeks ^[46,49]	2
30-52 weeks ^[16,120]	3

Part 2 Promote Workplace Support (Max: 1 Pt)

For All Spaces:

Projects offer the following services to support employees returning from leave:^[16,18,19,20]

- a. Programs covering at least one of the following:
 1. Part-time options (e.g., ramp-back programs).
 2. Work from home flexibility.

- b. Coaching program or resources to help employees transition when returning from leave.
- c. Training or resources for managers on how to work with employees to create a plan for leave and optimally support employees returning from leave.
- d. Program or plan for supporting staffing while employee is on leave, such as temporary staffing services or training for current employees to cover job functions of employee on leave.

C09 NEW MOTHER SUPPORT | O (MAX: 3 PT)

Intent: Provide spaces and policies that encourage and support breastfeeding.

Summary: This WELL feature requires the provision of designated lactation rooms with supportive design and amenities, as well as initiatives and educational opportunities that help women initiate and sustain breastfeeding.

Issue: New mothers represent a significant segment of the global labor force, and postpartum care is essential to the health of breastfeeding women and their babies.^[51,52] Breastfeeding is widely recognized as the best source of nutrition to support the optimal growth and development of infants. The World Health Organization, United Nations Children's Fund and American Academy of Pediatrics recommend exclusive breastfeeding during an infant's first six months of life, as it is associated with a reduction in the risk of infections, type 2 diabetes and childhood obesity.^[51,53,54] For mothers, breastfeeding can help reduce both postpartum weight retention and also the risk of breast and ovarian cancer.^[55,56] Research shows that a lack of workplace accommodations contributes to shorter breastfeeding duration or leads to a drop in milk supply, resulting in early weaning.^[52]

Solutions: Nursing mothers need a safe and private space with essential amenities to continue breastfeeding or pumping after returning to work.^[52] Supportive programs, such as schedules that provide time for pumping or direct breastfeeding, lactation counseling, and accommodations during travel can help nursing mothers initiate and sustain breastfeeding.^[52] Best practice guidelines for lactation and wellness room design promote a comfortable, calm and private space that supports the needs of each individual, optimizes thermal and acoustic comfort and maximizes accessibility needs.^[57]

Impact: Supportive breastfeeding programs and spaces can help nursing mothers return to work and promote an environment that prioritizes the health and well-being of women and children. Breastfeeding programs can decrease healthcare expenses for mothers and children, reduce employee absences associated with caring for a sick child, increase earlier returns from maternity leave and significantly increase retention among female employees.^[49] By supporting breastfeeding, projects can reduce risk for short-and long-term health issues in both mothers and children, which benefits families, employers and society in general.^[52]

Part 1 Offer Workplace Breastfeeding Support (Max: 1 Pt)

For All Spaces:

The following policy accompanies all designated wellness or lactation rooms (must be separate from bathrooms):

- a. Paid break times for pumping, at least 15-20 minutes every 2-3 hours (or 2-3 pumping sessions per eight-hour workday), with adjustments as necessary to meet the needs of individuals.^[57]
- b. One-time coverage or subsidy of at least 50% for purchase of portable breast pump and/or availability of hospital-grade electric pump for multiple users.^[49]
- c. Access to sink, faucet, paper towel dispenser and soap (not required to be located in wellness or lactation room but may not be located in a bathroom).^[57]
- d. Access to a refrigerator with dedicated and sufficient space for milk storage based on assessment of occupant storage need (not required to be located in wellness or lactation room).^[57]

Part 2 Design Lactation Room (Max: 2 Pt)

For All Spaces:

Projects provide at least one dedicated lactation room that meets the following requirements:

- a. Is at least 2.1 m x 2.1 m [7 ft x 7 ft].^[57]
- b. Separate from the bathroom.^[49]
- c. Includes at minimum the following:
 1. Work surface and comfortable chair.^[57]
 2. At least two electrical outlets.^[57]
 3. User-operated lock with occupancy indicator or user-operated lock with signage available to indicate

occupancy.^[57]

4. System in place for room booking (designed in consideration of occupant privacy, such as a number system instead of occupant name).^[49,57]
 5. Access to sink, faucet, paper towel dispenser and soap (not required to be located in lactation room but may not be located in a bathroom).^[57]
 6. Access to a refrigerator with dedicated and sufficient space for milk storage based on assessment of occupant storage need (not required to be located in lactation room).^[57] Refrigerator is only required for regular building occupants.^[58]
 7. Dedicated storage space for pumping supplies.^[57]
- d. Provides a calming and comfortable environment, as described in an accompanying narrative, addressing at minimum:
1. Sound minimization.^[57]
 2. Lighting.^[57]
 3. Thermal comfort.^[57]
 4. Interior design and decorative elements (e.g., art, wall color, furniture selection, communications board).^[57]
- e. Present in a quantity that meets current and anticipated employee demand.^[49]

Part 3 Promote Breastfeeding Education and Support (Max: 1 Pt)

For All Spaces:

At least three of the following are addressed to support and promote breastfeeding, with programs offered at no cost or subsidized by at least 50%:

- a. Breastfeeding education and behavioral counseling for primary caregiver(s).^[49]
- b. Lactation support through at least one of the following:
 1. Postpartum lactation counseling to support breastfeeding initiation and continuation (no cap on sessions).^[49]
 2. Breastfeeding support groups or educational classes. Courses may be provided in-person or online; on-site or off-site; in group or individual settings; or through vendors, on-site staff, health insurance plans/programs, community groups or other practitioners.^[25]
 3. Banked breastmilk for occupants with specific medical conditions or situations (e.g., extreme prematurity, physical limitations, complications of the mother).^[49]
- c. Back-to-work lactation counseling to support eligible employees transitioning from leave to work. Counseling may cover a range of topics as relevant to the employee, including setting up a milk expression schedule at home and work, identifying places at work to express milk, effective techniques for milk expression, storing and handling human milk, maintaining and building milk supply, talking with supervisors about needs and adjusting to the physical and emotional demands of returning to work.^[49]
- d. Direct breastfeeding access through one of the following programs:
 1. On-site childcare with a policy supporting breaks for breastfeeding throughout the workday based on individual occupant needs.^[49]
 2. Allowing breastfeeding mothers to bring their child to work at least one day per week until at minimum six months of age.^[49]
- e. Travel accommodations are made for breastfeeding women traveling for business, including the following:
 1. For all trips, breastfeeding employees are provided an insulated cooler at no cost or reimbursement to cover the cost of insulated cooler.
 2. For all overnight trips lasting longer than 24 hours, breastfeeding employees are booked in hotels (or other overnight accommodations) with in-room refrigerator access.
 3. For trips lasting longer than 48 hours, employer provides coverage for breast milk shipping service (i.e., expressed milk shipped home).

4. Education and resources are provided with strategies for how to manage pumping and breastfeeding needs while on business travel.

Note: Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information. All educational materials must be checked annually to confirm information is relevant and up-to-date.

C10 FAMILY SUPPORT | O (MAX: 2 PT)

Intent: Support working parents and caregivers and ensure they are able to properly care for members of their family.

Summary: This WELL feature requires projects to offer programs that support individuals with childcare, eldercare and other family caretaking needs.

Issue: Many working individuals take on caregiving roles for their children, elder parents and other dependents, and with the rapidly growing population of older adults, the number of working caregivers will continue to rise.^[8] Many individuals are forced to turn down professional opportunities due to concerns about work interfering with family commitments.^[59] Caregivers often have to adjust their work schedules or take time off, which can significantly impact productivity due to increased absenteeism, workday interruptions, and unpaid leave.^[61] Moreover, loss of a loved one has been associated with higher risks of mortality, physical health problems leading to disability and hospitalization, and psychological stress like insomnia, depression and anxiety.^[66,68] Grief is also tied to significant productivity loss and related costs—in the U.S., grief-inducing experiences cost employers an annual average of \$75 billion in lost productivity and lost business.^[70]

Solutions: By offering a range of accommodations, employers can create a supportive culture that meets the diverse needs and caretaking responsibilities of employees.^[60] On-site childcare that supports flexible schedules can help working parents balance family needs and work demands. Flexible work arrangements can help retain and attract employees while also improving employee productivity and engagement.^[60] Additionally, financial assistance, support groups and referral to community services can help individuals manage the unique challenges associated with being a caregiver.^[62] Providing employees sufficient time away from work to grieve, in addition to grief counseling and other support, can help reduce employee anxiety, depression and other health risks over time.^[66,65]

Impact: Programs and accommodations that offer flexibility benefit both caregivers and employers by ensuring that employees are able to balance their work and personal lives in a healthy manner.^[61-63]

Part 1 Offer Childcare Support (Max: 1 Pt)

For All Spaces:

Projects provide at least three of the following:

- a. On-site childcare centers compliant with local childcare licensure, operated by either the employer or a separate organization, or subsidies of at least 50% for off-site child care.^[49]
- b. Back-up childcare assistance.^[63]
- c. Seasonal childcare programs or policies for occupants with school-age children.^[63]
- d. Policy allowing all employees to use paid sick time, paid time off or personal days for the care of a child.
- e. Policy covering one or more of the following to support all eligible employees with children: part-time options, work from home flexibility or flexible schedules.^[62]

Part 2 Offer Eldercare Support (Max: 1 Pt)

For All Spaces:

A policy is in place to support employees who are caregivers of elderly family members, including at minimum:

- a. Referral program to support services (e.g., eldercare assessment, case management).^[63]
- b. Resource list of local support services, including:
 1. Organizations or businesses that can help with information or products.^[63]
 2. Seminars and support groups for individuals caring for elderly family members.^[63]
- c. Policy allowing all employees to use paid sick time, paid time off or personal days for the care of an elderly family member.^[62]
- d. Policy covering one or more of the following to support all eligible employees caring for an elderly family member: part-time options, work from home flexibility or flexible schedules.^[62]

Part 3 Offer Family Leave (Max: 1 Pt)

For All Spaces:

Employers provide the following for all eligible employees at minimum:

- a. At least 12 weeks of paid leave during any 12-month period for the care of a spouse, domestic partner, child, dependent, parent, parent-in-law, grandparent, grandchild or sibling for the following events:
 1. Care of a family member with a serious health condition, including an illness, injury, impairment or physical or mental health condition that involves inpatient care in a hospital, hospice or residential healthcare facility or continuing treatment and/or continuing supervision by a healthcare provider.^[64]
 2. A family member has received notification to report for active military duty or is currently on active military duty, provided that the employee can demonstrate dependency on said family member for caregiver responsibilities.^[64]
- b. The option to use paid sick time for the care of a spouse, domestic partner, child, dependent, parent, parent-in-law, grandparent, grandchild or sibling.

Part 4 Offer Bereavement Support (Max: 1 Pt)

For All Spaces:

Employers provide a bereavement support policy for all eligible employees, including at minimum:

- a. Protocol for notifying employers of the loss.
- b. At least 20 days of bereavement leave offered as follows:
 1. At least five days of paid leave during any 12-month period for the loss of a child, spouse, parent or dependent.^[69,71]
 2. At least three days of paid leave during any 12-month period for the loss of a family member, colleague or friend.^[69,71]
 3. Additional unpaid weeks of leave during any 12-month period, granting employees a minimum total of 20 days of leave to use at any point in the bereavement process. The days of paid leave may be counted toward the 20 days.
- c. Bereavement support resources, including:
 1. Specialized education materials on coping with grief, including resources for returning to work after a loss.^[65,67]
 2. Information on accessing local bereavement support services.^[65,67,72]
- d. Coverage for bereavement counseling services at no cost or subsidized by at least 50%.

Note:

Education must be culturally appropriate and literacy level appropriate. Education can come in the form of trainings, brochures, videos, posters, pamphlets, newsletters and/or other written or online information. All educational materials must be checked annually to confirm information is relevant and up-to-date.

C11 CIVIC ENGAGEMENT | O (MAX: 1 PT)

Intent: Encourage the creation of opportunities for individuals to become actively involved in and connected to the surrounding community through engagement and volunteerism.

Summary: This WELL feature requires a commitment to civic engagement and social responsibility with a focus on charitable activities and contributions and voting support.

Issue: Millennials (those born after 1982) represent an increasingly large segment of the workforce, yet surveys find that one in four millennials plan to quit their current employer in the next year.^[74] This lack of retention often stems from employee perception that company goals do not extend beyond profit.^[74] Companies that do not demonstrate stronger social values through community engagement initiatives experience lower employee morale, engagement, pride and productivity compared to companies that provide civic engagement opportunities like community volunteering.^[76]

Solutions: With a growing global millennial workforce, it is essential for companies to consider the link between corporate social reputation and talent attraction.^[74] There are a variety of ways to increase opportunities for civic engagement and establish a culture of social responsibility. Scheduling volunteer opportunities during work hours, providing paid time off to volunteer or vote and matching employee charitable contributions can all encourage participation in social, environmental and political affairs.^[73,74,75,76] Working with local or community organizations can also help enhance employees' connections to and engagement with the surrounding community.^[75,76]

Impact: Providing opportunities for civic engagement can help create a positive, socially responsible work culture, enhance employee retention and organizational reputation and make a positive contribution to the local community. Purpose-driven companies that practice civic engagement through charitable contributions outperform counterparts in terms of business performance.^[22] Team volunteering and community engagement opportunities have been shown to enhance employee loyalty, team bonding, employee engagement and work satisfaction.^[73,74,75,76] Surveys have found that millennials are 24% more likely to recommend their workplace if the employer provides volunteer opportunities and that employees who participate in community engagement have 13% higher morale.^[76]

Part 1 Promote Civic Engagement (Max: 1 Pt)

For All Spaces except Dwelling Units:

Charitable activities

At least two of the following requirements are met:

- All eligible employees are given the option to take paid time off to participate in volunteer activities for at least 16 hours of paid time annually (separate from vacation, sick or other paid time off), with at least eight hours organized by the employer for a registered charity or non-profit.
- Projects provide a list of volunteer opportunities in the project area and community, with at least one opportunity per month that would be suitable for employees.
- Projects contribute annually to a registered charity of employee's choice to match employee donations, up to a maximum amount defined by the employer.

Voting opportunity

Projects provide the following:

- Timely reminders to employees to register to vote for local and national elections, including instructions on how to register.
- Timely reminders to employees to submit absentee ballots for local and national elections.
- Timely reminders to employees to vote in local and national elections, including instructions on how to determine voting station.
- Leave for all employees to vote in national and local elections.

For Dwelling Units:

Voting Opportunity

Projects commit to the following:

- a. Timely reminders to residents to register to vote for local and national elections, including instructions on how to register.
- b. Timely reminders to residents to submit absentee ballots for local and national elections.
- c. Timely reminders to residents to vote in local and national elections, including instructions on how to determine voting station.
- d. Vans, shuttles or alternative enhanced transport for residents (as applicable) to voting stations are provided on voting days if project is more than 800 m [0.5 mi] walk distance from a voting station.

C12 ORGANIZATIONAL TRANSPARENCY | O (MAX: 2 PT)

Intent: Promote transparency in organizations through adherence to and disclosure of equitable and inclusive social and business practices.

Summary: This WELL feature requires projects to participate in third-party certification programs that evaluate an organization's adherence to principles of equity and inclusion.

Issue: Organizations that espouse fair, equitable and just treatment toward their workforce help create a culture of reduced stress and greater employee satisfaction and loyalty. Diversity in the workplace is a key component of company success, driving both profit and positive culture, and is often overlooked as a core component of a healthy environment. Unfortunately, only 55% of companies in the U.S. report that racial diversity is a top priority, and only 4% of companies use blind resume reviews.^[77,78] Diversity and inclusion impacts retention, with voluntary turnover among racial minorities in the U.S. nearly 30% higher than that of their white counterparts.^[79] Beyond race, gender is also a key component of diversity. Barriers to career advancement are more severe for women than men, and despite equal educational attainment and qualifications, women in the U.S. continue to earn 80.5% of what men earn, while in the UK women's earnings are only 80.2% of men's.^[78,80]

Solutions: Addressing diversity in the workplace is complex and touches upon all aspects of an organization's operations, including hiring practices, determination of salary and wages, workplace culture and organizational structure. Projects that promote diversity in the workplace and espouse fair, equitable and just treatment toward their workforce through measurable actions—particularly by participating in certified organizational transparency programs—drive both profit and positive culture by reducing employee stress and increasing employee satisfaction and loyalty.^[81]

Impact: Through transparent, open and committed actions, organizations can cultivate and maintain a diverse and inclusive culture that supports individuals of all backgrounds. By focusing on diversity and inclusion, companies stand to experience both cultural and economic gains: for every 1% rise in workforce gender diversity in U.S. companies, there is a 3% rise in sales revenue, and for every 1% rise in workforce ethnic diversity, there is a 9% rise in sales revenue.^[81] Moreover, companies in the U.S. with the most female board directors outperform competitors in sales by 16% and return on invested capital by 26%.^[81]

Part 1 Promote Equity Program Participation (Max: 2 Pt)

For All Spaces:

The organization participates in one of the following programs and results are made publicly available on-site and on the organization's website:

- a. The JUST disclosure framework operated by the International Living Future Institute.^[82]
- b. B Corporation certification operated by B Lab.^[83]
- c. GoodWell certification operated by GoodWell.^[84]
- d. Business Working Responsibly Mark operated by Business in the Community Ireland.^[85]
- e. Sustainability reporting following the G4 Sustainability Reporting Guidelines organized by the Global Reporting Initiative.^[86]

C13 ACCESSIBILITY AND UNIVERSAL DESIGN | O (MAX: 3 PT)

Intent: Provide buildings that are accessible, comfortable and usable by people of all backgrounds and abilities.

Summary: This WELL feature requires projects to comply with basic accessible design requirements in their region and integrate principles of universal design into the design and operation of the space.

Issue: More than one billion people, or about 15% of the global population, live with some type of disability.^[87] Among this population, nearly 200 million individuals experience considerable difficulties in functioning, and adults with disabilities are more likely to experience poorer health conditions such as diabetes, arthritis, asthma and obesity.^[87,89] Yet due to changes in global health and longevity these numbers are changing rapidly. The global rise in the populations of older adults and individuals living with chronic health conditions is expected to significantly impact the number of people living with a disability.^[87] The design of the built environment is particularly critical for the health, fulfillment and inclusion of the disability community.^[90] Unfortunately, not all countries have existing or robust standards for accessible design. Design can have a profound impact on who is able to interact with a space easily, safely and ably, yet many environments are not designed with consideration of people with disabilities.^[87]

Solutions: Spaces and places that are truly accessible are not limited to compliance with local code.^[9] Rather, they invite individuals with diverse abilities and mobility needs to use the space. Both accessible and universal design address multiple aspects of a built space, including infrastructure, signage and technologies, and together seek to enhance the opportunity for all individuals to exist independently and comfortably in a space.^[88]

Impact: Through thoughtful incorporation of accessible and universal design, projects can establish an inclusive and enabling community in which people of all abilities can effectively and easily access, utilize and engage with a space.

Part 1 Ensure Essential Accessibility (Max: 1 Pt)

For All Spaces:

The following requirement is met:

- a. Projects meet local accessibility laws and/or codes without exclusions or exemptions.

Part 2 Integrate Universal Design (Max: 2 Pt)

For All Spaces:

A narrative describes how projects use universal design principles as guidance to accommodate a diverse range of occupant abilities. All projects must consult with a professional trained in universal design to ensure spaces are optimized to meet occupant needs. Projects address the following based on anticipated occupant need:^[91]

- a. Physical access: accommodating entry and exit points to enable entrance to the space, flexible use of space and usability beyond the requirements of local laws or code.^[9,87,92]
- b. Developmental and intellectual health: strategies that use color, texture, images and other perceptible information to support individuals with varying cognitive abilities (e.g., learning disabilities).^[87,92,93]
- c. Wayfinding: strategies to help individuals intuitively navigate through spaces (e.g., signage, maps, symbols, mobile and digital technologies, information systems).^[92]
- d. Inclusion: developing and implementing operational programs and processes (e.g., braille, auditory cues) that are inclusive of individuals with disabilities.^[9,87,92]
- e. Technology: offering technology (e.g., audio and visual equipment, web access) that incorporates the needs of individuals with disabilities, made available to all occupants at no cost.^[9,87,92]
- f. Safety: removing barriers to safety to reduce anxiety, and to support easy access to all built features and spaces.^[87,92,93]

C14 BATHROOM ACCOMMODATIONS | O (MAX: 2 PT)

Intent: Provide bathrooms that support the needs of all individuals.

Summary: This WELL feature requires bathrooms to include basic sanitary materials and to support accommodations for users with diverse needs.

Issue: Bathrooms are one of the most critical building amenities, as they must be responsive to and accommodate a wide range of human needs and abilities. Unfortunately, many buildings do not provide equity in bathroom access to those of all abilities and genders.^[94] Women often struggle to get the bathroom accommodations they need due to an insufficient quantity of bathrooms and lack of sanitary materials.^[94] Caregivers to small children, older adults or other individuals who require assistance frequently lack access to facilities that support their needs.^[94]

Solutions: A variety of design considerations exist to make bathrooms available and inclusive for all. It is estimated that at least a quarter of all adult women are menstruating at any time, and bathrooms should provide convenient access to hygienic products and trash receptacles in all stalls.^[94] Furthermore, baby changing stations, which are increasingly found in men's, women's and family bathrooms, are often regarded as an essential feature in public and private facilities. Single-user facilities provide safe, comfortable bathroom availability for individuals of all gender identities. Finally, an increased presence of family bathrooms can help accommodate parents with infants or small children and support caregivers of individuals with mental and physical disabilities of all ages, such as those living with Alzheimer's.^[94]

Impact: Inclusive bathrooms can accommodate the various needs of diverse populations, promote gender equality and support the health needs of all individuals.

Part 1 Provide Essential Accommodations (Max: 1 Pt)

For All Spaces except Dwelling Units:

The following requirements are met:

- a. Bathrooms meet local accessibility code without exclusions or exemptions.
- b. The quantity and location of bathrooms are determined based on actual or anticipated occupant demand.
- c. All bathrooms provide the following:
 1. Toilet paper.
 2. Trash receptacles in stalls (in women's and single-user bathrooms). If toilet paper cannot be flushed down toilets, trash receptacles must be in all bathroom stalls.
 3. Sanitary pads and/or tampons at no cost or subsidized by at least 50% (in women's and single-user bathrooms).
- d. All occupants have access to at least one bathroom per floor that provides the following:
 1. Syringe drop box.^[95]
 2. Infant changing tables.

Part 2 Provide Single-User Bathrooms (Max: 1 Pt)

For All Spaces except Dwelling Units:

All single-user bathrooms meet the following requirements:

- a. Meet local accessibility code without exclusions or exemptions.
- b. Meet occupant demand in quantity and location based on size of project (to ensure bathrooms are conveniently located for all occupants).
- c. Open to all individuals with accompanying signage.

Part 3 Provide Family Bathrooms (Max: 1 Pt)

For All Spaces except Dwelling Units:

All family bathrooms meet the following requirements:

- a. Meet local accessibility code without exclusions or exemptions.
- b. Accommodate expected demand and number of individuals in need of accompaniment or assistance in the bathroom (e.g., children, persons with Alzheimer's, individuals with other mental or physical disabilities).^[94]
- c. Contain the following accommodations:
 1. Infant changing table and holding chair.
 2. Children's toilet facilities or accommodations for child use of adult size toilet.
 3. Children's sinks or accommodations for child use of adult size sink (e.g., availability of stepstool).
 4. Motion sensor lights.
 5. Skid resistant floors.
 6. Safety grab bars.

C15 EMERGENCY PREPAREDNESS | O (MAX: 3 PT)

Intent: Prepare individuals in case of emergency.

Summary: This WELL feature requires projects to have an emergency management plan in place and to have accompanying supportive resources for responding to an emergency.

Issue: Natural disasters kill around 90,000 people and affect close to 160 million people worldwide every year, with both an immediate impact on human lives and a long-term impact on built spaces.^[96] However, surveys reveal that only 20% of employees feel prepared for a catastrophic event.^[25] Additionally, sudden cardiac arrests (SCAs) are common health emergencies that account for 54% of coronary heart disease deaths.^[97] Older adults, individuals with disabilities, pregnant women and children may have special needs during an emergency and are particularly vulnerable when disaster strikes.^[96]

Solutions: Emergency management plans can enhance communication, minimize confusion and improve personnel coordination during emergency situations. Establishing an effective emergency management plan requires awareness of local conditions and potential hazards, the needs of vulnerable groups and building response capabilities. Providing a database of building emergency equipment and supplies, an emergency notification system or readily accessible emergency resources such as first aid kits and defibrillators can increase response time and help improve survival rates.^[97] Readily accessible automated external defibrillators (AEDs) are life-saving devices that can improve the survival rate of SCA patients even in public settings where most users have had no prior training.^[98]

Impact: By focusing on prevention and preparedness, buildings and communities can support collective safety, survivability and well-being during emergency situations.

Part 1 Develop Emergency Preparedness Plan (Max: 1 Pt)

For All Spaces:

The following requirements are met:

- a. An emergency management plan is in place outlining response in the case of emergency situations within the building or surrounding community, including at least the following hazards:
 1. Natural (e.g., tornado, flood, wildfire, earthquake, heatwave).
 2. Fire.
 3. Health (e.g., acute medical emergency, infectious disease outbreak).
 4. Technological (e.g., power loss, chemical spill, explosion).
 5. Deliberate (e.g., human-caused threat).
- b. A narrative identifies how the following are incorporated into the emergency management plan:
 1. Roles and responsibilities of the emergency response team.
 2. Potential hazards and emergency situations.^[99]
 3. The needs of vulnerable occupants or groups (e.g., older adults, people with disabilities, pregnant women, children).^[99]
 4. Building response capabilities, including assessment of supplies, specialized personnel and physical structure.^[99]
 5. Plans for policy implementation and communication to building occupants, including occupant training on the emergency management plan and practice drills.^[99]

Part 2 Promote Emergency Resources (Max: 2 Pt)

For All Spaces:

A policy and accompanying resources are in place that support occupants in responding to an emergency, including at least five of the following:

- a. Database of building emergency equipment, supplies and procedures available to all occupants, including information cards indicating emergency procedures available to all guests upon entrance to the building.

- b. Emergency notification system in the building with auditory and visual indicators of emergency (e.g., speaker system, flashing lights).
- c. At least one first aid kit per floor meeting requirements of American National Standards Institute (ANSI)/International Safety Equipment Association (ISEA) Class A or Class B based on project need.
- d. AEDs within reach of any given occupant within 3-4 minutes^[100] and adoption of routine maintenance and testing schedule.^[25] The locations of building AEDs are identified through posters, signs or other forms of communication other than on the AED itself.^[25]
- e. Annual availability of a certified training course on cardiopulmonary resuscitation (CPR) and AED usage.^[25]
- f. Emergency response team for medical emergencies, including at least one certified medical professional or first responder present within the building.^[25]
- g. Rides subsidized by at least 50% to destination of need for emergency situations (e.g., urgent medical needs, personal or family emergency, public transit shutdown).

C16 COMMUNITY ACCESS AND ENGAGEMENT | O (MAX: 1 PT)

Intent: Provide public spaces, amenities and programming for community members to gather, socialize and collaborate.

Summary: This WELL feature requires projects to designate a shared, flexible public space for use by the surrounding community, and to offer programming that engages local individuals in managing or utilizing the space in diverse ways.

Issue: Studies increasingly demonstrate that the design and function of built spaces can contribute significantly to health disparities.^[111-113] Lower income neighborhoods more often lack safe and well-maintained parks, recreational facilities, sidewalks and attractive scenery, resulting in higher rates of obesity, depression, and distress, shorter life expectancy and reduced feelings of social cohesion that lead to greater risk of stroke.^[111-113] Moreover, research in the U.S. reveals a decline in community social support and social relations, with people who feel disconnected from their local community encountering more mental health issues than those who have a strong community connection.^[111,114]

Solutions: Buildings that provide spaces for public use can encourage greater social interaction, social networks, civic engagement, physical activity and collective feelings of community ownership, thereby reducing public health challenges like stress, depression and chronic disease in the surrounding community.^[111] Additionally, projects that offer community programming can foster social cohesion, community empowerment and collective trust, which are linked to decreased risk of heart disease, stroke and mortality and improved physical and mental health, happiness and healthy behaviors.^[111,112,115,116] Project owners and developers should consider how built spaces can be made more available to the surrounding community, encourage use by a variety of individuals and promote equitable community improvement and engagement.^[109]

Impact: By making built spaces available to the larger community and encouraging shared experiences and social interactions, projects can help address health disparities while increasing social cohesion, economic development and civic engagement.^[109,111]

Part 1 Provide Community Space (Max: 1 Pt)

For All Spaces:

Community space

Designated space is made available to the public at no cost that meets the following requirements:

- Is at least 186 m² [2,000 ft²].^[117]
- Open at all times, unless closed for security purposes (e.g., during nighttime hours) or for special events.^[117]
- Entry points provide access from a minimum of one public use street.^[117]
- Signage at entrance clearly indicates hours the space is open and the space's designation for public use.^[117]
- Provides quality seating areas and sufficient lighting and is easily navigable for individuals of all abilities.^[117,92]
- Adheres to a regular maintenance and cleaning schedule.^[117]

Community engagement

The following requirements are met:

- Access to one or more designated spaces is provided, at no cost or subsidized by at least 50%, to local community groups, student clubs or non-profit organizations for meetings and events.^[111,109,118]
- At least one community engagement program is provided, at no cost or subsidized by at least 50%, to the public on a quarterly basis.^[111,109,118]

APPENDIX C1:

Unique evidence-based health topics covered can include but are not limited to the following:

- Adolescent health
- Basic life skills education
- Cardiovascular health
- Disability and health
- Emergency preparedness and response
- Employment readiness
- Financial education or health
- Food safety
- Interpersonal violence
- Maternal and child health
- Mental health and mental health crisis
- Minority health
- Noncommunicable and chronic disease prevention (heart disease, stroke, cancer, diabetes, obesity, asthma, etc.)
- Nutrition
- Occupational health hazards
- Parenting and caregiving
- Senior health
- Sexual and reproductive health
- Sleep and sleep disorders
- Smoking and tobacco use
- Stopping the spread of germs
- Substance use, abuse and dependency
- Suicide prevention
- Vaccines and immunization
- Water, sanitation and hygiene
- Workplace safety
- Any other health condition identified and deemed appropriate for building occupants

REFERENCES

- 1: MacQueen KM, McLellan E, Metzger DS, et al. What is community? An evidence-based definition for participatory public health. *Am J Public Health*. 2001;91(12):1929-1938. [Reference](#). Accessed February 6, 2018.
- 2: World Health Organization. About social determinants of health. WHO. [Reference](#). Published 2017. Accessed January 30, 2018.
- 3: U.S. Department of Health and Human Services. Social Determinants of Health. [Reference](#). Accessed January 16, 2018.
- 4: U.S. Department of Health and Human Services. Access to Health Services. Healthy People 2020. [Reference](#). Accessed February 4, 2018.
- 5: World Health Organization. Health Literacy: The Solid Facts. Geneva, Switzerland; 2013. [Reference](#). Accessed January 16, 2018.
- 6: U.S. Department of Health and Human Services. National Action Plan to Improve Health Literacy. 2010. [Reference](#). Accessed January 16, 2018.
- 7: World Policy Analysis Center. Is paid leave available to mothers and fathers of infants? [Reference](#). Accessed January 15, 2018.
- 8: World Health Organization. Facts about ageing. WHO. [Reference](#). Published 2015. Accessed February 8, 2018.
- 9: Persson H, Åhman H, Yngling AA, Gulliksen J. Universal design, inclusive design, accessible design, design for all: different concepts—one goal? On the concept of accessibility—historical, methodological and philosophical aspects. *Univers Access Inf Soc*. 2015;14(4):505-526. doi:10.1007/s10209-014-0358-z.
- 10: World Health Organization. Workers' Health: Global Plan of Action - Sixtieth World Health Assembly. Geneva, Switzerland; 2007.
- 11: Garrin JM. The Power of Workplace Wellness: A Theoretical Model for Social Change Agency. *J Soc Chang*. 2014;6(1):109-117. doi:10.5590/JOSC.2014.06.1.08.
- 12: Centers for Disease Control and Prevention. Workplace Health Model - Workplace Health Promotion. [Reference](#). Accessed February 4, 2018.
- 13: World Health Organization. Workplace Health Promotion. WHO. [Reference](#). Published 2010. Accessed February 4, 2018.
- 14: The Community Preventive Services Task Force. Interventions to Promote Seasonal Influenza Vaccinations among Healthcare Workers. Washington, DC; 2008. [Reference](#).
- 15: National Business Coaliton on Health. Health Risk Appraisals at the Worksite. Washington, D.C.
- 16: Burtle A, Bezruchka S. Population Health and Paid Parental Leave: What the United States can learn from two decades of research. *Healthcare*. 2016;4(2):30. doi:10.3390/healthcare4020030.
- 17: Nepomnyaschy L, Waldfogel J. Paternity leave and fathers' involvement with their young children. *Community, Work Fam*. 2007;10(4):427-453. doi:10.1080/13668800701575077.
- 18: Tanaka S, Waldfogel J. Effects of parental leave and work hours on fathers' involvement with their babies. *Community Work Fam*. 2007;10(4):409-426. doi:10.1080/13668800701575069.
- 19: Chatterji P, Markowitz S. Does the length of maternity leave affect maternal health? *South Econ J*. 2005;72(1):16. doi:10.1017/CBO9781107415324.004.
- 20: Carneiro P, Loken K V, Salvanes KG. A flying start: maternity leave benefits and long run outcomes of children. *J Polit Econ*. 2015;123(2):365-412. doi:10.1086/679627.
- 21: Tanaka S. Parental leave and child health across OECD countries. *Econ J*. 2005;115(501):F7-F28. doi:10.1111/j.0013-0133.2005.00970.x.
- 22: Lev B, Petrovits C, Radhakrishnan S. Is doing good good for you? How corporate charitable contributions enhance revenue growth. *Strateg Manag J*. 2010;31(2):182-200. doi:10.1002/smj.810.

- 23: Institute of Medicine. Health Literacy: A Prescription to End Confusion. Washington, DC: National Academies Press; 2004. doi:10.17226/10883.
- 24: National Institutes of Health. Surgeon General's Workshop on Improving Health Literacy. Bethesda, MD; 2006. [Reference](#). Accessed January 16, 2018.
- 25: Centers for Disease Control and Prevention. The CDC Worksite Health ScoreCard: An Assessment Tool for Employers to Prevent Heart Disease, Stroke, and Related Health Conditions. Atlanta; 2014. [Reference](#).
- 26: U.S. Environmental Protection Agency. Creating Equitable, Healthy, and Sustainable Communities: Strategies for Advancing Smart Growth, Environmental Justice, and Equitable Development. Washington, DC: Environmental Protection Agency; 2013. [Reference](#).
- 27: Kania J, Kramer M. Collective impact. *Stanford Soc Innov Rev*. 2011;9(1):36-41. [Reference](#).
- 28: Kania J, Hanleybrown F, Splansky Juster J. Essential mindset shifts for collective impact. *Stanford Soc Innov Rev*. 2014;12(4):2-5. [Reference](#).
- 29: Gulliford M, Figueroa-Munoz J, Morgan M, et al. What does "access to health care" mean? *J Health Serv Res Policy*. 2002;7(3):186-188. doi:10.1258/135581902760082517.
- 30: MetLife. Work Redefined: A New Age of Benefits. New York, NY; 2017.
- 31: Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. *Health Aff (Millwood)*. 2010;29(2):304-311. doi:10.1377/hlthaff.2009.0626.
- 32: Centers for Disease Control and Prevention. Communications | Planning | Model | Workplace Health Promotion. [Reference](#). Published 2015. Accessed February 4, 2018.
- 33: Health Enhancement Research Organization, American College of Occupational and Environmental Medicine, Care Continuum Alliance. Biometric health screening for employers. *J Occup Environ Med*. 2013;55(10):1244-1251. doi:10.1097/JOM.0b013e3182a7e975.
- 34: de Souza AC, Alexandre NMC, de Guirardello E B. Propriedades psicométricas na avaliação de instrumentos: avaliação da confiabilidade e da validade. *Epidemiol e Serviços Saúde*. 2017;26(3):649-659. doi:10.5123/S1679-49742017000300022.
- 35: Mellor N, Webster J. Enablers and challenges in implementing a comprehensive workplace health and well-being approach. *Int J Work Heal Manag*. 2013;6(2):129-142. doi:10.1108/IJWHM-08-2011-0018.
- 36: World Health Organization. Immunization coverage. WHO. [Reference](#). Published 2018. Accessed February 4, 2018.
- 37: World Health Organization. Influenza (Seasonal). WHO. [Reference](#). Published 2018. Accessed February 4, 2018.
- 38: Duncan IG, Taitel MS, Zhang J, Kirkham HS. Planning influenza vaccination programs: a cost benefit model. *Cost Eff Resour Alloc*. 2012;10(1):10. doi:10.1186/1478-7547-10-10.
- 39: Centers for Disease Control and Prevention. Make It Your Business To Fight The Flu: A Toolkit for Employers. Atlanta, GA.
- 40: Nettleman MD, White T, Lavoie S, Chafin C. Acceptance of Childhood Influenza Vaccination. 2001;23298:178-180.
- 41: The Community Preventive Services Task Force. Increasing Appropriate Vaccination : Reducing Client Out-of-Pocket Costs for Vaccinations. Washington, DC; 2014.
- 42: Lee BY, Bailey RR, Wiringa AE, et al. Economics of employer-sponsored workplace vaccination to prevent pandemic and seasonal influenza. *Vaccine*. 2010;28(37):5952-5959. doi:10.1016/j.vaccine.2010.07.003.Economics.
- 43: Greenbaum E, Meinert E. Vaccinating Against the Flu: A Business Case. Washington, DC; 2010.
- 44: Centers for Disease Control and Prevention. Adult Immunization Schedule. [Reference](#). Published 2017.
- 45: World Health Organization. Table 1 : Summary of WHO Position Papers - Recommendations for Routine Immunization. [Reference](#). Published 2017.
- 46: International Labour Organization. Recommendation R191 - Maternity Protection Recommendation, 2000 (No. 191). [Reference](#). Accessed January 30, 2018.
- 47: Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. *Cochrane database Syst Rev*. 2002;

(1):CD003517. doi:10.1002/14651858.CD003517.

- 48: Coulson M, Skouteris H, Dissanayake C. The role of planning, support, and maternal and infant factors in women's return to work after maternity leave. *Fam Matters*. 2012;90(1):33-44.
- 49: Slavit W. Investing in Workplace Breastfeeding Programs and Policies: An Employers Toolkit. Washington, DC; 2009.
- 50: Ruhm CJ. Parental Leave and Child Health. National Bureau of Economic Research. 1998. [Reference](#).
- 51: U.S. Department of Health and Human Services. The Surgeon General's Call to Action to Support Breastfeeding 2011. Washington, DC; 2011.
- 52: Shealy K, Li R, Benton-Davis S, Grummer-Strawn LM. Support for Breastfeeding in the Workplace. Atlanta, GA; 2005. doi:10.1097/00006223-200003000-00003.
- 53: United Nations International Children's Emergency Fund. Breastfeeding. [Reference](#). Published 2015.
- 54: American Academy of Pediatrics. Policy statement: breastfeeding and the use of human milk. *Pediatrics*. 2012;129(3).
- 55: Ip S, Chung M, Raman G, et al. Breastfeeding and maternal and infant health outcomes in developed countries. *Evid Rep Technol Assess (Full Rep)*. 2007;(153):1-186.
- 56: Baker JL, Gamborg M, Heitmann BL, Lissner L, Sorensen TI, Rasmussen KM. Breastfeeding reduces postpartum weight retention. *Am J Clin Nutr*. 2008;88(6):1543-1551. doi:10.3945/ajcn.2008.26379.
- 57: York L, Lee J. AIA Best Practices: Lactation / Wellness Room Design. 2016.
- 58: American Society of Interior Designers. Wellness Rooms - Here and Now. [Reference](#). Published 2016. Accessed January 1, 2017.
- 59: U.S. Department of Labor. Employment Characteristics of Families - 2016. Washington, DC; 2017.
- 60: Pew Research Center. Americans Widely Support Paid Family and Medical Leave, but Differ Over Specific Policies. Washington, D.C; 2017.
- 61: Metlife Mature Market Institute. The Metlife Caregiving Cost Study: Productivity Losses to U.S. Businesses. Westport, CT; 2006.
- 62: Higgins C, Lyons S. Reducing Work-Life Conflict: What Works? What Doesn't? doi:10.1371/journal.pone.0097769.
- 63: Canadian Centre for Occupational Health and Safety. Work/Life Balance. [Reference](#). Accessed December 15, 2017.
- 64: State of New York. Paid Family Leave: How it Works. [Reference](#). Published 2017.
- 65:
Life After Death - Six Steps to Improve Support in Bereavement.; 2014. [Reference](#). Accessed April 26, 2018.
- 66: Stroebe M, Schut H, Stroebe W. Health consequences of bereavement: a review. *Lancet*. 2007;370:1960-1973. [Reference](#).
- 67:
National Hospice and Palliative Care Organization. When an Employee Suffers a Loss. [Reference](#). Published 2007. Accessed April 26, 2018.
- 68: Buckley T, Sunari D, Marshall A, Bartrop R, McKinley S, Tofler G. Physiological correlates of bereavement and the impact of bereavement interventions. *Dialogues Clin Neurosci*. 2012;14(2):129-139. [Reference](#). Accessed April 26, 2018.
- 69:
Customized Paid Leave Benchmarking Report. 2017. [Reference](#). Accessed April 26, 2018.
- 70:
James J, Friedman R, Cline E. *Grief Index : The "Hidden" Annual Costs of Grief in America's Workplace : 2003 Report* Sherman Oaks; 2003. [Reference](#). Accessed April 26, 2018.
- 71:
Examining Paid Leave in the Workplace.; 2008. [Reference](#). Accessed April 26, 2018.

- 72:
Aoun SM, Rumbold B, Howting D, Bolleter A, Breen LJ. Bereavement support for family caregivers: the gap between guidelines and practice in palliative care. van Wouwe JP, ed. *PLoS One*. 2017;12(10):e0184750. doi:10.1371/journal.pone.0184750
- 73: Levine P, Kawashima-Ginsber K. Civic Health and the Economy: Making the Connection. National Conference on Citizenship; 2013.
- 74: Deloitte. The 2016 Deloitte Millennial Survey: Winning over the next Generation of Leaders. New York, NY; 2016. [Reference](#).
- 75: Hayes K. A Narrative Study of Service Learning and Workplace Volunteering: Increasing Participation and Improving Outcomes for Employee Volunteers. 2016.
- 76: Turner YS. The Civic 50: Best Practices in Corporate Community Engagement. Giv Thoughts. 2015;(GT-V1N9):1-8.
- 77: McKinsey & Company. Women in the Workplace 2016. New York, NY; 2016. [Reference](#).
- 78: The B Team. The Diversity Paradox: Capturing the Value of Difference by Looking Beyond the Numbers. The B Team; 2015.
- 79: McKay PF, Avery DR, Tonidandel S, Morris MA, Hernandez M, Hebl M. Racial differences in employee retention: are diversity climate perceptions the key? *Pers Psychol*. 2007;60(1):35-62. doi:10.1111/j.1744-6570.2007.00064.x.
- 80: Lips HM. The Gender Pay Gap: Challenging the Rationalizations. Perceived Equity, Discrimination, and the Limits of Human Capital Models. *Sex Roles*. 2013;68(3-4):169-185. doi:10.1007/s11199-012-0165-z.
- 81: The B Team. Diversity: Bringing the Business Case to Life.; 2015.
- 82: International Living Future Institute. JUST. [Reference](#). Published 2018. Accessed April 9, 2018.
- 83: B Lab. Certified B Corporation. [Reference](#). Published 2018. Accessed April 9, 2018.
- 84:
GoodWell. GoodWell. [Reference](#). Accessed April 9, 2018.
- 85: Business in the Community Ireland. Business Working Responsibly Mark. [Reference](#). Accessed April 9, 2018.
- 86: Global Reporting Initiative. G4 Sustainability Reporting Guidelines. [Reference](#). Accessed April 9, 2018.
- 87: World Health Organization. World Report on Disability. Geneva, Switzerland; 2011. [Reference](#).
- 88: Heylighen A. About the nature of design in universal design. *Disabil Rehabil*. 2014;36(16):1360-1368. doi:10.3109/09638288.2014.932850.
- 89: Boslaugh SE, Andresen EM. Correlates of physical activity for adults with disability. *Prev Chronic Dis*. 2006;3(3). [Reference](#). Accessed April 18, 2018.
- 90: U.S. Department of Health and Human Science Services: Office of Disease Prevention and Health Promotion. Disability and Health: Overview. Healthy People 2020. [Reference](#). Accessed April 18, 2018.
- 91:
Lanteigne V. WELL v1 Innovation Proposal - Universal Design. 2017.
- 92: Levine D. The NYC Guidebook to Accessibility and Universal Design.; 2003.
- 93: Centre for Excellence in Universal Design. What is Universal Design. [Reference](#). Accessed February 12, 2018.
- 94: Anthony KH, Dufresne M. Potty Parity in Perspective: Gender and Family Issues in Planning and Designing Public Restrooms. *CPL Bibliogr*. 2007;21(3):267-294. doi:10.1177/0885412206295846.
- 95: Dimmick BL, Douglas D. Reasonable Accommodations for Diabetes Management in the Workplace. 2014:1-26.
- 96: World Health Organization. Environmental health in emergencies: natural events. [Reference](#). Accessed August 12, 2017.
- 97: Mancini ME, Cazzell M, Kardong-Edgren S, Cason CL. Improving workplace safety training using a self-directed CPR-AED learning program. *AAOHN J*. 2009;57(4):159-167-169. doi:10.3928/08910162-20090401-02.
- 98: Caffrey SL, Willoughby PJ, Pepe PE, Becker LB. Public use of automated external defibrillators. *N Engl J Med*.

2002;347(16):1242-1247. doi:10.1056/NEJMoa020932.

99: Federal Emergency Management Agency. Emergency Management Guide for Business and Industry. Washington, DC; 1993. [Reference](#).

100: Occupational Safety and Health Administration. Best Practices Guide: Fundamentals of a Workplace First-Aid Program. 2006:28.

101: Frontczak M, Schiavon S, Goins J, Arens E, Zhang H, Wargocki P. Quantitative relationships between occupant satisfaction and satisfaction aspects of indoor environmental quality and building design. *Indoor Air*. 2012;22(2):119-131. doi:10.1111/j.1600-0668.2011.00745.x

102: Turpin-Brooks S, Viccars G. The development of robust methods of post occupancy evaluation. *Facilities*. 2006;24(5/6):177-196. doi:10.1108/02632770610665775.

103: Frankfort-Nachmias C, Nachmias D, DeWaard J. Research Methods in the Social Sciences. In: 8th ed. New York, NY: Worth Publishers; 2015.

104: McHorney CA, Ware JEJ, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*. 1993;31(3):247-263.

105: Barnett-Page E, Thomas J. Methods for the synthesis of qualitative research: a critical review. *BMC Med Res Methodol*. 2009;9(1):59. doi:10.1186/1471-2288-9-59.

106: Limb M, Dwyer C. *Qualitative Methodologies for Geographers: Issues and Debates*. London: Arnold; 2001. [Reference](#). Accessed April 26, 2018.

107:

Baxter J, Eyles J. Evaluating qualitative research in social geography: establishing "rigour" in interview analysis. *Trans Inst Br Geogr*. 1997;22(4):505-525. doi:10.1111/j.0020-2754.1997.00505.x

108:

Giordano GN, Lindström M. Trust and health: testing the reverse causality hypothesis. *J Epidemiol Community Health*. 2016;70(1):10-16. doi:10.1136/jech-2015-205822

109:

Public Life and Urban Justice In NYC's Plazas. New York, NY; 2015. [Reference](#).

110:

Advocates for Privately Owned Public Space - MAS. [Reference](#). Accessed April 26, 2018.

111:

Heroux J, Norris T, Rube K, Nadimi V. *The Case for Healthy Places*. American Public Health Association; 2016. [Reference](#). Accessed April 26, 2018.

112:

Clark CJ, Guo H, Lunos S, et al. Neighborhood cohesion is associated with reduced risk of stroke mortality. *Stroke*. 2011;42(5):1212-1217. doi:10.1161/STROKEAHA.110.609164

113:

Gordon-Larsen P, Nelson MC, Page P, Popkin BM. Inequality in the built environment underlies key health disparities in physical activity and obesity. *Pediatrics*. 2006;117(2):417-424. doi:10.1542/peds.2005-0058

114:

U.S. Department of Health and Human Services. Healthy People 2020: Social Determinants of Health. [Reference](#). Accessed February 7, 2018.

115:

Kim ES, Park N, Peterson C. Perceived neighborhood social cohesion and stroke. *Soc Sci Med*. 2013;97:49-55. doi:10.1016/j.socscimed.2013.08.001

116:

Chuang Y-C, Chuang K-Y, Yang T-H. Social cohesion matters in health. *Int J Equity Health*. 2013;12(1):87. doi:10.1186/1475-9276-12-87

- 117:**
NYC Planning - Privately Owned Public Space. [Reference](#). Published 2009. Accessed April 26, 2018.
- 118:** NYC Department of Planning. Zoning Districts and Tools: Privately Owned Public Spaces. [Reference](#). Accessed April 26, 2018.
- 119:**
Robert Wood Johnson Foundation. *From Vision to Action: A framework and measures to mobilize a culture of health*; 2016. [Reference](#).
- 120:** Rossin-Slater M. Maternity and Family Leave Policy. National Bureau of Economic Research. 2017. [Reference](#).

INNOVATIONS

Innovation features pave the way for projects to develop unique strategies for creating healthy environments.

Innovation features address a novel concept or strategy not already included in WELL or achieve results above and beyond the existing requirements in a WELL Feature. Projects may receive up to 10 points in Innovation.

Projects should use Feature I01: Innovate WELL to submit innovation proposals. This feature provides guidelines on the requirements that must be met in order for an innovation proposal to be considered for approval. Other Innovation features represent strategies pre-approved by IWBI.

I01 INNOVATE WELL | O (MAX: 10 PT)

Intent: Promote the continuous evolution of WELL by encouraging projects to go above and beyond existing WELL feature requirements or to propose a new intervention that addresses health and well-being in a novel way.

Summary: As the scientific understanding of health continues to evolve, so too does the ability to address the complex issue of promoting health and well-being through building design and operations. In addition to supporting projects that go above and beyond current feature requirements, WELL embraces novel approaches to creating healthy spaces.

Part 1 Propose Innovations (Max: 10 Pt)

For All Spaces:

The proposal meets the following requirements:

- a. Positively impacts project occupants or the general public through one of the below:
 - 1. Goes above and beyond the current requirements of an existing WELL v2 feature.
 - 2. Relates to health and wellness in a novel way that is not covered in WELL v2.
- b. Substantiated by existing scientific, medical and/or industry research.
- c. Consistent with applicable laws and regulations and leading practices in building design and operations.

Note: Projects must submit a narrative describing the details of the proposal and all supporting documentation and research through WELL Online.

I02 WELL ACCREDITED PROFESSIONAL (WELL AP) | O

(MAX: 1 PT)

Intent: Recognize projects that engage a WELL AP to support the WELL certification process.

Summary: The WELL Accredited Professional (WELL AP) credential denotes expertise in WELL and a commitment to advancing human health and wellness in buildings and communities. The presence of a WELL AP on a project team can benefit project planning and achievement efforts by streamlining the WELL application and certification process.

Part 1 WELL AP (Max: 1 Pt)

For All Spaces:

At least one member of the project team:

- a. Has achieved the WELL Accredited Professional credential.
- b. Maintains accreditation until project's initial certification is achieved.

Note: Projects must submit proof of an active credential through WELL Online.

I03 EDUCATE WELL | O (MAX: 1 PT)

Intent: Promote on-going education about WELL by encouraging projects to offer building tours and educational components highlighting WELL features pursued for certification.

Summary: Increasing awareness about healthy buildings is a central part of WELL's mission. Education on WELL is best showcased by inviting individuals into the physical project space and highlighting the WELL features pursued. To receive credit for this Innovation, projects must provide tours of the space as well as implement education strategies that enable building occupants and visitors to learn more about the impact of built spaces on their health and well-being.

Part 1 Offer WELL Educational Tours (Max: 1 Pt)

For All Spaces:

Projects meet the following requirements:

- a. Projects provide free tours of the WELL Certified space. Tours may be offered on a pre-determined schedule or upon request and achieve the below:
 1. Offered at least six times per year.
 2. Attended by at least 50 people per year.
- b. Projects include at least two WELL educational components alongside the tours (e.g., permanent signage highlighting WELL features, a case study about WELL Certification, a newsletter or other printed/online publication featuring occupant engagement with WELL).
- c. Projects describe at least one way in which availability of tours is advertised (e.g., project website, signage, social media).

Note: Projects must provide IWBI with the tour script and tour destination descriptions (including at least one destination per WELL concept) as part of their documentation. Projects must also submit tour schedules and attendee lists annually through WELL Online.

I04 GATEWAYS TO WELLNESS | O (MAX: 1 PT)

Intent: Recognize projects that have taken meaningful steps toward deeper commitments to health and wellness.

Summary: Organizations build a culture of wellness in different ways. For some, it starts at the top with a commitment from leadership to enact change. For others, it's borne out of grassroots initiatives, gaining momentum from the ground up. While every organization travels a different path, there are a variety of independent programs and initiatives on offer to support an organization's journey. IWBI awards an Innovation point to projects that participate in wellness programs that act as gateways to deeper commitments.

Part 1 Complete Health and Wellness Program (Max: 1 Pt)

For All Spaces:

Within the last three years, the project has completed an independent health and wellness program or initiative that meets the following requirements:

- a. Addresses a minimum of three WELL Concepts.
- b. Primary goal is to advance the health and well-being of individuals or communities.
- c. Includes transparent development, rating and scoring or evaluation.
- d. Based on supporting scientific, medical and/or industry research.
- e. Viewable online at no cost.

Note: This Innovation point is only available to projects pursuing certification for the first time. Projects must submit proof of completion or achievement through WELL Online. Projects can document participation in multiple programs that collectively address three or more WELL Concepts but may only receive one point under this Innovation. A list of health and wellness programs and initiatives that have been evaluated by IWBI and found to meet the above criteria can be found at <https://v2.wellcertified.com/resources/preapproved-programs>.

I05 GREEN BUILDING RATING SYSTEMS | O (MAX: 5 PT)

Intent: Recognize projects that have achieved certification under leading green building rating systems.

Summary: WELL aligns with leading green building rating systems and recognizes projects that balance a commitment to environmental sustainability with a commitment to human health. Policies that reduce the environmental impact of buildings contribute to the advancement of human health at the building and community scale. The environment itself can act as a mechanism to promote and reinforce health by providing fresh air, clean water, affordable and accessible food and green spaces for physical activity and social connection. By balancing sustainability and human health considerations, both people and planet can thrive.

Part 1 Achieve Sustainable Building Certification (Max: 5 Pt)

For All Spaces:

The project has achieved certification for a green building rating system that meets the following requirements:

- a. Primary goal is to advance sustainability and green practices in built spaces.
- b. Demonstrates leadership and innovation.
- c. Includes transparent development, rating and scoring processes.
- d. Undergoes third-party review to confirm achievement.
- e. Based on supporting scientific, medical and/or industry research.
- f. Viewable online at no cost.
- g. Addresses at least three of the objectives below:
 1. Reduce contribution to global climate change.^[1]
 2. Enhance individual human health, well-being and vitality.^[1]
 3. Protect and restore water resources.^[1]
 4. Protect, enhance and restore biodiversity and ecosystem services.^[1]
 5. Promote sustainable and regenerative material resource cycles.
 6. Build a greener economy.^[1]
 7. Enhance community through social equity, environmental justice and quality of life.^[1]

Note: Projects receive the full five points in Innovation for pursuing a green building rating system that meets the above criteria. Projects cannot receive more than five points for pursuing additional green building rating programs. Project must submit proof of achievement through WELL Online. A list of green building rating systems that have been evaluated by IWBI and found to meet the above criteria can be found at <https://v2.wellcertified.com/resources/preapproved-programs>.

APPENDIX CORE 1:

The WELL Core Applicability Matrix provided below identifies the applicability of features for WELL Core projects. WELL Core projects must achieve all preconditions and a minimum of one point per concept and no more than 12 points per concept.

In some cases, WELL Core projects have additional point-earning opportunities for extending benefits to tenants. In all such cases, the WELL Core project is eligible for a single additional point, regardless of any tiered points within the feature language.

Applicability designations are defined as follows:

- Whole Building: All areas within the project boundary.
- Extent of Developer Buildout: Includes all non-leased space and all construction within the leased space for which the project team is responsible.
- Leased Spaces: All areas within the project boundary that are leased to or owned by tenants.
- Non-leased Spaces: All areas within the project boundary that is not considered leased space.
- Building management staff: Individuals responsible for maintaining and operating the building, including contractors and sub-contractors.
- Direct staff: Building staff under direct employ.

[Download the WELL Core Applicability Matrix](#)

APPENDIX VERIFICATION METHODS:

The WELL v2 Verification Submittal Requirements table provided below indicates the verification method and relevant documentation (as applicable) required for all parts of WELL features.

Performance tests must be conducted by a performance testing agent approved by GBCI. All other documentation should be submitted directly from the project through WELL Online.

If a field is left blank, that means the project is not required to submit any documentation of that type. If a signatory is listed under "(OR) LOA", then that means the project may submit a letter of assurance signed by that signatory in place of the signatory identified under "LOA". If a signatory is listed under "(AND) LOA", then that means the project must submit a letter of assurance signed by that signatory as well as a letter of assurance signed by the identified under "LOA".

Verification methods or submittal requirements may vary based on the pathways chosen by the project in pursuing achievement of a given feature.

[Download the Submittal Requirements](#)

REFERENCES

1: U.S. Green Building Council. LEED v4 Impact Category and Point Allocation Development Process.

