LEED: A Set-up For Sick Buildings? Is LEED Diamond the Answer?

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Introduction

LEED certifications do not protect the most vulnerable building occupants from indoor air contaminants, such as chemicals, particles, allergens, and microbes. Although Indoor Environmental Quality requirements are part of LEED and points can be earned by taking additional measures that can improve Indoor Air Quality (IAQ), the designation of LEED (silver, gold, or platinum) is, in and of itself, insufficient to protect the most vulnerable building occupants. A new designation, perhaps "LEED Diamond," should be introduced with mandatory criteria to ensure excellent IAQ and protect all building occupants.

Who is most vulnerable?

Children, pregnant women, and more susceptible adults (people with asthma, allergies, or chemical intolerance). At any given time, of 100 people, 3 are pregnant or will become pregnant within a year, 7 are children under the age of 5 (another 17 are still under the age of 18 and the brain continues to develop into the early 20s!), 7 have asthma, 20 have allergies, and 15 are chemically intolerant.

Why is indoor air now more important than ever?

Ninety percent of Americans spend 90% of the day indoors (home, school, office, vehicles). Since WWII, there has been an exponential increase in the production and use of synthetic organic chemicals in the United States (Figure 1). These chemicals have found their way into our interior spaces, e.g., architectural finishes, furnishings, fragrances, cleaning chemicals, and pesticides (Figure 2).

Figure 1. Synthetic organic chemical production

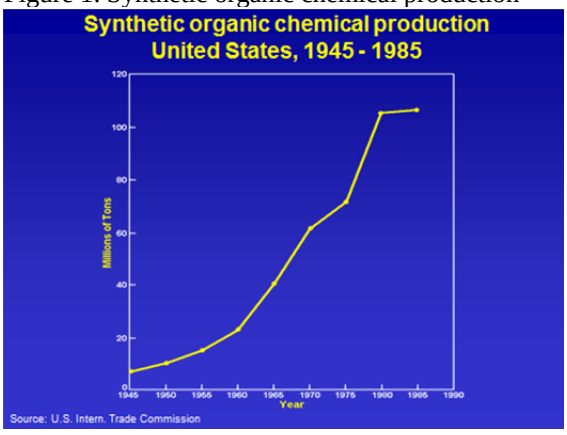
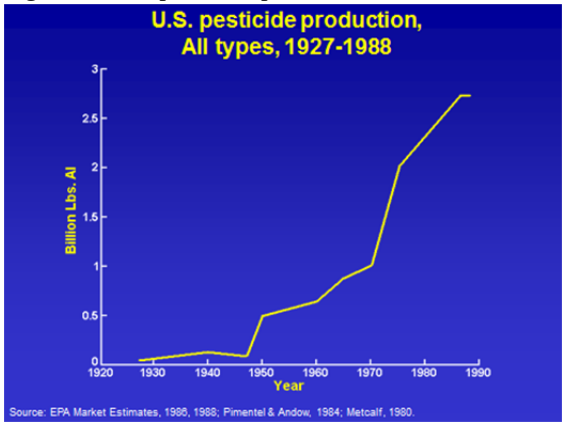


Figure 2. U.S. pesticide production



Many of these chemicals are evolutionarily novel substances, some of which we are unable to metabolize or eliminate. Following the oil embargo of the 1970s, energy conservation efforts led to a decrease in fresh air entering homes and commercial

buildings (Figure 3). The result of these two trends is that indoor air contains hundreds of volatile organic compounds (VOCs)—far more than in outdoor air (Figure 4).

Figure 3. Historical of ventilation standards

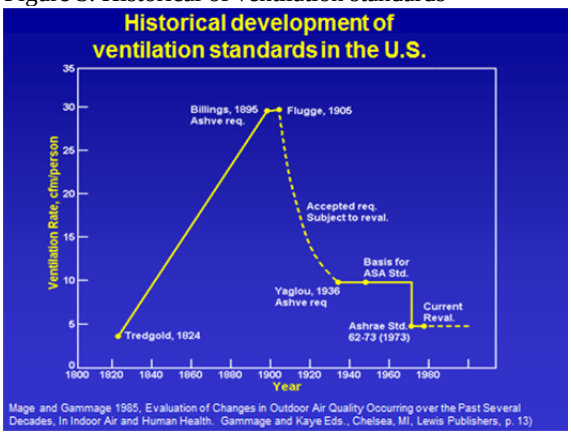
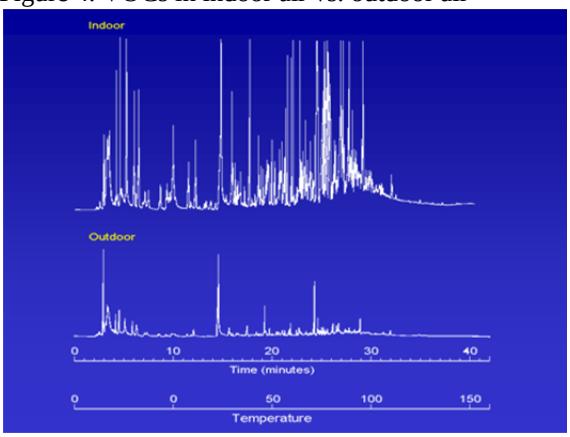


Figure 4. VOCs in indoor air vs. outdoor air



How can indoor air contaminants affect the health of vulnerable individuals?
Risks of chemical exposures for pregnant women are increasingly well-documented through animal studies and epidemiology. Neurodevelopmental disorders such as autism are rising in prevalence (Figure 5). Pesticides, the presence of vinyl flooring and other air contaminants have been linked to autism. Chemicals may affect fetal development as early as the first month of pregnancy, and truly "safe" levels of exposure cannot be established given multiple critical developmental stages, combined with wide-ranging differences in individual genetic susceptibility. People with asthma and allergies suffer symptoms when their threshold for reactivity is exceeded and less than optimal IAQ can significantly affect these individuals, absences from work or school, emergency room visits, medications, productivity, and quality of life. Many conditions may be influenced by IAQ (Figure 6). Note that difference people in the same building may have different symptoms or conditions that are affected by indoor air, e.g., asthma, autoimmune disease, migraine, sinusitis. Frequently, chemical intolerances underlie many of these conditions.

Figure 5. Rising prevalence of autism

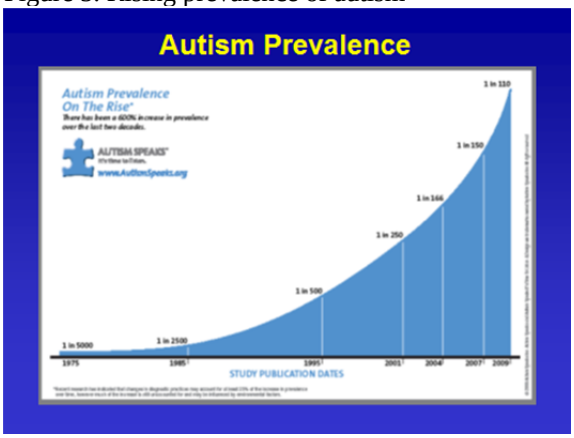
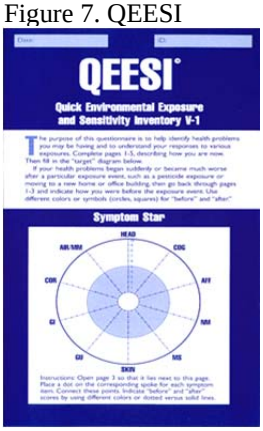


Figure 6. Conditions associated with poor IAQ

What is chemical intolerance?

Chemical intolerance is quite common, affecting from 5 to 15% of the population. We now prefer the term chemical intolerance to terms like "Multiple Chemical Sensitivity," which are problematic in the medical community. This is because "sensitivity" implies an immunologic sensitization involving IgE, and, in general, chemical intolerance is not due to allergic sensitization. Health practitioners and individuals can use the Quick Environmental Exposure and Sensitivity Inventory (QEESI), available online at no charge at www.chemicalexposures.org, to gauge how chemical exposures may affect health and daily life (Figure 7). In many cases, chemical intolerance affects people's ability to use public buildings, attend church, school, or work, and can even drive people from their own homes. Chemical intolerances are the hallmark symptom of a larger underlying dynamic called "TILT" or "Toxicant-Induced Loss of Tolerance."

Figure 7. QEESI



What causes TILT?

TILT is a two-step process involving (1) initiation and (2) triggering. The initiating event, commonly one related to indoor air, causes a fundamental loss of prior, innate tolerance (Figure 8). Remodeling exposures, pesticide exposures, mold, and sick buildings are common initiating events (Figure 9).

Figure 8. TILT theory of disease

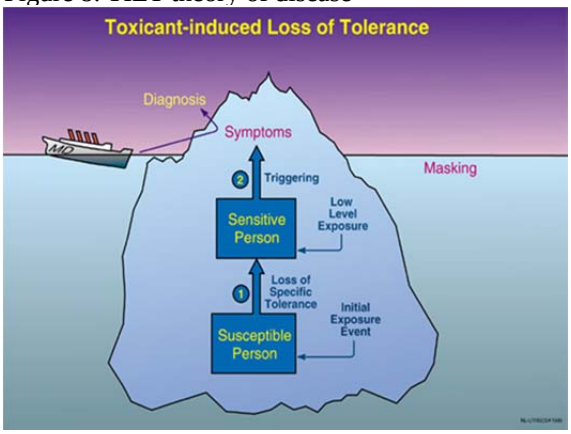
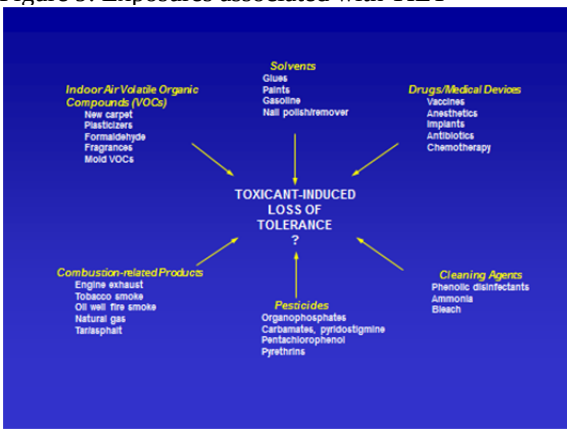


Figure 9. Exposures associated with TILT

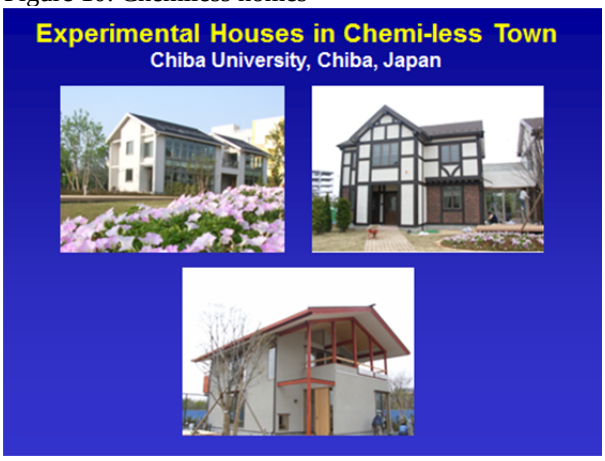


Following initiation, symptoms may be trigged by a wide-range of exposures, which commonly include indoor air contaminants. The TILT theory of disease is based on observations of groups of people in over a dozen industrialized nations where, following a well-documented exposure event, a subset of exposed individuals report new onset intolerances. Chemical intolerances are common, as are new intolerances to foods, medications, alcoholic beverages, and caffeine. These intolerances to substances that are structurally/chemically dissimilar to one another cannot be explained by classical allergy or toxicology, yet they are clearly documented. This compelling anomaly led to the Toxicant-Induced Loss of Tolerance or TILT theory.

Why should architects design buildings for the most vulnerable individuals?
If you protect the most vulnerable people, you will protect everyone. Regrettably, because LEED designations are not designed to ensure excellent IAQ, susceptible individuals may get sick when they live, work, or go to school in a LEED building. A new designation, such as "LEED Diamond," could combine the best practices for sustainable, energy efficient building construction and operation with state-of-the-science precautionary approaches for human health. Reasonable and attainable design and practice for excellent IAQ would build on current criteria such as control of environmental tobacco smoke. However, future criteria should extend to providing sufficient fresh air, minimizing use of outgassing materials and furnishings, adopting safe cleaning practices, and guidelines for occupant behavior such as no use of fragranced products.

Conclusion
In Japan, the largest home manufacturer (Sekisui House, Ltd.) is placing a priority on IAQ, side-by-side with sustainability and energy efficiency (Figure 10).

Figure 10. Chemiless homes



LEED designations influence the entire U.S building industry. A LEED Diamond designation would have the potential to protect the health of current and future generations. Buildings account for 40% of our energy consumption and 90% of the air we breathe. Someday, we will look back at how we constructed and operated our buildings and realize that we should have paid far more attention to IAQ. At that time, it will be clear what we should have done long ago—design for the most vulnerable individuals in our population—at least 1/3 of the population—will protect everyone. Protecting the most susceptible people will protect everyone.

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