

WISCONSIN'S HEALTHIEST HOME

At Dimension Design, Build, Remodel Inc., we have made healthy indoor environments a central focus for all our new home and remodeling projects. In 2018, we set out to build one of the healthiest homes ever built in Wisconsin and the United States. With the help of our design/build team, we completed our healthy home in Sussex and had it tested by Wisconsin's number one building biologist, Martine Davis, owner of Indoor Environmental Testing Inc. Ms. Davis evaluated the three major indicators of quality indoor air: Volatile Organic Compounds (VOCs), particulates, and bioaerosols. The results were incredible and even exceeded our expectations on what we could achieve in a new home construction project.

In order for us to achieve these outcomes, we initially had to understand what makes a typical home unhealthy to live in. While some issues are obvious, some are not. Nevertheless, they greatly impact our health and that of our families. In order to truly build a home of this caliber, you must first understand the problem, where it comes from, and how to solve it. So let's start with the problem.

Modern day culture has many benefits. But all too frequently convenience and costs are exchanged for health. It is true with food and it is equally true for the homes we live in. Maintaining a truly healthy lifestyle involves eating well, exercising, and sustaining that lifestyle in a home that is healthy to live in. Most people assume their homes are healthy to live in. After all, if you can't see it, smell it, or touch it, how can you know it is there or it is even a problem unless you have some immediate health issue, which many do. It can be difficult to make a connection to our indoor environments as a culprit or even a means to a solution unless you test for it.

We have gotten really good at creating energy efficient homes. However, this had led to homes that are tight and do not breathe, so harmful air environments stay trapped inside our homes. Couple that with inferior mechanical systems that cannot help or may even make it the situation worse. You now have a recipe for very poor indoor air quality. Plus, if the home's exterior shell is not built properly, water can enter the structure and mold problems can develop, which can be devastating to families. The compound effect of all these chemicals, molds, dust, etc. off gassing and floating around in our homes can be damaging, causing short- and long-term health issues. Even worse, it can be hard to correlate these issues with our own homes unless we have them tested.

Let's define what the makeup is for healthy indoor air. As we stated, it is divided into three parts – VOC's, particulates, and bioaerosols.

VOC's, made up of odors and gases in the home, come from many things, including...

- carbon monoxide
- tobacco smoke
- toxic mold
- pesticides
- plywood
- particle board
- wood paneling
- carpet and pads
- insulation
- paints
- finishes
- solvents
- adhesives
- synthetic fabrics
- cleaning products
- body care products
- mothballs
- insecticides
- aerosol products
- art and hobby materials
- dry cleaned garments
- air fresheners

As you can see from the list, one of the biggest violators is the building supplies and finishes used in home construction and remodeling. According to the EPA, there are now more than 88,000 chemicals in common use, many that have been associated with birth defects, reproductive disorders, and neurological behavior problems. Unfortunately, many of those same chemicals are used in the materials and production of our homes. One of the most prevalent chemicals found in building materials, among other things, is formaldehyde. Its use is based on the desire to make things cheaper to produce and more durable, so they last longer. Those are good things until you consider the impact on our health. Regrettably, that is rarely considered by consumers unless they have directly related health issues that impact their quality of life. These chemicals will continue to off gas into our homes for many years after it is built.

Particulates or particle matter (PM) are divided into two categories – PM 10 and PM 2.5. PM 10 is the larger particles 10 microns and smaller. PM 2.5 is finer particle matter 2.5 microns and smaller. For comparison, the average human hair is 50-70 microns.

Particle matter is a complex mixture of soot, smoke, metals, nitrates, sulfates, dust, water, rubber, etc. They are so small they act as a gas. You can't see them through the naked eye and some are so small that they cannot be detected unless specialized equipment is used. A number of health impacts have been associated with exposure, including premature mortality, increased hospital admissions for heart and lung issues, acute and chronic bronchitis, and asthma attacks to name a few. They especially can affect infants, children, and older adults. Fine particles pose the greatest health risk, as they can get deep into lungs and even the bloodstream, plus impact the heart. Coarse particles irritate the eyes, nose, and throat. Both occur by both human and natural sources, which can be primary or secondary, such as auto emissions, dust from construction, cooking smoke, and smoke from fire.

Bioaerosols are living things that consist of bacteria, viruses, mildew, and mold. They may be allergens and cause respiratory reactions and ailments, some of which can be life threatening. Mold spores are probably the most common bioaerosols. They occur naturally in the environment but can also occur inside the home due to improper construction techniques or a failure of the home's exterior weatherization or foundations walls and an interior leak in a water pipe. The home's mechanical systems must also be able to control humidity levels, as humidity above 58% promotes mold growth inside the home. It is important to keep the humidity inside homes between 30-50% for optimum occupant health.

A lesser known and highly controversial "potential" health hazard in homes is electromagnetic fields (EMFs). Some people claim to have significant health impacts from increased EMFs. Given that, it is important enough that we addressed ways to lessen the overall EMF inside our healthy home to minimize its potential impact on human health. As more studies come out, we are finding this to be more of an issue than once believed.

So let's dig into the test results (see attached) for our Sussex home. The test consisted of measuring the following:

- HCHD (Formaldehyde)
- Total VOC's
- Carbon Dioxide (CO2)
- Relative humidity (RH)
- Particulates (PM 10 and PM 2.5)
- Mold present (14 different types)

Formaldehyde: the World Health Organization recommends levels less than 80 ppb (parts per billion). The average new home construction project has 160-180 ppb with some in excess of 300 ppb. **Our healthy home had readings between 0-10 ppb.**

Total VOC's: The recommended level per the US Green Building Council is 500 ppb or lower. The average new home construction project is around 1900 ppb. Below 200 ppb is considered ideal. **Our healthy home reading is 180 ppb.**

CO2 (Carbon Dioxide): This is a measure of fresh air/oxygen which is an indication of proper home ventilation. The average new home is between 800-1800 ppm (parts per million) depending on how tight the home is. **Our healthy home had readings between 494-660 ppm.**

RH (Relative Humidity): Mold growth begins at 58% relative humidity. Anytime the surface relative humidity stays above 58% for more than 48 hours, mold growth begins. It is important to monitor this year-round. Optimal levels of humidity inside the home are recommended between 30-50%. **Our healthy home measured RH between 44.5-47.8%.**

Particulates (PM 10 and PM 2.5): The Environmental Protection Agency recommends PM 10 max level at 150 ug/m³ and PM 2.5 at 35 ug/m³. **Our healthy home PM 10 level was between 5-20 ug/m³ and PM 2.5 between .2-.6 ug/m³.**

Total Mold VOC's: There were a total of 14 mold varieties tested for in our home. Some naturally occur in the environment. Some are indicators of problems within homes. There are no standards set but typically levels below 6 ng/l indicate a minimal amount of mold growing inside the home. Levels between 6-20 ng/l indicate a low level of mold is present and people sensitive to mold may be affected. Levels below 3 ng/l indicate levels that will not typically affect even hypersensitive individuals. **Our healthy home tested at below 1 ng/l, suitable even for those most sensitive to mold. The main mold DNA found, Cladosporium, is the most common and prevalent mold found outside on grass and trees and is found in every household.**



"All air quality parameters collected in this residence substantially surpassed expectations. The low levels of VOCs, Formaldehyde, particle counts and EMF levels are unprecedented and very difficult to achieve in new construction which makes this home well-suited for anyone with environmental sensitivities or for discerning individuals who understand the significant benefits of such a home on health and well-being."

Martine Davis, Indoor Environmental Testing Inc.

The results found here were carefully planned and part of a bigger process. Any one of those parts of the process alone is not enough to obtain these results. It takes a team of designers, engineers, project managers, vendors, and tradespeople all communicating and working together. The importance of material selection in both the rough and finish stages as well as properly designed electrical and mechanical systems all play a vital role. Typical builder grade construction will not achieve these results.

It is important to remember however that it is not about complete elimination of these harmful elements. The goal is to reduce the overall footprint of the VOC's, particulates, and bioaerosols, then manage what is left with the proper mechanical systems. This is not an all or nothing proposition. Although there can be an added cost associated with building using these methods, doing everything we did in this home is not necessary to achieve a significant level of improvement as it relates to standard builder grade construction practices. There are many things that can be done that do not have large cost impacts but can significantly impact a home's health. This process can also be adopted to addition and remodeling situations with significant positive impacts on the health of your home environment that will positively impact you and your family now and in the future.

For more information, please visit our website at www.dimension-dbr.com or call us at 262-402-6602.

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