

Design for Health



EcoNest Home in Pecos, New Mexico. Photo credit: Laurie Dickson



EcoNest Architecture
Healthy Home Design & Consulting

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Design for Health

We have written an expanded version of this topic as a course, [Designing a Home for Multiple Chemical Sensitivities](#), for the Building Biology Institute. Architects can take this course and quiz for 20 Continuing Education Units (CEUs).

Introduction

Everybody deserves to have a healthy home that is free from harmful chemicals, is resilient against mold and is built to minimize electromagnetic field exposures. Healthy design and construction is crucial for those with Multiple Chemical Sensitivities (MCS) but all homes should be built with careful consideration of the health impacts on the occupants regardless of their health/sensitivity status.

Unfortunately, current conventional building practices fall short in addressing harmful chemicals and often fail to prevent mold. As designers and builders become more aware, the gap between conventional and healthy construction is narrowing with respect to chemicals and mold but many designers and builders are not even aware of the need for electromagnetic safety.

Even with growing general awareness, for those suffering from acute or chronic sensitivities, finding a home that will be good enough for them to regain their health in can be as difficult as looking for a needle in a haystack.

The selection of the design/build/consulting team, the site, and the choice of the building systems, protocols, and products are all essential to achieve a healthy home. These guidelines include additional protocols that are crucial in creating a home that can be a healing sanctuary for someone who has severe sensitivities or chronic illness.

Setting realistic expectations at the outset of any project is very important and often very disconcerting to someone struggling with environmentally induced chronic illness. Building a home that is healthier than most conventionally built homes is an easy task, but it is not a guarantee that, even with the best of efforts, a new home will be immediately inhabitable by someone with acute sensitivities. There is a lot that is currently still unknown including accurate health information about the majority of chemicals and the exact medical basis behind severe sensitivities.

Building a home that is healthier than most conventionally built homes is an easy task, but creating a home that is safe for a sensitive person is much more challenging.

At best a committed team can work with the information that is known, in partnership with the sensitive individual and their support team. (We will use SI as an abbreviation for “Sensitive Individual” throughout the rest of this document.)

In building a healthy home, the Owner will be responsible for making a myriad of timely decisions which can be stressful even for healthy individuals who have full energy.

While a healthy home expert can provide a list of potential products for each of the hundreds of choices needed based on a product’s chemical profile and previous track record only the SI can determine which of those choices is the best for them. There is no single formula that can universally meet the needs of all people who suffer from MCS because everyone is unique in their sensitivities.

Building the Right Team - a Collaborative Approach

The process of designing and building any home is a very complex one.

In building a home for someone with MCS, who may feel unwell, whose very survival may depend on the outcome and who will require non-conventional materials and protocols, new layers of complexity are added. Although this all sounds impossibly daunting, we have seen many new build projects for environmentally sensitive clients go very smoothly and successfully despite the many hurdles, in large part because of the dedication and collaboration of a good team with a common vision. There must be the skill and commitment from the Architect, General Contractor, and Owner to work together collaboratively and respectfully.

The SI, who is the expert in their own sensitivities, must be an integral part of the process. The team may be expanded to caregivers, medical professionals and consultants who are experts in various aspects of healthy housing from materials specification to testing.

Building a healthy home involves consultants that must be integrated into the team. The team includes some or all of the following members, although one person may be qualified to perform several of these tasks:

- The Architect or Designer
- The General Contractor
- The Healthy Home Consultant

A Healthy Home Consultant can work collaboratively with the architect and prepare written materials and protocols for a health home.

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- An Owner's Advocate, if required
 - An Electromagnetic Radiation Specialist (EMRS)
 - A Building Envelope Specialist

Long before you break ground, your home will be built on paper. This is your first opportunity to choose the materials that your home will be made of and to include certain features in the design that will serve your health.

Finding the Right Site

Before a healthy building can be planned careful site assessment is required to assure that the proposed site is one that will support health. Anyone, regardless of their current state of health, who wishes to purchase a home site should perform due diligence to avoid phenomena that could lead to expensive or problematic construction. These could include unfavorable soil conditions such as clay soils, high water tables, radon gas, climatic conditions such as flood and fire hazards and unfavorable microclimates (high wind, dampness, erosion etc.).

For those with MCS, mold, and electro hypersensitivity, there are a number of additional factors to be evaluated which can greatly affect the success of the home to support their health.

Air Quality

The more unpolluted the better. The EPA publishes yearly [Air Quality Index summaries](#) so you know what to expect on an annual basis, how conditions have changed over time, and historical trends. Some things to avoid include areas that are near industrial plants, properties that use pesticides, large parking lots or traffic corridors.

Light and Noise Pollution

Evaluate levels of noise pollution at different times of day and night. Visiting the site at night will help determine if there are sources of night sky pollution generated by surrounding lighting.

Water Quality

So-called "potable" water may contain radon, pesticides, chlorine, e-coli, and a host of other contaminants. Water can become contaminated by ingredients intentionally added to disinfect it, by not being sufficiently treated, or by contaminants present in the delivery system. If well water is

used onsite, the water should be tested. If municipal water is used, the [Environmental Working Group \(EWG\)](#) maintains a database of annual municipal water test results and has more stringent thresholds for the various potential pollutants.

Existing Electro-climate

Avoid proximity to high-voltage power lines, microwave relay stations, and cellular phone and broadcast towers. As a rule of thumb, distances of one-tenth mile from high-voltage power lines and one-half mile from microwave cellular and broadcast towers are adequate. Hire an EMRS to measure the impact of surrounding EMR sources on the building site.

Past and Future Pollution Potential

Past industrial or farm uses may warrant soil and water testing for potential pollutants such as pesticides that could be present in the soil or water. Find out how land use may change in the future. A zoning study may reveal that the land use patterns may change in the future to include undesirable densities or activities.

Geopathic Stress Zones

These are invisible zones that lie beneath the earth's surface. They occur over geophysical disturbances such as underground water ways, ore deposits or caverns. Traditionally these stress zones are detected through dowsing but can be detected on specialized equipment such as a Geo magnetometer. Geopathic stress zones should be avoided especially around sleeping areas.

Choosing the Right Building System

The building envelope (foundations, walls and roofs of our home) is meant to protect us from the elements. We will primarily address wall systems and options.

The challenge is to exclude as much moisture as possible whether it is from the outdoor climate (rain, snow, humidity) or from occupant generated moisture on the inside without trapping moisture within any part of the wall assembly. Moisture trapped in walls often goes undetected and is one of the leading causes of mold and mold illness.

The founders of Building Biology have identified several characteristics for an ideal health-supporting building system. These characteristics include:

Long before you break ground, your home will be built on paper. This is your first opportunity to choose materials and features that will serve your health.

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- Mass walls
 - Transparency to moisture, often called “breathable walls” or “flow through” wall systems
 - High hygric buffering capacity with the ability to take and release large amounts of moisture without producing mold or any other moisture related issues
 - No synthetic vapor barrier
 - Natural finishes inside and outside
 - A good roof overhang and a well elevated earth-coupled foundation i.e. avoiding crawlspaces and basements in favor of slab-on-grade construction

Wall systems that are currently available in North America that meet the above Building Biology criteria include:

- Light Straw Clay, Hemp Crete and other natural fiber and clay or lime techniques
- Predominantly clay soil techniques such as adobe, compressed earth blocks, cob, and rammed earth
- Industrially made masonry products including wood insulated concrete forms (Faswall and Nexcem) and aerated autoclaved concrete blocks (AAC)

The simplicity of these systems, robust resistance to mold, solidity, absence of harmful chemicals and aesthetics make them a very attractive alternative. Mass walls can also play a significant role in blocking some electromagnetic frequencies from the outdoor environment and have excellent acoustic properties.

In contrast to our European counterparts the benefits of these mass wall systems are not well understood in North America, and the industry is not geared to their construction. The initial construction costs are higher, and their superior longevity is not often valued.

Because mass wall systems are not as commonly used, it can be difficult to find experienced builders and the components needed in some parts of the country.

In North America at least 95% of homes are built with light frame wood construction composed of 2x wood stud framing with insulation between the studs.

For these reasons, for some, light frame construction may be the only wall system choice available for a new healthy home. The good news is that Building Science has, over the last few decades, increased our understanding of why buildings fail and how to prevent the failures that commonly lead to health

Mass walls can play a significant role in blocking some electromagnetic frequencies from outside of the home.

failures. Better homes can be built through a deeper understanding of how moisture, air and thermal effects interact with the building envelope. There are now many strategies that can be employed in new homes to achieve a healthier environment with light frame construction than in the past. There are also improved building material options and many architects and contractors who know how to apply these strategies to build a better envelope.

Design Strategies for Health

The following strategies are important consideration for the health of all occupants and of the utmost importance when designing a successful home for a person with MCS.

Design for Moisture Management

Many health problems begin when buildings become moldy. Moisture control begins with good design that includes:

- Site grading that directs all water safely away from the building.
- Attention to every aspect of the building enclosure to ensure that excessive moisture intrusion is prevented, and moisture generated from within the envelope is not trapped and has the ability to dry to the atmosphere on a daily and seasonal basis.
- Generous roof overhangs and protection over door and window openings that will help keep rain and melting snow away from the building and its penetrations.
- A well-designed and detailed perimeter drainage system that will keep basements, crawl spaces, and floor slabs dry.
- Mechanical and passive strategies for evacuating moisture generated from within the building by human activity.
- Placement of floor drains and/or auto shut off valves and detailing so that a water discharge resulting from equipment failure will not have costly and health threatening consequences. All equipment eventually does fail and generally has a shorter life expectancy than the structure.

Design for Combustion Source Management and Safety

The introduction of harmful combustion byproducts into the home poses a serious health threat that can be entirely avoided through proper design and equipment specification. The measures we describe are neither code-required nor commonly found in standard construction.

Create a good hat and a good pair of boots for your home. A well designed and built roof and good perimeter water management is crucial for avoiding moisture problems.

- The mechanical room should be designed so that no exchange of air takes place between it and the living space.
- Consider eliminating all combustion appliances. Any gas appliances should be properly vented to the outside and the home should be supplied with CO monitors.
- All combustion gas sources and moisture generating sources should be well vented directly to the outside.
- The garage should be separated from the living space so that air exchange does not occur between the two.
- A source of fresh air intake should be provided to make up for air consumed in combustion and air exhaust processes so that the home does not become negatively pressurized and pull air from unwanted sources. Intakes for fresh air should be located where there is fresh outdoor air and not from attics, below the structure or from hard to access and hard to clean locations, like under a deck.

Consider a detached garage. A home will be far healthier if you don't drive your car right into it!

Designing to Accommodate the MCS Lifestyle

When designing for a person with Multiple Chemical Sensitivities there are several features that can be “built-in” to the design to accommodate the special needs of a person who is homebound and in recovery from the toxic world “out there.”

Here are some common ones:

Sleeping Porch

Many people with chemical sensitivities crave fresh air and feel the best when they are outdoors. A screened in porch can provide a sanctuary with the comforts of home and the benefits of nature combined. It can also be a great comfort to a sensitive occupant in knowing that if some chemicals have unwittingly been brought into the home, they have somewhere safe to go until the home can be set right again.



Image by Mae Yuuki of EcoNest Architecture.

Sauna

Although not suitable for all, and best used under the guidance of a health care professional, an in-home sauna has helped many people in their detoxification process and to quickly overcome the effects of exposures through travel or other activities outside the home. Having a small unit in the home makes using it convenient and safe. Designing one in is worth considering.

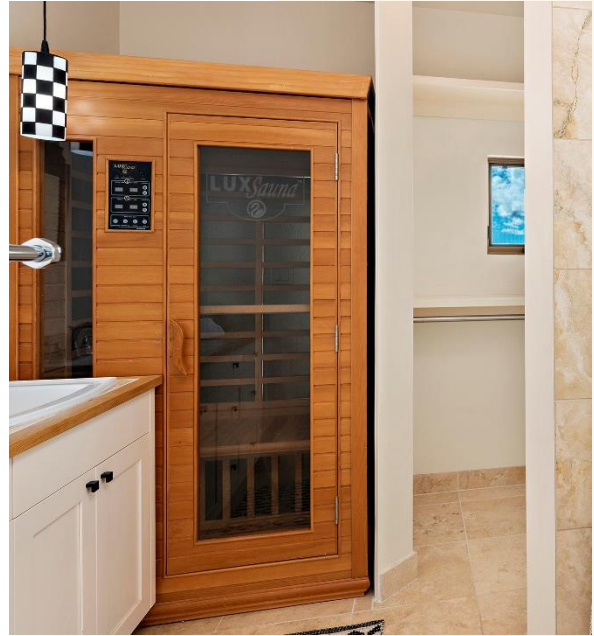


Photo by Marshall Elias. Courtesy of EcoNest Architecture.

Bedroom Sanctuary

The bedroom is the most important room in the home for healing. Much healing occurs while we are asleep.

This room should be designed to:

- have ample cross ventilation.
- have the ability to be darkened at night.
- be zoned for quiet and away from any motorized equipment.
- have a means for turning off all electricity so that the sensitive individual can sleep in a more natural electro-climate while planning for dedicated and shielded circuitry to any special medical equipment. A dedicated circuit at least 8 feet from the bed should remain active for a stand-alone filter.
- have the ability to be easily cleaned with solid surface floors and not wall-to-wall carpeting.
- have ample storage outside of the sleeping room so that it can remain uncluttered. Closets can be located off the bedroom and contain drawers for dresser items.



Image by Mae Yuuki of EcoNest Architecture.

The Owner should plan to furnish it with non-toxic furniture, an organic mattress and bedding and to keep it uncluttered. A

good quality HEPA vacuum and regular deep cleaning are required to rid it of any SVOCs and dust.

Separation of Activities

Cooking

Some people do not tolerate the smell of cooking foods and creating a kitchen area that can be isolated from the other living spaces of the home is a helpful arrangement. For many milder climates and for the warmer months of harsher climates much of the odorous cooking can be done outdoors if a suitable and conveniently located outdoor space is provided.



Image by Mae Yuuki of EcoNest Architecture.

Isolation of possessions

Enclosed and ventilated shelving with glass doors can provide a way for the occupant to keep certain possessions in the home. Often objects like books or music collections are desired but not well tolerated or too difficult to keep dust free. The plastics on entertainment devices like a TV may also offgas too much when in the living space but can still be enjoyed behind glass



Photo by Kaboompics / [Pexels.com](https://www.pexels.com)

Detached storage shed

Some maintenance equipment and products used around the home such as lawn mowers or necessary chemicals should be stored in an area away from the home.



Photo by fietzfotos / [pixabay.com](https://www.pixabay.com)

Shoes off area

A shoes-off policy is a good idea in any healthy home and essential where there are sensitivities to chemicals, mold, or other biological contaminants that can be tracked in on shoes. The design of the home can help or hinder the practice. The best designs create an inviting space where the request for shoe removal is implicit.

Avoiding contamination of the sanctuary from “the world out there”

Some people must be extremely isolated from exposures to chemicals and yet have families or visitors whose clothing will get saturated as they go about their daily activities. Some MCS clients have found it useful to have a dedicated area adjacent to the entrance for showering and changing prior to entering the main living space. A dedicated laundry machine can be in proximity to the entry for washing contaminated clothing.

Air out room

A room that is detached from the home with ample cross ventilation and outlets for stand-alone filters is often useful for providing a sheltered space where objects can be left to outgas before bringing them into the home.

Garage

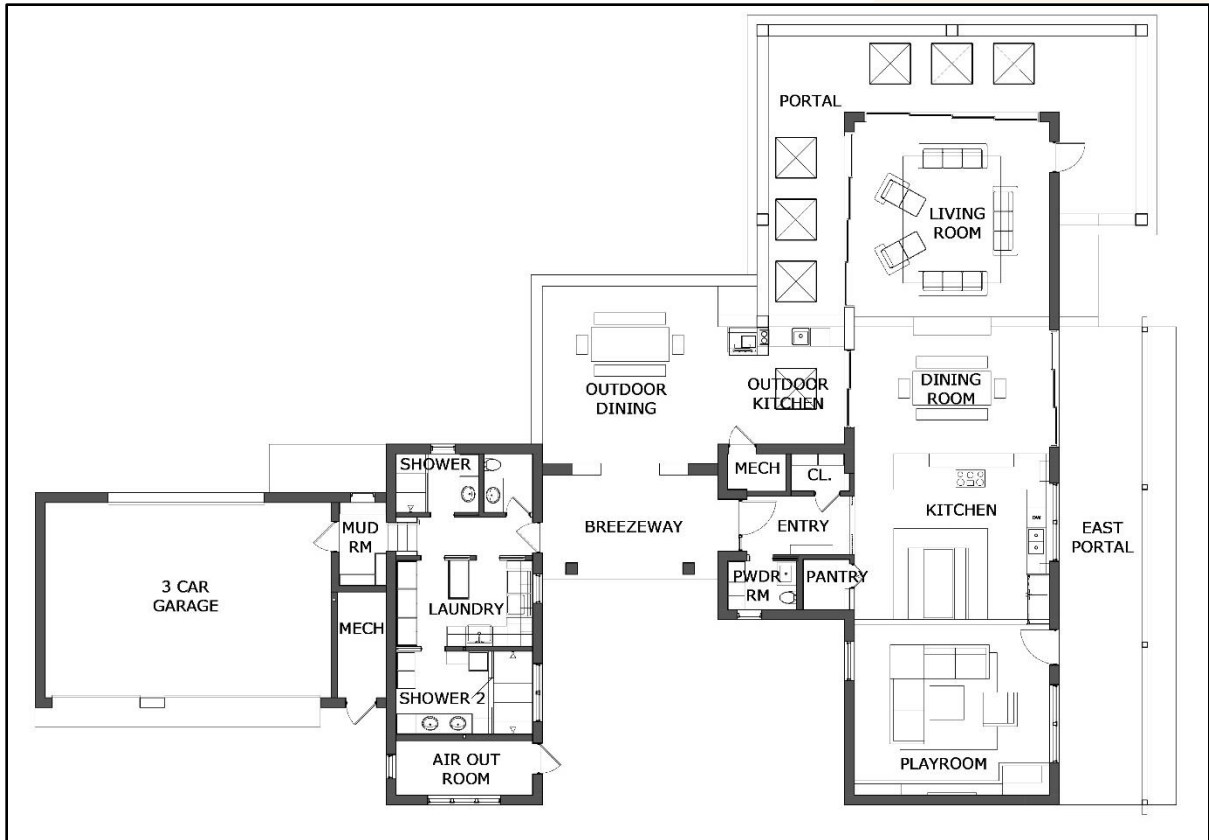
The garage should be a separate building. It can be joined to the home by a breezeway for inclement weather.

Separate Mechanical Room

Mechanical equipment should be located outside of the home envelope and may be attached to the garage provided that equipment is all direct vented to the outside.



*Photo Credit: Laurie Dickson.
Courtesy EcoNest Architecture.*



This home was designed for a family with severe sensitivities to mold and chemicals. The walls and roof are built out of autoclaved concrete. The home is laid out in a series of 4 pavilions joined by a series of breezeways. Two are shown. It has radiant heating and cooling in an elevated slab-on-grade and each pavilion has its own centralized HEPA/carbon air filtration system with fresh air intake that can be dampened down when there is a wildfire/smoke event.

The garage pavilion shown above contains an isolated mechanical room and air-out room. The family showers en-route from the garage to the home and changes into clean clothes to prevent cross-contamination in the home. Their street clothes go directly into the laundry. The garage and mechanical rooms are separated from the home. An isolated air out room is included for products that need to fully outgas before bringing them into the home.

There is an outdoor kitchen and extensive covered living and entertainment space outside of the building envelope.

Courtesy EcoNest Architecture.

Choosing Safe Materials

Interior finishes that cover large surface areas and the Owner's furnishings will have the biggest impact on the indoor environment and most of what is called "healthy building" pays attention only to these. When designing a home to be an MCS sanctuary, attention to all materials is merited because each of the hundreds of products seen and hidden behind the

walls can have a small impact which can add up to too much impact for the highly sensitive.

There is a good reason why people with MCS have difficulty finding already built homes that they can tolerate. Standard building materials commonly used in new construction include:

- insecticides, mildewcides, herbicides, and other biocides found in building materials or applied onsite.
- composite wood products that are bound with formaldehyde-emitting glues, including particleboard, chipboard, plywood, and manufactured sheathing.
- building products, finishes, cleaning products, and additives that emit harmful VOCs, including solvent-based paints, sealants, finishes, and adhesives.
- building products containing fire retardants, plasticizers, and other sources of SVOCs.
- asphalt and products containing asphalt, including impregnated sheathing, roofing tars, and asphalt driveways.
- building materials contaminated with mold.
- floor materials that are absorbent, hard to clean and maintain, and require frequent replacement (such as carpeting).

There are 5 strategies for reducing the chemical load in a healthy home. In order of effectiveness, these strategies are:

Elimination

If all toxins could simply be eliminated from buildings, we would have the basis for an ideal environment. In many instances, it is not only possible, but also cost-effective to use a product without toxic chemicals. For example, solid surface countertop materials can often be attached to cabinets with mechanical fasteners, minimizing the need for adhesives. Exposed wood may be left unsealed in locations where sealing is unnecessary.

Substitution

Where chemicals must be used, it is almost always possible to substitute a less toxic substance in place of a standard one. For example, paint with no harmful emissions, VOCs, or preservatives can be specified in place of a standard paint that contains harmful chemicals.

Prudent Use

In a few cases, the use of a toxic substance is unavoidable. For example, there is no acceptable substitute for the solvent-based glues used to join most plastic plumbing lines. When using a toxic substance is unavoidable the toxic load can be reduced by introducing protocols into the contract such as doing portions of the work outside of the building, isolating the procedure by applying mechanical ventilation while in progress or curing, thorough and effective clean-up after the procedure and giving notice to the homeowner so they can avoid exposure until the operation has been fully cured or cleaned up.

Curing

In cases where toxic substances are chosen for reasons such as cost or durability, the impact of the product will be reduced if it is properly cured. Many materials can be purchased with factory-applied finishes that have been heat or UV-cured. Such finishes, which may have been quite noxious in their liquid state, are safely applied and cured under controlled conditions. Many factory-applied finishes will have little or no impact on air quality by the time they are installed in the home and some manufacturers may be willing to build the product and apply these finishes well in advance and then warehouse them before installation in the home.

Sealing

If a toxic building component cannot be eliminated or substituted, then sealing it may help to reduce the rate of outgassing. Although this approach is far from perfect, there are cases where we recommend vapor sealants or barriers for this purpose.

Throughout the planning of a healthy home, you will be weighing the health risks, costs, time, and aesthetics of the above five strategies to find the solutions that are best for you.

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