

The House of Good Air



A couple from California built a comfortable and MCS-safe house in rural southern Arizona.

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Looking for a healthy house

Sam and Jennifer (not their real names) moved to Arizona from northern California when Jennifer became sick with severe MCS. They bought an old house on twenty acres (8 hectares) in rural Pinal county, north of Tucson. After they moved in it became clear that the house was too moldy for Jennifer to live in and they slept in a tent next to the house for a while.

They decided to tear down the old house and build a new one elsewhere on the large lot. It was not practical to live in the tent until the house was built and the

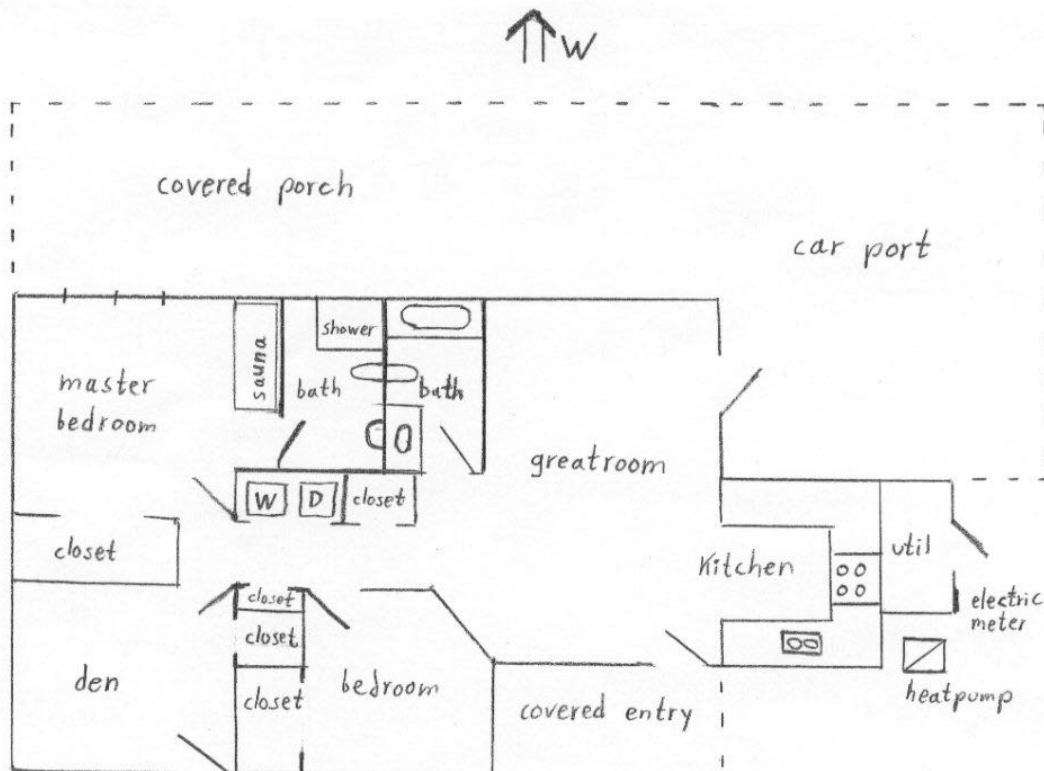
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couple struggled to find temporary housing. They had to move several times and even sleep in a motel for a while until they were able to rent a house that didn't make Jennifer sick.

Designing the house

The couple drew up the design for their new house themselves, with excellent indoor air quality the fundamental principle. The book *Healthy House Building for the New Millennium*, by John Bower (Healthy House Institute, 2000) became their guide throughout the project, with adaptations for the Arizona climate. They also got input from other people who had healthy houses built in the Tucson area.

The floor plan was designed to keep noise, fumes and EMF as far away from the bedrooms as possible. The three bedrooms were clustered in one end of the house. In the middle is the living room and a second bathroom. In the other end is the kitchen and the carport. On the far end, behind the kitchen, is a utility closet with the air handling system, water heater, water softener, heat pump and electrical meter.



People with MCS commonly use a sauna to help remove toxic chemicals stored in the body. The house was designed with room for a free-standing sauna in the master bedroom, complete with a 240 volt electrical outlet. Another 240 volt outlet was installed in the den in case they decided to move the sauna there.



The living room

The laundry was placed in a closet in the hallway to the bedrooms to save the cost of a separate laundry room, though they regretted this location because of the noisy machines.

A deep covered porch runs along the whole rear side of the house (west side), where it provides a private outdoor space and shades the house against the afternoon sun.



The covered back porch

They made the house wheelchair accessible so they would be able to live in the house into their old age. This included making all doors three feet (90 cm) wide with no threshold. The master bath has plenty of room for a wheelchair to turn around. The house was unofficially named Casa de Buenos Aires, which means House of Good Air in Spanish.

Finding a builder

It is always best to find a builder with experience building a healthy house. It saves a lot of explanations, time and mistakes. Sam and Jennifer were fortunate to find a builder who had just finished building a house for someone with MCS in the same area. He had learned a lot from that job and was willing to do what it took to make a successful project, including enforcing a smoking ban on the work site.

Sam still had to be intimately involved in the project. He regularly consulted with the contractor and visited the worksite often, especially during the critical times.

The foundation

The local building code required that the soil below the foundation be soaked with pesticides in order to deter termites. Since the house would be built without any wood, the county inspectors waived that requirement, though diatomaceous earth was voluntarily added to the soil to deter insects.

The foundation was a concrete slab on grade, which is very common for the area. A plastic pipe was installed in the gravel below the slab in case there was a radon gas problem, but it was never needed. There was no basement or crawl space, as they can create mold problems.

The slab was fully insulated with foam boards underneath and a plastic diffusion retarder to prevent radon gas or wicking of moisture from the soil.

The contractor used lumber to build the form for the concrete instead of reusable forms, so there was no need to grease the forms. (Greased forms can make the edges of the slab stinky.) The concrete was free of additives (admixtures) and wet-cured, though mineral pigments were added to tint the floor of the house. The nearly cured concrete was also buffed to make the surface very smooth. It was then sealed with the Crystal Shield non-toxic sealer. This was done to save the cost of installing floor tiles. It looks attractive and has held up well in the following twelve years, without any resealing.

The walls

The outer walls were built of a type of polystyrene foam blocks called Integrated Concrete Forms. The blocks were hollow and once the walls were erected the cavities were filled by concrete reinforced with rebar. This created a very strong, airtight and somewhat insulated wall. The walls were later further insulated on the inside.

Making the outer walls separate from the interior walls, and using such solid materials, made the house very airtight. This is very helpful in preventing air pollution from wildfires or human activities from entering the house, besides making the house more energy efficient.

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The polystyrene Integrated Concrete Forms create strong airtight outer walls. The floor is tinted and buffed concrete.



The interior walls were made of steel studs that were degreased.

The interior walls were framed using steel studs. The steel was cleaned of manufacturing oils with a TSP detergent before the studs were installed. This was very labor intensive.

Studs were also mounted on the inside of the exterior walls to further insulate them. Formaldehyde-free fiberglass was mounted between these studs and then covered with formaldehyde-free gypsum drywall.

The contractor had not used formaldehyde-free fiberglass before and remarked that this was the first time fiberglass didn't give him a rash on his hands.

The interior walls were then covered with regular gypsum drywall that came from a manufacturer that didn't add formaldehyde to their gypsum. The walls were painted with a less-toxic paint, ChemSafe, that is no longer available.



The walls and ceilings were insulated with formaldehyde-free fiberglass.

Boric acid was placed inside the interior walls, before the insulation was installed, to deter ants and roaches.

The outside of the walls was covered with a special product called Dryvit, which protects the polystyrene blocks as specified by the manufacturer. Regular stucco was then put on top as the outer skin of the house.

The bathrooms

The house has two bathrooms. A lot of thought was put into the design of the master bathroom to prevent mold growth. The shower stall was custom built of stainless steel sheets on three sides and a curtain across the opening. The walls

and ceiling of the bathroom were covered with ceramic tile mounted with a home-made additive-free grout (recipe in John Bower's book) that had to be wet-cured.

The second bathroom was built with a bathtub, stainless steel sides and a shower curtain.

The roof

The roof was mounted on steel trusses. The roof material was steel panels with standing seams, which creates a very strong and durable roof. They did not want to use the standard toxic plywood decking under the roof and it wasn't necessary with these strong steel panels. They simply covered the top of the trusses with a vinyl underlayment (recommended by the manufacturer of the roof panels), and then mounted the panels on top. No purlins or decking were used.

The roof had no penetrations for any vents, to reduce the chance of future leaks and thus mold. All vents were instead directed out through the walls.

Steel panels were used for the soffits and ceilings over the porches and the car port.



The steel trusses.

Doors and windows

All the doors were of steel, with a steel frame, so there was no wood for any termites to attack. The doors were painted with automotive paint, as it quickly becomes inert and is very durable.

All windows had aluminum frames with a thermal break inside the frame for energy efficiency.

Pipes and wiring

Regular ROMEX electrical cables were used. They were purchased early on and left to offgas in the sun for months before they were installed.

The electrical outlet boxes were special airtight models, to prevent fumes from the insulation from entering the living space.

All the water pipes were of copper with lead-free solder. The pipes were insulated from the steel wall studs using small pieces of a plastic garden hose.

Heating, cooling and ventilation

The summers are very hot in southern Arizona, with powerful cooling a necessity. The winters are cool enough that heating is needed. The house is heated and cooled with a heat pump. This system also filters the air through a large HEPA air cleaner and adds some fresh air through an outside air intake.



Rigid steel air ducts.

The air is transferred through rigid steel air ducts that were degreased before they were installed, to remove manufacturing oils. Extra-large ducts were chosen to reduce the noise from the ventilation system. The ducts were sealed with aluminum tape. Flexible air ducts were not used since they are impossible to clean.

There are return air registers in every room to provide even ventilation. It was the plan to have an air return register in the walk-in closet in the master bedroom, but the contractor forgot to install it. Such a register would exhaust stale air from clothing and other belongings stored in the closet.

Other details

The kitchen cabinets are of stainless steel and steel with a baked-on powder coated paint.

The house has a central vacuum that is mounted in the carport. This means all the air and particles sucked up are fully removed from the house. It also means no EMF exposures and much less noise.

The kitchen has an oversized range hood with a powerful fan to remove cooking odors.



The upper kitchen cabinets are of powder-coated steel, while the lower cabinets are stainless steel.

Moving in

The house was finished in the summer of 2004. It was then baked out by running the heat pump in the hot weather for two weeks. They had planned on offgassing the house for four weeks, but it became only two weeks because the landlord of their rented house wanted to do renovations there.

Moving into the new house was a success. The weather was so hot they had to keep the windows closed and run the air conditioner right away, but it worked well.

Jennifer did have respiratory problems that summer, but they think it was mostly because the contractor had forgotten to install the HEPA air filter. It took a year before they discovered it was missing.

More information

This website has other healthy house stories and information, which are available on www.eiwellspring.org/saferhousing.html.