Desert Moon House:
Design of a Healthy House

When building one's own house, there is a unique opportunity to design the house so it fits the owner and the place. This article describes the design considerations for a less-toxic, low-EMF house built in northeastern Arizona. It is part of a series of articles about this house. The other articles cover choice of materials and building methods, the heating system and the electrical system.

Keywords: healthy house, design, MCS, EMF

Design criteria

There were many criteria for the design of this house. The fundamental ones were:

- Extremely good indoor air quality
- ultra-low electromagnetic radiation
- comfortable indoor temperature, year round
- superior energy efficiency
- low maintenance, especially low need for any toxic materials
- reasonable cost

The project greatly benefited from the collective experience of nearly two dozen healthy houses that had been built for people with MCS in the area over nearly twenty years. Each new house was an experiment with some new material or enhanced method.

These experiences were essential for the success of this house, especially the choice of materials (which is covered in great detail in a separate article). Good choice of materials is essential — too many houses built for people with MCS have literally taken years to offgas enough to be habitable. Of course, conventionally built houses would take at least a decade to offgas enough, assuming nobody contaminated them further in the meanwhile.

Siting the house

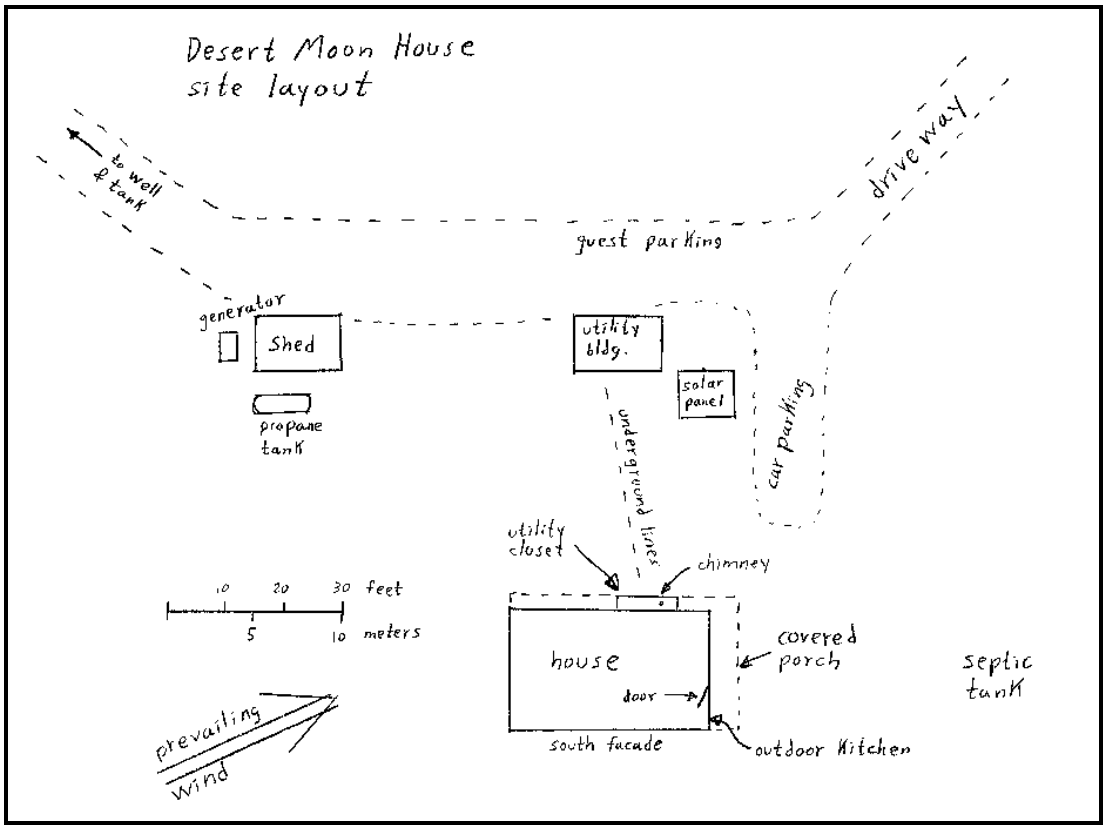
The house is placed on a large lot of nearly 40 acres (16 hectares) in a very rural area in the high country of northeastern Arizona. The house faces south and is designed to use the sun for heating, using passive solar design methods. This dramatically lowers the heating cost, and is quite affordable when done from the start. There is also a radiant in-floor heating system, with a propane boiler located outside the house. The heating system is covered in a separate article.

The prevailing wind direction is from the west and southwest. The site is designed to take advantage of that, by placing pollution sources downwind from the house, such as the driveway and parking for vehicles (especially diesel vehicles, such as delivery trucks). The septic system, propane generator and propane heating system are also located downwind.

The entrance, porch and outdoor kitchen are all located on the east side of the house, so the house blocks the wind most of the time. This has all worked very well.

Foundation

The house is a single story ranch house. There is no crawlspace underneath. The floor is built directly on the ground, using a cement slab. That is the healthiest method, and also the best for a heavy floor with tile, as well as being most energy efficient for a house with passive solar heating. There are plastic tubes embedded in the concrete slab for heating.



The porch

The porch or patio is an important part of an EI house. It can serve as a sleeping area while the house is too new to sleep in, or later while repairs take place. It also provides a place to store things outside, while mostly protected from the weather. It may even be used for long-term storage of items too toxic to keep in the house, or short-term storage of recently purchased items that need to be offgassed. It is also a low-cost method to add space to a small house.

The porch is on the east side of the house so the house blocks the wind most of the time.

Outdoor kitchen

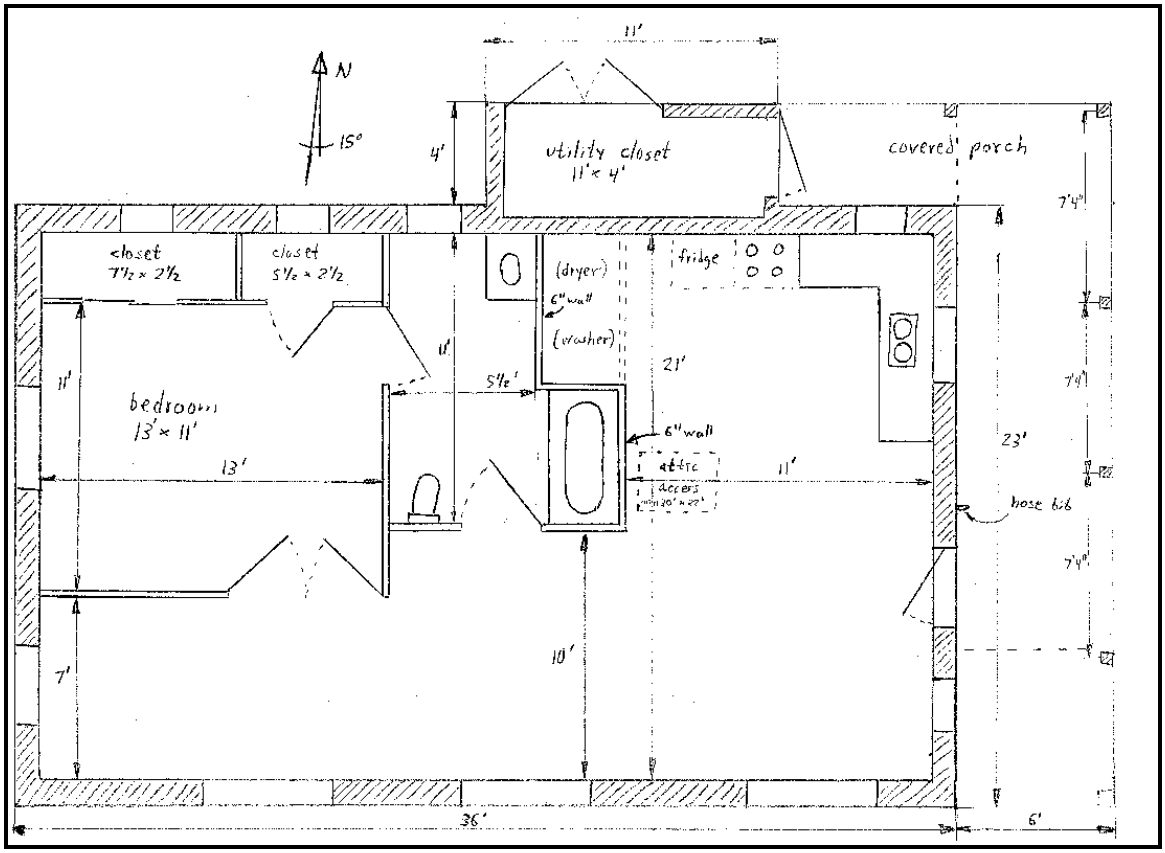
The owner is extremely sensitive to cooking odors and to electromagnetic radiation (such as from a stove), so a small outdoor cooking area is placed at one end of the porch, where there is no roof to trap the gas fumes. It is located right outside the door, with the indoor kitchen located right inside the door. The food is prepared inside, and cooked outside.

The cooking area is equipped with a porch light and electrical outlet, though propane is used for the cooking. Stacked concrete blocks provide a small place for

the portable stove, which is surrounded by concrete blocks to block the wind. The house and the porch roof provide shelter from most winds and rains. This arrangement is functional year round, and is only unusable during brief episodes of severe weather.

A propane powered refrigerator is located in a separate utility room, which is sealed off from the rest of the house. The refrigerator is accessed directly through a door at the end of the covered porch. A propane refrigerator is used, as it emits no electromagnetic radiation (EMF) and no sound.

Interior layout



The interior layout of the house was designed from several criteria:

It is laid out to accept the heat of the sun, which comes through the south-facing windows and floats into the deeper parts of the house. This is best done with an open floor plan. The few interior doors open up to the solar-heated south side of the house, so the winter sun's rays can reach deeply into the house. There is a double door into the bedroom for that reason, which also can make the room a part of the living room.

In the summer, the sun is high in the sky, and is prevented from entering the house by the roof overhang.

The living room runs the length of the south façade, to receive and distribute sun heat. The long room is also suitable for an electrically sensitive person to experiment with electronics, such as a radio or a TV.

Larger rooms are more forgiving than small rooms because they have more air volume, both in terms of the materials used and also when bringing items inside that are not absolutely non-toxic. This again calls for an open floor plan in a small house.

The kitchen is located right inside the front door to be conveniently close to the outdoor cooking area. The kitchen is fully open to the living room and has a small pantry, which could be used to house a washer and dryer if desired. These are otherwise housed in the outbuilding.

The door to the bedroom can be closed to stop the glare from the winter sun that is heating up the house through the south windows, if one needs to rest from the light (the owner is light sensitive). With the double doors open, the bedroom becomes an extension of the living room.

The north wall of the bedroom has two closets that also provide a thermal buffer zone to the colder northern wall. Each closet has a small (1 x 2 ft, 30 cm x 60 cm) window for ventilation, which is protected by a large overhang so it can be left open under almost any weather conditions.

There is only one bedroom. The house is only 830 sq ft (82 sq meters) and two bedrooms would make all the rooms very small.

The bathroom is at the center of the house, with a small outside wall to the north. A window provides ventilation to exhaust humid air from bathing, which cannot be allowed to build up in the house as it might encourage mold growth (moldy houses are a big problem in Arizona, too). The window replaces an electric fan, which is unacceptable in an ultra-low-EMF house. This window is also protected by a large roof overhang.

All surfaces in the bathroom are tiled, including the ceiling, to deter mold growth. This may make it the room with the best air quality. It was made large enough so it could be used to sleep in, if the rest of the house was still too new when the first winter came.

The floors throughout the house are tiled with ceramic tiles, for health reasons. The tiles also provide about an extra ton of heat mass to help store solar heat for the night. The color of the tiles was chosen so the ever-present desert dust does not show up well.

A utility closet is located on the outside of the north wall and sealed off from the rest of the house. It contains propane appliances, including a propane refrigerator that is easily accessible through a dedicated door from the front porch. It has not been a problem having propane appliances in this sealed-off compartment, i.e. no leaks through the walls, and no fumes from the chimney.

Mobility features

Since there are no MCS/EHS safe assisted living or nursing homes, the house is designed to be accessible to a wheelchair user. Those features are not presently needed, and hopefully never will be, but the extra cost is low when doing it while the house is being built.

The bathroom has room enough for a wheelchair, and the commode is certified accessible to wheelchair users. There are four grab bars, one at the commode, one at the sink and two above the tub. The grab bars are now used to hang towels on, and the ones at the tub are practical when washing clothes in the tub.

All the doors in the house are 36 inches (90 cm) wide, to allow passage of a wheel chair. There are no thresholds under the doors, except the entry door. A ramp to the entry door was sculpted into the concrete of the front porch when it was poured.

The only modifications that should be needed for an actual wheel chair user are the kitchen counter and the bathroom sink. Perhaps also the shower.

Other features

The house is super-insulated with thick double walls (R-32) with staggered wooden studs, to avoid thermal bridging. The ceiling is insulated to R-60, twice the local building code. Some houses in the area have a vestibule, which works like an air lock to keep cold air out when entering the house. There was not room for one in this small house, and it would have been cumbersome for the traffic between the kitchen and the outdoor cooking area. With the front door placed out of the typical wind, it has not been needed, either.

The house has a greywater system, which takes waste water from the bathroom shower, bathroom sink and washer and deposits it into a large underground rock bin outside the house. The kitchen sink cannot legally drain to a graywater system. Greywater systems extend the life of the septic system tremendously and save a lot of water for watering trees. It is legal only in a few states, including Arizona. This system has a valve that either directs the greywater to the rock bin or to the septic system, which may soothe some building inspectors.

Ventilation

Ventilation is important for a tight house. It helps airing out the new house at the start and later it prevents moisture and odors from building up inside. Bathing releases a lot of moisture into the air and so does cooking. It can condense in colder areas of the house and eventually cause mold problems.

Several windows in this house can be left open during most weather conditions, due to overhangs, which is a very useful feature. The large roof overhang on the north side protects those windows, while the porch roof protects the kitchen window. On the southwest corner of the house, where most winds come in, is a special window designed only for ventilation. It is a small (2 ft x 2 ft, 60 cm x 60 cm) awning window, that hinges on the top and is located high on the wall, so it is also protected by the two-foot roof overhang. This window has been particularly helpful. And the high location from the ground also meant less dust coming in that way.

Awning window, protected by roof overhang.

Small windows ventilating the bathroom and bedroom closet.

Solar system

The house is off the grid. It is powered by a 12 volt DC solar system, which is described in a separate article. A standard 110 volt AC solar system was not used because the inverter generates a lot of radio-frequency radiation and dirty electricity.

The outbuilding

Next to the house is a small outbuilding of 10 ft x 14 ft (3 m x 4.5 m). The size was chosen as it did not require a building permit in this county, and it fit the budget.

The outbuilding is heated and fully insulated. It houses the washing machine, a clothesline, two pumps and the batteries for the solar systems. Those are all items best kept outside the main house.

Several underground conduits connect the outbuilding to the house. These contain water, heating loop and DC electrical wires. One separate two-inch conduit is used for fiber-optic control lines and future communications. Another two-inch conduit is intended to be used for a whole-house vacuum line in the future.

Low maintenance

The house was designed for extremely low maintenance needs, to avoid the typical projects involving toxic paints, varnishes and tar shingles. The only exposed wood is the interior door frames.

The roof, exterior walls and posts are all covered by steel plates with a 45-year warranty. A separate article in this series discusses the materials and construction methods in detail.

Experience with the house

The house has been very successful.

The protected windows were very helpful during the first summer's offgassing period. They could be left open all the time, regardless of the weather. The little awning window was cracked open most of the first winter.

The outdoor kitchen facilities have worked well, too, with few problems; mostly when the wind came from an unusual direction and cooled the pot so much it wouldn't boil.

No propane or combustion fumes have ever been detected inside the house, though combustion fumes can sometimes be smelled when opening the door to the utility closet, depending on the wind.

It would have been nice to have a small second bedroom, or a large walk-in closet, with more room to store books, clothes, linen and paper files, but that was not in the budget.

More information

Additional articles about this and other healthy houses can be found on www.eiwellspring.org/housingcases.html.

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