

REQUEST FOR BID
To Have The
Healthy Housing Research Institute
be Located in Rockvale, Colorado

The Healthy Housing Research Institute is seeking a place where it can do research on how to build housing for the electrically and chemically sensitive that is both healthier and more affordable than what is presently available. This could be a town (or other political unit) with land available for new housing and that is willing to allow the needed improvements in building codes. The town needs to have moderate to low levels of electromagnetic fields. The byproduct of the research would be a Safe Haven for the electrically and chemically sensitive to live. The experimental housing would go on the tax rolls like any other new housing. Benefits to the town include wages to local tradesmen during housing construction, increased tax revenue, and well paid jobs at the Institute when fully operational. Like any other Economic Development proposal, the town will have to provide some concessions and inducements.

Dr. Gary Johnson, a retired Professor of Electrical Engineering at Kansas State University, has purchased 60 acres in the extreme northwest corner of Rockvale, 48 acres of which would be suitable for experimental housing. As of summer, 2016, he and John Ardrey are doing storm water management around the cul-de-sac at the end of Shaft Avenue and preparing to place hot mix on the cul-de-sac and adjacent driveways. Because of this history, Rockvale is being given this Request for Bid before any other town. It is hoped that the citizens of Rockvale will give the concept careful consideration and that the Town Board will make the final decision in early 2017. If the decision is negative, Dr. Johnson will put the 60 acres on the market and start the search elsewhere for a town that wants the Institute.

The main concession requested is an ordinance to the effect that the Healthy Housing Research Institute can build experimental housing on the 40 acre Lot 19 of Mesa Traces Subdivision and the adjacent 8 acre Parcel A. When detailed drawings and a certification by a Professional Engineer that the housing is at least as safe and healthy as that built according to current codes are presented to the Town of Rockvale, the Town will issue a Certificate of Occupancy and add the dwelling to the tax roll at the actual cost of labor and materials.

Several pages of explanation and discussion are available. If not attached, they are available in .pdf format at the website www.emsri.org.

TOWN OF ROCKVALE AND ECONOMIC DEVELOPMENT According to the Internet, Rockvale had a population of 487 in 2010. The median household income in 2013 was \$35,787, as compared with \$58,823 for the State of Colorado. There are no retail establishments. Some streets are gravel. The paved streets tend to be in poor repair. A good share of housing is old and small, in poor condition in some cases. Fremont County records show 26 parcels owned by the Town Of Rockvale. These include four nice lots on Shaft Avenue, estimated actual value of \$18,000 each. There are perhaps a dozen other parcels that are not town buildings or parks, with total estimated actual value less than \$40,000, that might be used for infill construction of residential or commercial property if setback and square footage requirements were relaxed.

Rockvale needs high quality, attractive housing added to the tax base to help pay for road improvements. Rockvale needs good paying jobs so its residents can afford better housing. A typical economic development strategy is to offer inducements (e.g. free or low priced land) to some business to get it to move here. But the Town Of Rockvale is too poor to offer significant financial inducements. And it would take *very* significant financial inducements to get most business owners to overlook the unattractive features of Rockvale.

But does Rockvale have any *attractive* feature that can be exploited to bootstrap its way upward? One such possible feature is the naturally low electromagnetic field levels on the 40 acre Lot 19 at the west end of the Mesa Traces Subdivision (past the cul-de-sac at the end of Shaft Avenue), and part of the adjacent Parcel A. These plots could be used for healthy housing for the electrically sensitive among us. (Note that there is a restrictive covenant on Lots 1-18 of this Subdivision, but none on Lot 19, allowing the Town of Rockvale considerable flexibility in zoning and permitting.) Lot 19 could also be used to house a Research Institute that would collect data, write technical papers, and plan additional healthy housing for the electrically and chemically sensitive. This would be the first Research Institute in the world dedicated to these intolerances. Rockvale could become the equivalent of Mayo Clinic (Rochester, Minnesota) or some famous Cancer Research Institute for these afflictions.

The concept would be to build an experimental dwelling unit (house, duplex, guest house, cabin, etc.) and rent it to the electrically and/or chemically sensitive. The healthy half of a couple could perhaps find work in Colorado Springs or Pueblo. Construction on the next dwelling unit would start soon after the previous one was finished. Each unit will be carefully tested for electromagnetic performance. Construction techniques will be varied in an attempt to find those which result in both safety and affordability. Renters experience of intangibles like comfort or liveability will be folded in to the design process, of course. Construction techniques, costs, and performance

would be carefully documented on the Institute website.

This is obviously a very long research project. It could take 10 to 20 years before Lot 19 is at a maximum carrying capacity. It is expected that at least 20 dwelling units will be built. The units will be off grid, operating from solar panels and batteries. A nice research project would be to supply backup power from a 240 VAC to 380 VDC power converter connected to Black Hills at the cul-de-sac, with a DC distribution line from the converter to the housing units.

The direct benefit to Rockvale will be the addition of dwelling units to the tax base. One indirect benefit will be jobs during construction. Local people will be utilized as much as possible, just as John Ardrey has done all the dirt moving and Chris Boxwell has done all the equipment maintenance so far. The main requirement for Rockvale is to pass the necessary ordinances to allow construction and operation to proceed in an efficient and cost effective manner.

BUILDING CODES I taught the National Electrical Code and the National Electrical Safety Code in classes at Kansas State University. (The NEC basically covers wiring on the customer side of the meter while the NESC covers wiring on the utility side of the meter). I am a licensed Professional Engineer in Kansas and served as an Expert Witness in court in dozens of cases involving alleged failures to meet requirements of the NEC or NESC. I believe the various building and electrical codes are very important in protecting the safety of people. However, we must remember that the codes are living documents, revised every three or four years to reflect new information as it becomes available. There are always compromises that must be made. A change in code that yields greater safety for one group might result in less safety for another group. A question that is not explicitly asked as often as it should be is: Can society afford that change?

There has been considerable discussion in recent decades about the "Sick Building Syndrome". Changes in construction materials and techniques resulted in buildings that were mechanically sound and energy efficient but caused a portion of our population to exhibit symptoms of chemical sensitivity because of poor indoor air quality. Codes were changed to increase the amount of ventilation. Likewise, I believe that present practices of society are resulting in indoor electromagnetic pollution that is sickening another portion of our population. It took years before indoor air quality was recognized by the authorities as an issue that needed to be dealt with. Likewise, it is taking years to get similar recognition for the problem of electromagnetic pollution, but I am confident that it will eventually happen. In the meantime it is critical that some organization investigate ways of building dwelling units that are more healthy electromagnetically than the ones being presently built, and that are also affordable. I propose that the Healthy Housing Research Institute be such an organization.

I will try to illustrate the compromises involved in Code writing with some examples. The first is one that seems simple, but exhibits more and more complexity as more questions are asked. That is the minimum height above ground for an electrical distribution line. The NESC gives several different values, one for land where motor vehicles are not allowed (or not possible), another for agricultural land, then for lines over roads, over bodies of water large enough for sailboats, etc. I was hired by an utility to visit a small town in southeast Kansas where an electrocution had occurred, to advise on the legal exposure of the utility. A lawsuit almost always follows a death, and the utility was trying to decide how much to offer to settle out of court.

The power line had been built over farm land many years previously and was at the proper height according to code. The local high school had built a football practice field parallel to the line some years before the electrocution. The school decided to build some portable goal posts to use for practice. The shop teacher welded the goal posts together on the *other* side of the power line. The coach recruited a big farm kid on the team to help drag the goal posts to the proper location. When the goal post hit the line, the kid was knocked free with minor injuries. The coach was literally cooked when the dry earth presented enough resistance to the short circuit to not allow the line circuit breaker to trip. If the line had been six inches higher, the incident would not have happened.

The utility company lawyer would argue (correctly) that the line was there first. The school should have put the field somewhere else or asked the utility to move the line. Certainly the shop teacher erred by not building the goal posts on the *same* side of the line as the practice field. The coach *really* should have been more aware of his surroundings, etc. But the widow would respond that the line was obviously too low and should have been made 'safe' by raising it. The problem is that there is no magic height at which the line goes from 'unsafe' to 'safe'. A farmer might decide to build a barn directly under a power line. A roofer might then be electrocuted while pulling metal roofing panels up through the rafters (another of my cases). A large excavator can hit most power lines with a bucket if the operator is not watching.

The widow would then say that if power lines *above* the earth are unsafe, then all lines should be buried. The utility lawyer would counter by mentioning backhoes and excavators that do not bother to 'call before digging'. He argues that high voltage electricity is unsafe, whether buried or overhead, and there is no way to make it 100% safe from all possible human actions. The only way to prevent *all* deaths from high voltage electricity is to just eliminate all high voltage electricity. In the same way, the only way to eliminate *all* automobile related deaths is to eliminate automobiles. Neither is likely to happen! Society has accepted the death toll from electricity and automobiles as part of the cost of modern civilization.

In the case of power lines, we could save hundreds of deaths per year if all power lines were twice as high above the ground, say a minimum of 40 feet up, or were buried. This would cost the utilities many billions of dollars, which would be passed along to the customers. The increase in the monthly bill would be substantial, maybe double or more. Any increase in electric bill increases the number of families who are unable to pay the bill and who then get cut off by the utility. The number of premature deaths in these families due to heat, cold, and the lack of food refrigeration will increase.

It is also true to a large extent that a dollar spent to replace an existing power pole in good condition with a taller one, purely to satisfy a change in the NESC, is a dollar not available for schools, health care, or roads. It is not unthinkable that the expenditure of enough money in the USA to prevent one hundred electrocutions per year would increase the number of homeless and reduce the quality of schools, health care, and roads enough to indirectly cause a thousand premature deaths from other causes. How much safety can society afford? is a good question that needs to be addressed rationally by all concerned parties. Consumer protection groups that fight increases in electric bills basically represent the poor at the table where NESC code values for power line heights are debated. The net result of all the debate is that advocates of increased heights may see minor increases for new construction, but power lines built to earlier codes will not be required to be rebuilt.

Residential building codes have the same basic safety issues as the height of power lines. A dollar spent on a safety feature is a dollar not available for food, clothing, and education for the family. And increasing the cost of construction for safety features increases the number of homeless, who just cannot afford the new features. The number of homeless is increasing rapidly in this country. Some fraction are homeless because of increased housing costs, and some fraction of the increased costs is due to increased safety requirements in the building codes. The homeless, the working poor, the electrically sensitive, the chemically sensitive have very little voice in how the codes are written and interpreted. I hope that the Institute can be one of the groups that will speak for the sick and poor in our society.

Let me give some other examples of code issues. There was a time over forty years ago that I consulted for a dairy farmer about a problem with tingle voltages. A stray voltage of as little as a volt or so is enough to sicken a milk cow and eventually kill her. I discovered that the tingle voltages were due to connecting the overhead ground wire to earth at every possible point in the farmyard, according to code. This requirement created ground loops that in turn produced the stray voltage. A simple fix was to only connect the overhead ground wire to earth at one point on the farmyard. The system was still safe for people, and *also* completely safe for the milk cows. The local code enforcement took the attitude "We don't care if following the NEC kills all the milk cows

and bankrupts the poor dairy farmer. Wire it exactly as written!” I was saying “Wait a minute. What is wrong with this picture?” My memory is that I was unsuccessful and that the farmer did go bankrupt after his cows died slow and miserable deaths.

A similar attitude is still present in the electric utilities regarding Smart Meters. There are many cases where people became ill immediately after a Smart Meter was installed on their property. The utilities are saying “Our mind is made up. We are saving 15 cents per month by firing the meter reader. Smart Meters are safe. We will not examine evidence to the contrary!” This is not precisely a code issue, but clearly is a case where Professional Engineers expected to make decisions in favor of public safety are instead deciding to follow the economic benefit. This is my judgment of the situation based on my interaction with electrical engineers at Black Hills.

About 20 years ago I was building a laboratory in eastern Kansas in a place served by a Rural Electric Cooperative. The NEC gave two options for the utility interconnection, Fig. A and Fig. B. I determined that Fig. A would give me less of a ground loop problem (essential to my research) so I asked the REC for that type of interconnection. They said they did not have a professional engineer on staff and referred me to the PE that they used as a consultant. This PE turned out to be a former student of mine. He gave me a lecture on the importance of codes and safety that strongly resembled the one I gave his class some years earlier. He then gave me his professional opinion that Fig. A was in the general category of immoral, illegal, and unethical, and there was no way the REC would provide me that type of interconnection. Rather than use a ‘proper’ interconnection, I used a 600 feet long extension cord for power to my lab.

Other examples could be given, but these illustrate that sometimes the Code is actually wrong or merely inadequate to protect some group (milk cows, electrically sensitive) and sometimes those who interpret the Code are wrong. The problem is that there is no effective system of checks and balances. Rarely is there a place to go or a person to call to appeal what you believe to be a bad interpretation.

How can this situation be improved? I believe an active Healthy Housing Research Institute would be a big help. The Institute would publish results of its research online and be a clearing house for related efforts of others.

WHO IS LEGALLY RESPONSIBLE FOR THE DESIGN OF SAFE HOUSING? The short answer is Professional Engineers. These are people who have received an engineering degree from an accredited university, have done engineering design work under the supervision of PEs for several years, and have passed an examination. They are then licensed to practice engineering, not unlike the license to practice medicine that is granted to physicians. Building codes are written by PEs. A house wired according to the current National Electrical Code is presumed to be electrically

safe even if no PE stamped the electrical drawings for that particular house. Soil conditions can vary substantially from one site to another, so Colorado requires the stamp of a PE (usually a civil engineer with specialty of soils and foundations) for the foundation design of every house built.

This PE does not normally come to the building site during construction to supervise the activity. There will be an inspector who will watch the contractors and eventually certify that the foundation was actually constructed according to the design. But for the case of this experimental housing, designs will be different from existing practice (by definition of research) so a PE must both do the design *and* watch the contractors carefully to make sure the different design is faithfully executed. A non-PE inspector would be redundant.

DESIRED ORDINANCE Every governmental entity (town, city, county, etc.) has the right to establish by ordinance which Codes will be used for construction in their geographical area. For example, the Town of Rockvale Codes and Regulations, 2012, shows that the Uniform Building Code of 1994 was put into force in 2005 and removed in 2011. There were two Codes put into force, the International Residential Code 2006 and the International Energy Conservation Code 2006. The IRC 2009 would have been available in 2011 but was not selected. The Board of Trustees added to the IRC 2006 in Resolution 4-2012 that the design wind speed for roofs in Rockvale would be 100 mph. That resolution does not ‘guarantee’ that the wind speeds in Rockvale will never exceed 100 mph, or that no roof designed for 100 mph will ever fail in Rockvale. One could argue that safety would be improved by some (tiny) amount by spending additional (large) sums to have a 120 mph roof, but the decision was made that 100 mph was ‘safe enough’ or as “safe as citizens of Rockvale can afford”.

The point is that Rockvale has considerable flexibility in deciding how safe is ‘safe enough’ for new construction. Codes can be selected, deselected, and modified at any time. Rockvale will have to pass one or more ordinances if it wants the Healthy Housing Research Institute to function effectively in the town. Exact wording will be a matter of negotiation, of course. The ordinance needs to include the following information: “The Healthy Housing Research Institute will be given authority to build experimental housing on Lot 19 and Parcel A, a total of 48 acres presently owned by Gary L. and F. Jolene Johnson. Once a housing unit is complete, the detailed building plans, the actual construction costs, and certification signed and stamped by a PE that the unit was built according to the plans, and is at least as safe and healthy as housing built according to current codes, will be submitted to Rockvale. Rockvale will then add the housing unit to the tax roll and issue a certificate of occupancy.

This arrangement will work best if there are no artificial constraints, such as setbacks, permits, minimum square footage, types of housing, etc. imposed on the In-

stitute. It is requested that Rockvale sell water for the dwelling units at a single tap (at standard retail rate) at one of the lots surrounding the cul-de-sac. It will then be hauled to cisterns at the individual dwelling units.

ELECTRICAL INTOLERANCE I am in the fraction of the population that is sensitive to many foods, chemicals, and electromagnetic fields. It dates back to when I was in the third grade. Milk gave me a low grade fever and a stomach ache such that I did not feel like going to school. It took a big part of a year before anyone diagnosed the problem, such that I had to repeat the third grade. I still need to avoid certain foods if I want to feel OK.

My intolerance to electromagnetic fields has been getting worse over the past decade. I had to leave the Methodist Church in Canon City because the ATT cell tower a block away would cause coming-down-with-the-flu symptoms for the next 24 hours after attending a church service. Likewise, WiFi and 60 Hz magnetic fields will make me ill. It is similar to food intolerances in that the body can handle a certain dose before showing adverse symptoms. I could eat one dip of Breyer's Butter Pecan ice cream without a problem but would not dare to drink a whole glass of cold milk. I can be in a 60 Hz magnetic field of 2 milligauss for several hours, but a half hour at 50 milligauss is a definite problem.

The electromagnetic soup surrounding us is getting thicker year by year. More people are exceeding their tolerance threshold and are starting to display symptoms. Some get so severe that they just cannot live in typical housing anymore. Those with money buy 40 acres in the high desert and build an off-grid house. Others pitch a tent in a National Forest or live in their car. There is essentially no rental housing in the USA that caters to the electrically sensitive.

One typically sees an estimate quoted that about 3% of the population has electromagnetic sensitivity to some degree. Type those words into a search engine and huge quantities of information will be found.

EXPERIMENTAL HOUSING The basic concept, at least initially, will be to build housing with concrete walls that *absorb* electromagnetic signals, and then use metal siding and roofing that *reflect* electromagnetic signals. Power inside the housing unit would be DC, probably 24 V, possibly 48 V, and perhaps 380 V. Residents would use landlines and wired computers (no cell phones or WiFi). The idea is to reduce the fields inside the dwelling to the point where the electrically sensitive can tolerate them. It appears that concrete made with steel mill slag for aggregate will have adequate absorption of signals. Early research will be to find a good recipe for such concrete that will have adequate strength and surface appearance. All units would be built on a concrete slab. Heating, domestic hot water, and cooking would be done with propane.

ELECTRIC POWER Any unit built on Lot 19 or Parcel A of Mesa Traces Subdivision would be off-grid, powered by a bank of photovoltaic panels and 6 V deep-discharge batteries. Inverters with output of 120 VAC would be used only for brief periods to power 120 VAC appliances that cannot be readily converted to DC.

TELEPHONE, INTERNET, AND TV The cell tower signal levels in the gulch are quite low, such that cell phones barely work out in the open, and hopefully will not work at all inside the units. All cell phones brought into the gulch will need to be turned off. There might need to be storage boxes at the cul-de-sac where visitors can deposit their cell phones before entering the gulch. It is expected that landline type telephone service will be over the Internet. Each unit will be connected together by Ethernet cable, coax, or optical fiber, so there is a common hub. Getting from the hub out of the gulch will be by coax or optical fiber. There are several options for connecting to the Internet at that point. Channels CBS, ABC, NBC, PBS, and Fox are all available over-the-air at the cul-de-sac, so coax with signal boosters would be a cheap way of getting these stations to the gulch.

LIGHTING Lighting will be by LED strips on the ceiling, connected series-parallel as needed to operate on the DC system. One bedroom in 745 Shaft has been equipped with this sort of lighting. It is more efficient than the old incandescent lighting and produces a nice uniform light. In my opinion, this is much superior to any other form of lighting, and will become common over the coming years. The LED strips do not produce either 60 Hz or higher frequency fields that might hurt a resident. This is in distinction to the compact fluorescent bulbs and compact LED bulbs. Both have electronic circuit boards mounted inside the bulb, which produce large amounts of dirty electricity, and are therefore unacceptable to electrical sensitives. Interested persons should schedule an inspection trip to see the LED strips in 745 Shaft and the solar panels and batteries at the camper.

COOLING Each unit will have a top-of-the-line 24 VDC evaporative cooler. I have installed one on the camper and it works really well.

WATER, GRAY WATER, AND COMPOSTING TOILETS It is essential that initial and operating costs be kept as low as possible for the safe housing concept to succeed. There are cabin sites on Lot 19 where a conventional septic system is just not affordable. For such sites the Institute needs the option of using composting toilets and a gray water filtering system. In this desert place, water is neither cheap nor abundant, so conservation will be important.