

# Electromagnetic Pollution Solutions

*Protecting our homes and communities -then taking action at the federal level where critical changes must take place.*

left  
forum

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Sponsor:  
Occupy EMF Harm

**The Left Forum**  
May 22, 2016 - 12:00 p.m.  
John Jay College of Criminal Justice  
524 West 59<sup>th</sup>, Rm. 1.114, NYC

# Overview of EMF Evaluation and Mitigation

## Electromagnetic Pollution Solutions Left Forum

May 22, 2016

**Oram Miller, BBEC, EMRS**

Certified Building Biology Environmental Consultant,  
Electromagnetic Radiation Specialist

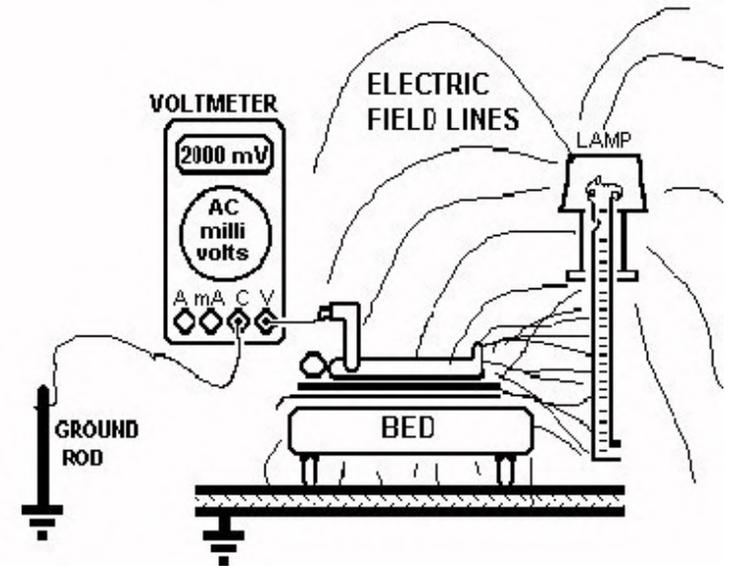
Los Angeles, California

310-720-7686

[www.createhealthyhomes.com](http://www.createhealthyhomes.com)

# Goals of Building Biology®

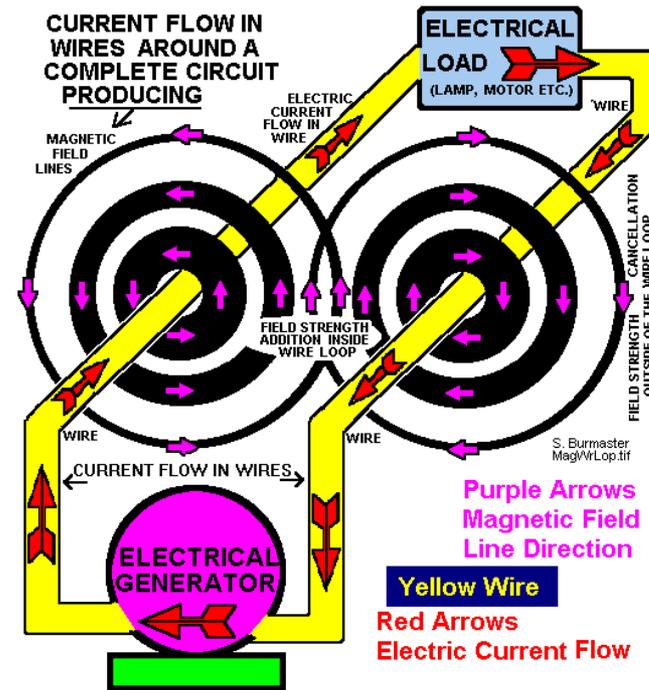
- ▶ Find and reduce sources of toxicity in the home or office – IAQ, EMFs, Outgassing Building Materials
- ▶ Strengthen your tolerance to toxic influences outside the home
- ▶ By reducing exposure to household toxins and creating an EMF-free sleeping, living and work environment



Courtesy Spark Burmaster, EE, BBEC

# Four types of “EMFs”

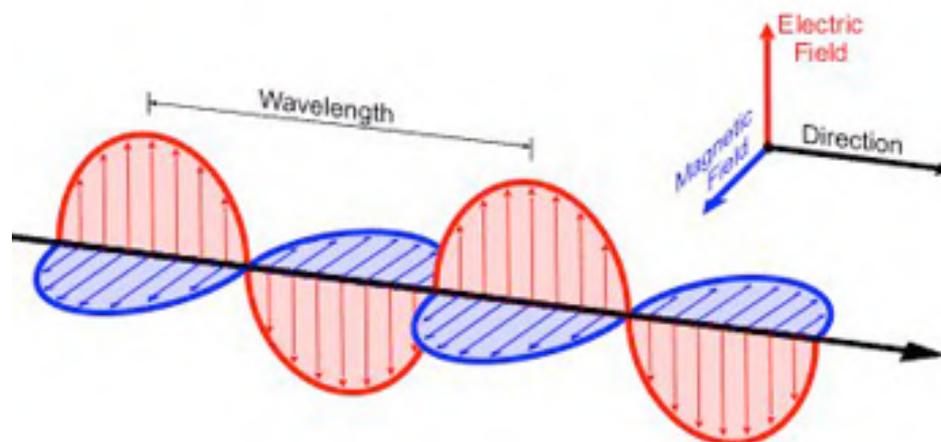
- ▶ AC Electric Fields from house wiring and power lines (at 60 Hz)
- ▶ AC Magnetic Fields from house wiring and power lines (at 60 Hz)
- ▶ Radio Frequency (RF) Fields (800, 900, 2,400 MHz)
- ▶ “Dirty Electricity” from harmonic frequencies (2,000 — 100,000 Hz)



Courtesy Spark Burmaster, EE, BBEC

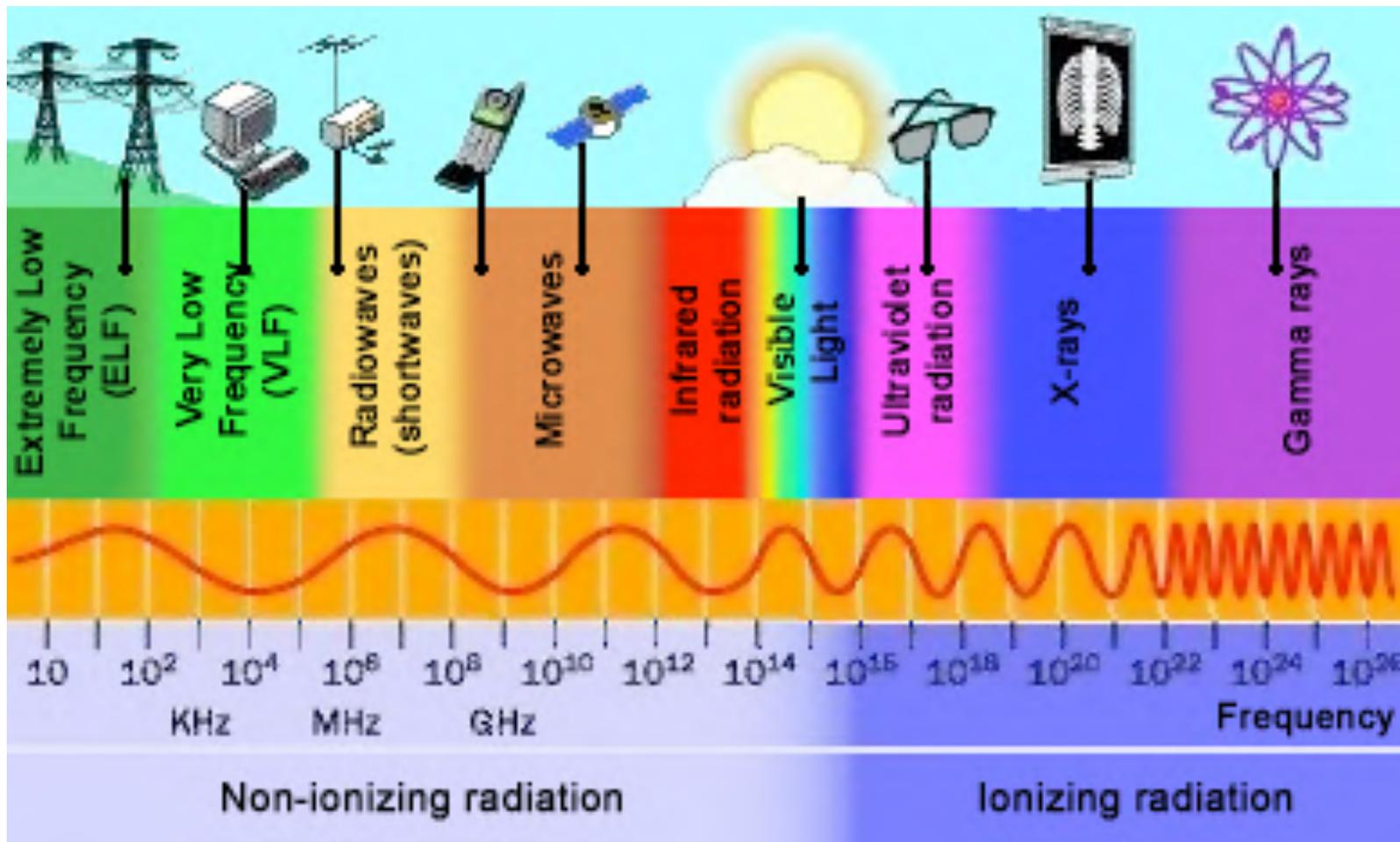
# Electric & Magnetic Field (EMF) Exposure

- ▶ AC Electromagnetic Fields are created by alternation of polarity (positive to negative to positive) of AC electricity on electric power lines, circuits and power cords, at 60 times per second
- ▶ The “M” in EMF is the magnetic field component
- ▶ The “E” in EMF is the electric field component
- ▶ These fields emit off power lines, circuits and power cords at right angles to each other
- ▶ They enter our living space and can affect our health



[www.ixquick.com](http://www.ixquick.com)

# Electro-Magnetic Spectrum



[www.astrosurf.com](http://www.astrosurf.com)

# Sources of Radio Frequency Field Exposure Indoors

- ▶ Wi-Fi routers and laptops
- ▶ Cordless telephone base station is “always on”
- ▶ Both emit continuous pulsed digital carrier frequencies in standby mode
- ▶ Think of them like ashtrays with burning lit cigarettes, filling room with smoke



[velocidaddeinternet.com](http://velocidaddeinternet.com)



[china-telecommunications.com](http://china-telecommunications.com)



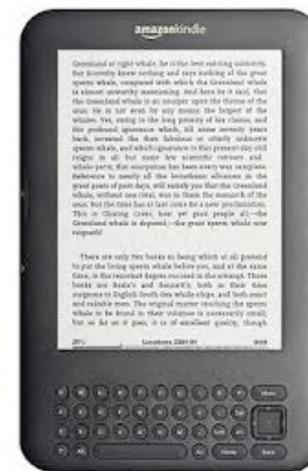
[photographersdirect.com](http://photographersdirect.com)

# Sources of Radio Frequency Field Exposure Inside Home

- ▶ Cell phones
- ▶ Tablets
- ▶ e-Readers
- ▶ Thermostats
- ▶ Game Consoles
- ▶ Appliances



[www.nickolexie.en.busytrade.com](http://www.nickolexie.en.busytrade.com)



[en.wikipedia.org](http://en.wikipedia.org)

# Sources of Radio Frequency Field Exposure Outdoors

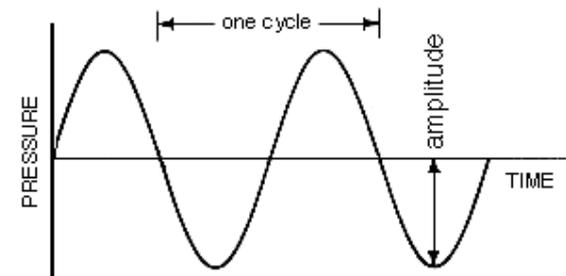
- ▶ Radio and TV broadcast towers
- ▶ Cell phone antennas
- ▶ Smart Electric, Gas & Water Meters
- ▶ Wi-Fi routers in neighbors' homes and businesses



# Radio Frequency Field Exposure

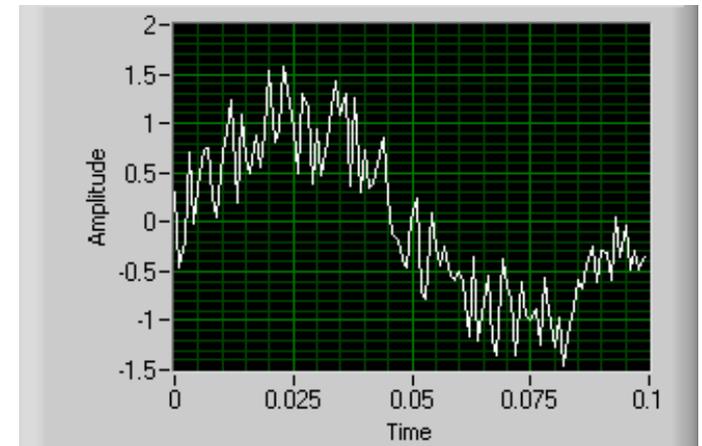
Harm comes from:

- ▶ Frequency
- ▶ Power Output
- ▶ Distortion of Waveform
- ▶ Smooth analog wave form is best
- ▶ Pulsed digital frequencies interfere with biological functions
- ▶ Effects are cumulative



[www.sfu.ca](http://www.sfu.ca)

Smooth Analog Signals –  
Well Tolerated



Zone.ni.com

Pulsed Digital Signals –  
Not Well Tolerated

# Building Biology Safe Exposure Guidelines for RF

Building Biology Evaluation Guidelines for Sleeping Areas,  
SBM-2008, Page 1

Radiofrequency Radiation (High Frequency, Electromagnetic Waves)

|  | No Anomaly | Slight Anomaly | Severe Anomaly | Extreme Anomaly |
|--|------------|----------------|----------------|-----------------|
| Power Density in microWatts/meter squared ( $\mu\text{W}/\text{m}^2$ ) | < 0.1      | 0.1 - 10       | 10 - 1,000     | > 1,000         |

# The Bottom Line

If you use a cell phone, cordless phone, tablet, laptop or have a smart meter, you must ask yourself:



[turbohealthcare.com](http://turbohealthcare.com)

“How many cigarettes am I willing to smoke on a daily basis?”

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Reduce Use
- ▶ Increase Distance
- ▶ Favor Hardwired Connections
- ▶ Prefer speakerphone and texting
- ▶ Air tube earphone for cell phones and cordless telephones  
[www.lessemf.com](http://www.lessemf.com)
- ▶ Place “snap bead” on earphone cord  
[www.lessemf.com](http://www.lessemf.com)



Ferrite “Snap”  
Bead



RF3 Air Tube Ear Phone

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Keep your landline telephone and use it
- ▶ Use corded telephones rather than cordless
- ▶ Tell family and friends to call your home landline corded telephone number first
- ▶ Hardwired network using Ethernet cables
- ▶ Must disable Wi-Fi on router *and* computer
- ▶ Put tablet, e-Reader, laptop & cell phone in Airplane mode when not receiving or transmitting



Corded Telephone



CAT-5e or 6 Wiring

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Internet network should ideally be hardwired using Ethernet cable, creating Local Area Network, or LAN
- ▶ Use Ethernet cables to connect devices (computers, printers, TVs) to router
- ▶ Amazon sells 50 and 100 foot Ethernet cables for less than \$13
- ▶ Use data switch for multiple computers, printers in one room



[www.amazon.com](http://www.amazon.com)



[www.amazon.com](http://www.amazon.com)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ If not electrically hypersensitive (EHS) and installing Ethernet network is not affordable, use pair of network adapters
- ▶ Netgear Powerline 200 or 500 Mbps
- ▶ Avoid models with Wi-Fi on second adapter
- ▶ This technology does generate dirty electricity on house circuits



[www.amazon.com](http://www.amazon.com)

*Oram Miller, BBEC, EMRS*

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ MOCA (Multi-media Over Cable Alliance) technology should be tolerated by electrically hypersensitive (EHS) individuals
- ▶ Uses existing co-axial TV cables already in walls
- ▶ Co-axial cable is shielded
- ▶ No dirty electricity generated
- ▶ Can still run television signals through co-axial cable using splitter



[www.amazon.com](http://www.amazon.com)

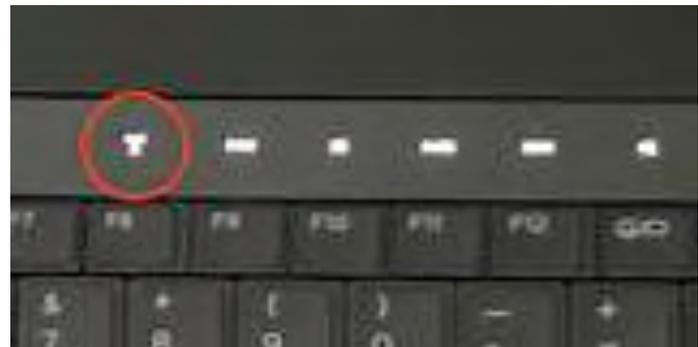
*Oram Miller, BBEC, EMRS*

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ You *must* manually disable Wi-Fi on router *and* laptop or desktop computer to get rid of Wi-Fi radio frequencies
- ▶ Plugging in Ethernet cable will *not* automatically disable Wi-Fi on its own on either your router or your laptop
- ▶ Consult with router's manufacturer, manual, or Internet Technology (IT) person to help disable Wi-Fi on router and computer



[iccinforcentre.com](http://iccinforcentre.com)



[piratstudenterna.se](http://piratstudenterna.se)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ No cordless keyboard and mouse
- ▶ Replace with *corded* keyboard and mouse
- ▶ Disable Bluetooth on computer
- ▶ Turn off power on cordless keyboard and mouse — will still transmit in the drawer



[en.wikipedia.org](http://en.wikipedia.org)



[ebay.pl](http://ebay.pl)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Mac Air and Macbook have no Ethernet port
- ▶ Use Thunderbolt-to-Ethernet adapter or USB-to-Ethernet adapter



[www.apple.com](http://www.apple.com)



[www.apple.com](http://www.apple.com)



[iphonehoesjeshop.nl](http://iphonehoesjeshop.nl)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Hardwired workaround for iPad and iPhone
- ▶ Put in Airplane mode — Get Internet without radio waves
- ▶ Go to Safer Use of Computers at [www.createhealthyhomes.com](http://www.createhealthyhomes.com)



[gottabemobile.com](http://gottabemobile.com)



[www.amazon.com](http://www.amazon.com)



[www.amazon.com](http://www.amazon.com)



[www.amazon.com](http://www.amazon.com)



[iphonehoesjeshop.nl](http://iphonehoesjeshop.nl)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Avoid Wi-Fi by providing hardwired Ethernet connection to TV for streaming video for Netflix, Hulu
- ▶ Plug Ethernet cable into Roku or Apple TV device
- ▶ Automatically disables Wi-Fi on Roku 1 & 2 and Apple TV 1 & 2
- ▶ With Apple TV 3, must disable Airplay with onscreen command
- ▶ Cannot disable Wi-Fi on Roku 3. We recommend not using
- ▶ Verify that Wi-Fi is disabled with RF detector, if you have one



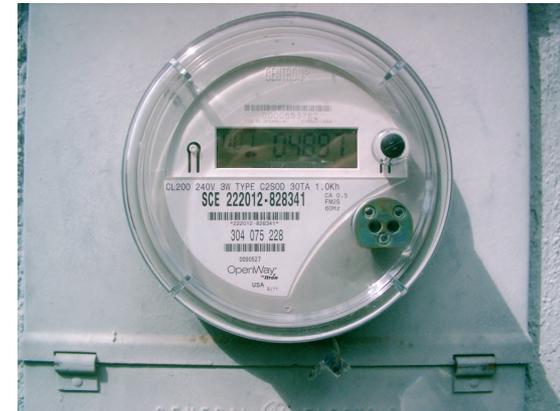
[commons.wikimedia.org](https://commons.wikimedia.org)



[zdnet.com](http://zdnet.com)

# Protect Yourself from Smart Utility Meters

- ▶ Smart Electric, Gas and Water meters now installed throughout most of the country
- ▶ Emit harmful “beacon signals” throughout the day and night to “synchronize” smart meters in mesh network
- ▶ Emit much stronger radio frequency signals one or more times per day to transmit data to utility home office
- ▶ Short (20-40 microSeconds), sharp/fast rise time and persistent (24/7) nature of beacon signals make smart meters more harmful than Wi-Fi, cell phones



# Sources of Dirty Electricity Exposure

- ▶ Electronic dimmer switches
- ▶ Compact Fluorescent Lamps (CFLs)
- ▶ Switched Mode Power Supplies
- ▶ Variable speed furnace and front-load washing machine motors
- ▶ Computers and printers



[www.conrad.com](http://www.conrad.com)

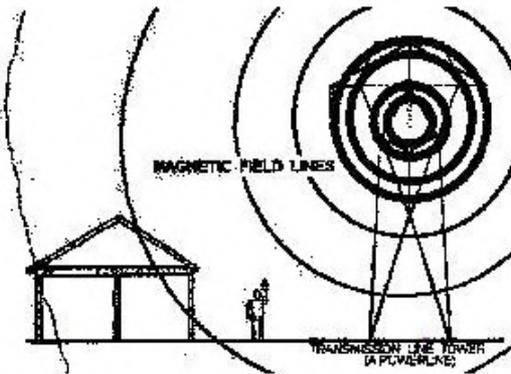
# Protect Yourself from Harmful “Dirty Electricity” (DE) Exposure

- ▶ Ideally eliminate sources of DE
- ▶ Avoid Compact Fluorescent Lamps
- ▶ Use Halogen incandescent bulbs
- ▶ LED bulbs — many are clean
- ▶ Install straight on/off switches rather than dimmer switches
- ▶ Use Dirty Electricity filters for what DE comes in from neighbors (repair wiring errors first)



**COMPARISON OF AC MAGNETIC AND AC ELECTRIC FIELDS**

**MAGNETIC FIELDS**

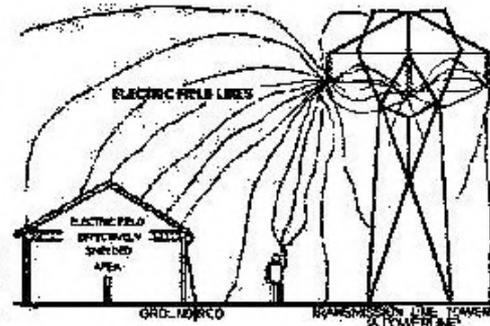


ARE THE ENERGIZATION OF THE SPACE AROUND ELECTRIC CURRENT FLOW

**PRODUCED BY ELECTRIC CURRENT FLOW**

DETECTED/ MEASURED BY:  
GAUSSMETER/ AMP METER

**ELECTRIC FIELDS**

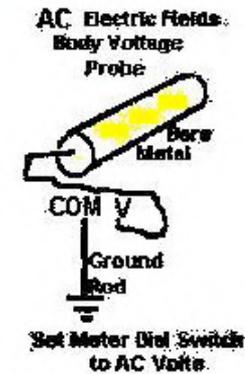
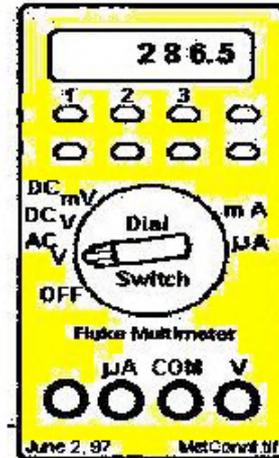
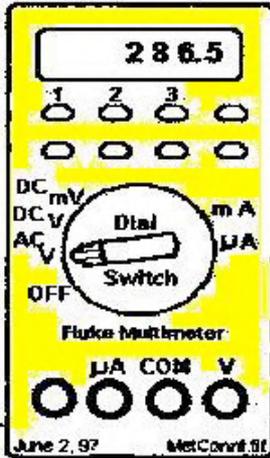


ARE THE ENERGIZATION OF THE SPACE BETWEEN VOLTAGE DIFFERENCES

**PRODUCED BY VOLTAGE**

DETECTED/ MEASURED BY:  
VOLT METER

28-Fs



Burmaster June 2, 1997. S. Burmaster. SASE&mf3.wpd

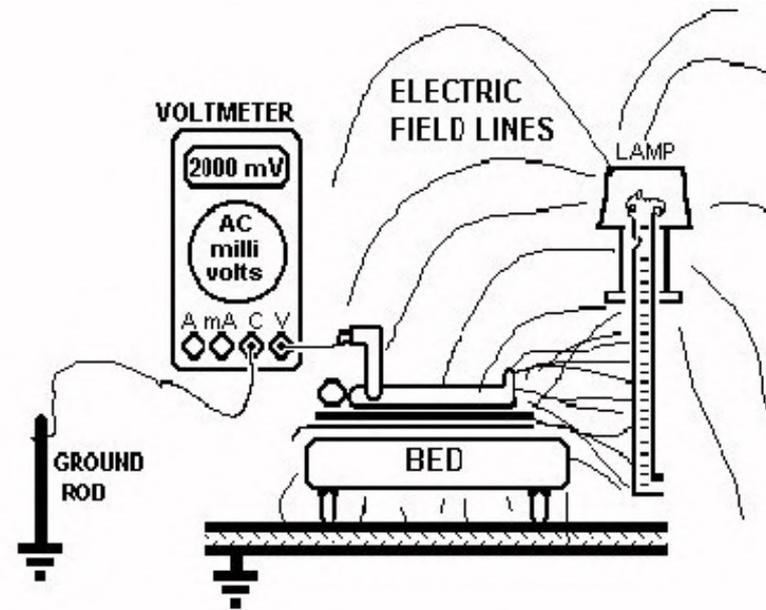


Courtesy Spark Burmaster, EE, BBEC

Oram Miller, BBEC, EMRS

# AC Electric Field Basics

- ▶ Produced by differences in electric voltage
- ▶ Measured with Volt meter (not Gauss meter)
- ▶ Similar to *pressure* in water hose (not flow)
- ▶ The “Unknown EMF”
- ▶ Independent of AC Magnetic Fields

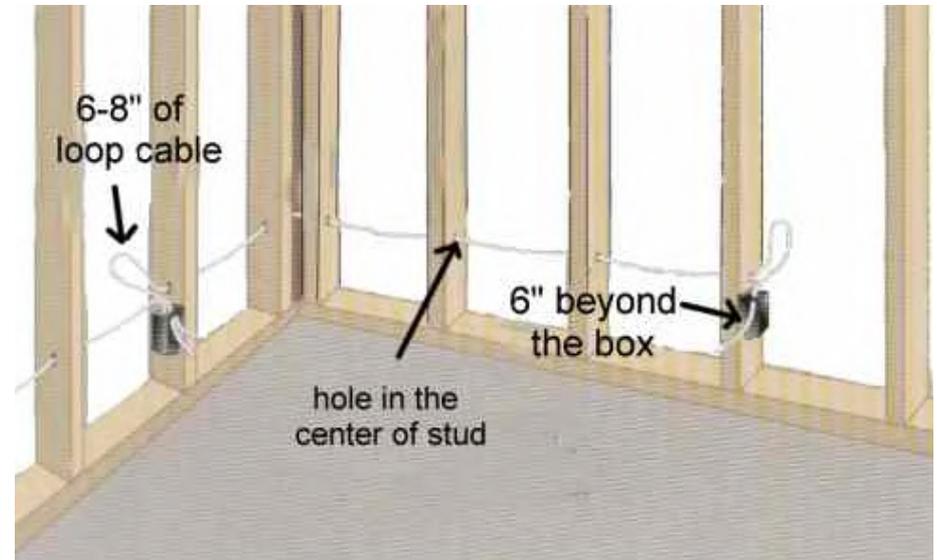


Courtesy Spark Burmaster, EE, BBEC



# Sources of AC Electric Field Exposure

- ▶ AC Electric fields present even if current is not flowing (e.g., lamp is off)
- ▶ Extends up to 6-8 feet from plastic-jacketed wiring (Romex) in walls
- ▶ Also extends 6-8 feet from unshielded AC power cords
- ▶ Decreases with distance
- ▶ Fields are present even when these devices are turned off but plugged in
- ▶ Affects people primarily while sleeping



Unshielded Romex Wiring



Bedside Lamp Cord

[www.etsy.com](http://www.etsy.com)

# Sources of AC Electric Field Exposure

Large electric field exposure from:

1. Electric blankets
2. Electric heating pads
3. Water bed heaters

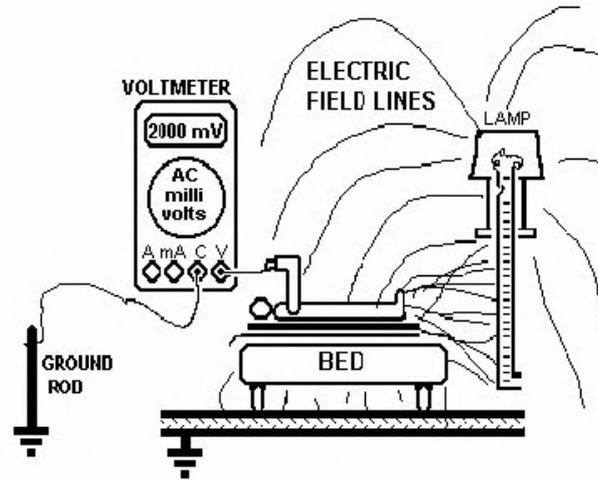
Fields are present even when these devices are turned off but plugged in



# EMF Meters and Instruments

## Electric Fields

- ▶ Body Voltage Meter
- ▶ Stand Alone Meter



Courtesy Spark Burmaster, EE, BBEC



Body Voltage Meters



Stand Alone Meters

# Building Biology Safe Exposure Guidelines for AC Electric Fields

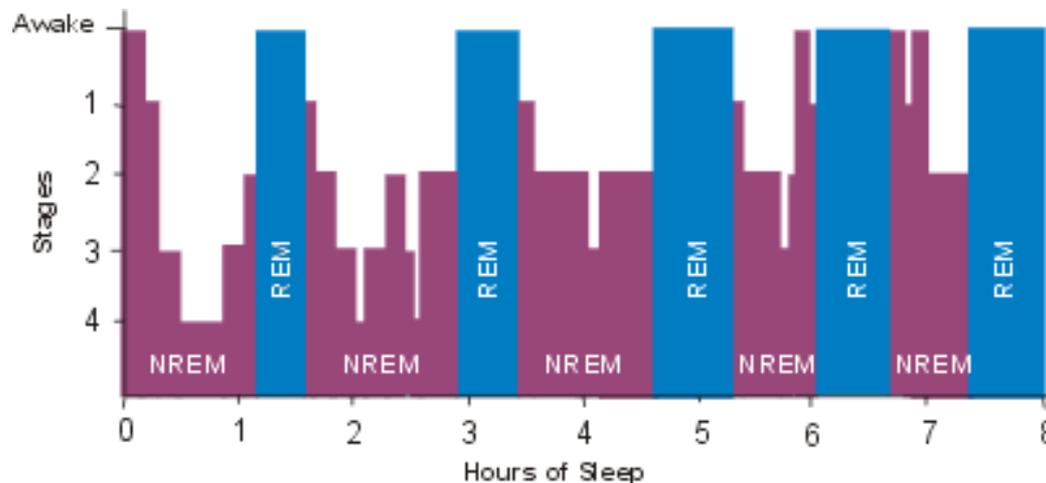
Building Biology Evaluation Guidelines for Sleeping Areas,  
SBM-2015

AC Electric Fields (Low Frequency, ELF/VLF)

|   | No Anomaly | Slight Anomaly | Severe Anomaly | Extreme Anomaly |
|---|------------|----------------|----------------|-----------------|
| Field Strength potential-free in Volt per meter (V/m) | < 0.3      | 0.3 - 1.5      | 1.5 - 10       | > 10            |
| Body Voltage with ground potential in milliVolt (mV)  | < 10       | 10 - 100       | 100 - 1,000    | > 1,000         |

# Adverse Health Effects from Exposure to AC Electric Fields

- ▶ Prevents deep, Stage Four Sleep
- ▶ Diminishes normal night time production of melatonin
- ▶ Causes chronic fatigue, fibromyalgia, sleep disorders, restless leg syndrome, allergies
- ▶ Also hyperactivity, depression, headaches



Sequences of states and stages of sleep on a typical night

# Improvements With Reduction of AC Electric Fields

- ▶ Deeper levels of Stage Four sleep
- ▶ Increase in normal night time melatonin production
- ▶ Results in:

Increased vitality and alertness

Reduction of muscle pain and joint stiffness

Increase in flexibility and range of motion

Reduction of fatigue, allergies, depression, cancer

Greater response to medical therapies

# Comments from Clients

- ▶ “My wife and I have not slept this soundly since we moved in!! ... I sleep undisturbed until 6:30 or 7 AM without interruption.”  
– j.r., North Tustin
- ▶ "I'm sleeping better. I used to wake up 5-7 times a night. Now I wake up maybe once, and sometimes not at all... My husband's sleeping better, too. Seems to be a big difference.”  
– n.j., Santa Ana
- ▶ "We slept so good. We shut off all necessary (marked) breakers. Just like you said, it felt like we were camping.”  
– d.b., Long Beach

# Reduce Electric Field Exposure — Plastic Romex Circuits in Walls

- ▶ Create electrically clean sleeping environment
- ▶ Romex circuits in walls and floor, electric fields extend 6-8 feet into bedroom
- ▶ Create zone without electric fields around, above, and below each bed
- ▶ Shut off circuit breakers — follow protocol on EMF Meters and Instruments page, Electric Fields section at [createhealthyhomes.com](http://createhealthyhomes.com)
- ▶ Install remote shut-off switch and contactor to turn off circuits from bedroom



hdimagegallery.net



safelivingtechnologies.com

# Reduce Electric Field Exposure — Metal-Clad Circuits in Walls

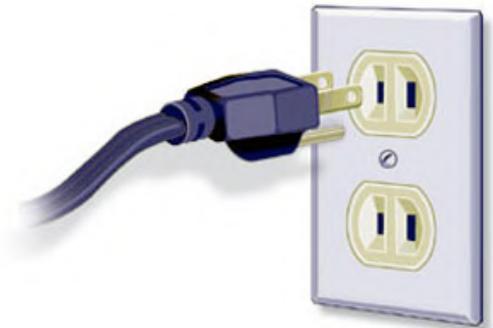
- ▶ If walls contain flexible MC (metal clad) or rigid (EMT) conduits, no electric fields emitted in bedroom
- ▶ You do not need to shut off breakers
- ▶ Use plug-in switches, shielded power strip
- ▶ Rewire lamps, appliances with shielded AC power cord (Mu Cord) [www.lessemf.com](http://www.lessemf.com)



[lessemf.com](http://www.lessemf.com)

# Reduce Electric Field Exposure

- ▶ Avoid electric blankets and electric heating pads (watch for reverse polarity on non-polarized plug)
- ▶ Use battery-operated clocks
- ▶ Laptop AC power cords and refrigerator AC power cords both must be 3-pronged and outlets must be properly grounded



wurchelectric.com

# Reduce Electric Field Exposure at Your Desk

## Ungrounded Laptop AC Power Cords – PCs

- ▶ Big source of energy-draining, unhealthy electric fields
- ▶ Many laptops have two-pronged (ungrounded) plugs
- ▶ Plug needs to be three-pronged (grounded)



- ▶ Purchase USB Ground Cord from [www.lessemf.com](http://www.lessemf.com)

- ▶ Also, outlet needs to be grounded



[www.popscreen.com](http://www.popscreen.com)

- ▶ Purchase circuit tester from hardware store to test ground at outlet – *both* amber lights need to be lit

## Two-pronged plug:



[www.ebay.com](http://www.ebay.com)

## Three-pronged plug:



[www.popscreen.com](http://www.popscreen.com)

# Reduce Electric Field Exposure at Your Desk

## Ungrounded Laptop AC Power Cords – Macs

- ▶ For Mac laptops, use the AC power adapter with the three-pronged plug
- ▶ Do not use the two-pronged adapter that slides directly into the transformer
- ▶ Pull the two-pronged adapter, shown on the left in the upper right corner, off the transformer, and slide on the cord shown on the right with the three-pronged plug
- ▶ Future models from Mac will not allow you to do this

### Two-pronged plug:



[laptopbattery.com](http://laptopbattery.com)

### Three-pronged plug:



[mactechgear.com](http://mactechgear.com)

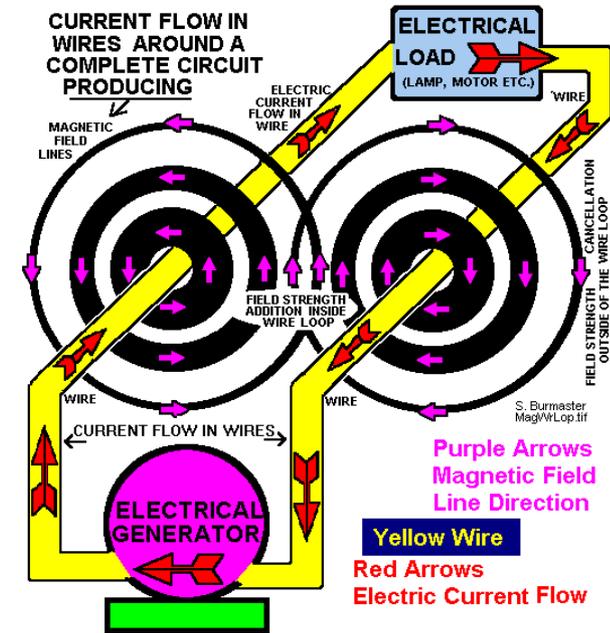


[shop.accessory4you.com](http://shop.accessory4you.com)

*Oram Miller, BBEC, EMRS*

# AC Magnetic Field Basics

- ▶ AC Magnetic Field exposure produced by current flow through a closed loop
- ▶ Occurs *only* when current is flowing
- ▶ Like *flow* of water through garden hose (not pressure)
- ▶ Independent of AC Electric Fields

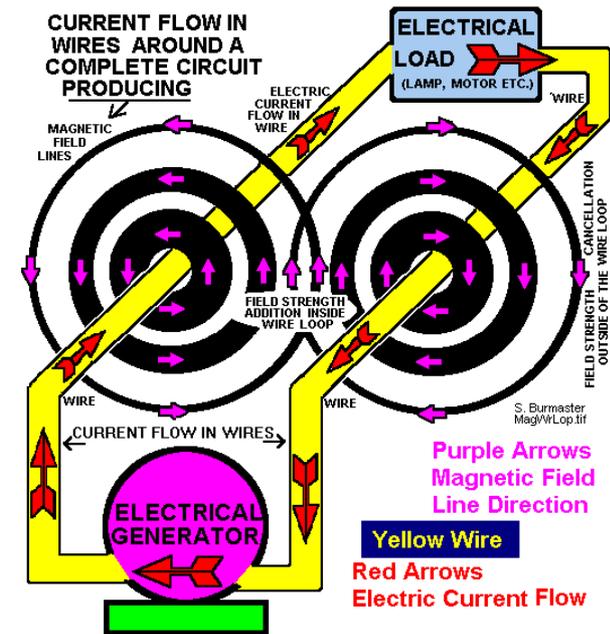


Courtesy Spark Burmaster, EE, BBEC

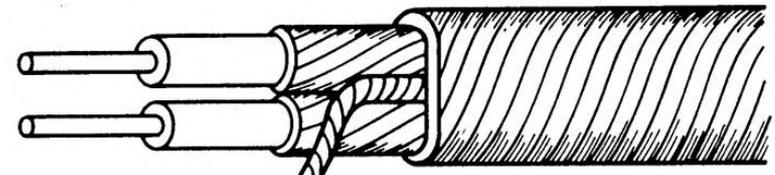


# AC Magnetic Field Basics

- ▶ Field strength decreases with distance from source
- ▶ Extends only 2-4 feet from typical point sources (transformers, motors)
- ▶ Can extend 6-10 feet from current on grounding system or wiring errors
- ▶ Occurs when hot and neutral are separated — overhead power lines, knob and tube circuits
- ▶ Fields are cancelled when wires run together — modern Romex, flex

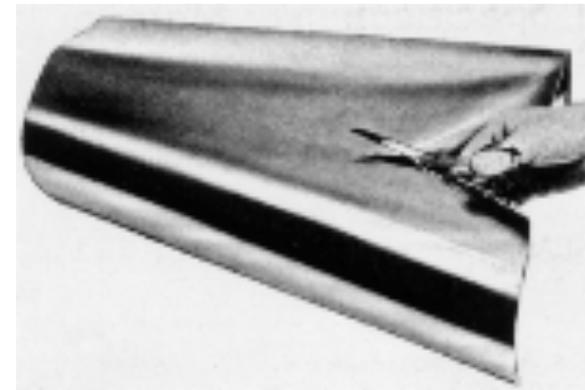


Courtesy Spark Burmaster, EE, BBEC, EMRS



# AC Magnetic Field Basics

- ▶ Shielding is difficult and very expensive
- ▶ Requires special materials, such as Mu Metal [www.lessemf.com](http://www.lessemf.com)
- ▶ Best to eliminate source or move yourself several feet away from source
- ▶ “Distance is your friend”



Mu Metal

# EMF Meters and Instruments

## Magnetic Fields

- ▶ Digital Gauss Meter, Gauss Master (single axis)
- ▶ FW Bell, Magnii Gauss Meters (triple axis)
- ▶ Tri-Field Flat Response model, *not* Frequency Weighted model (not recommended for measuring electric or radio frequency fields)

▶ “Buzz Stick”

- ▶ See EMF Meters and Instruments [www.createhealthyhomes.com](http://www.createhealthyhomes.com)



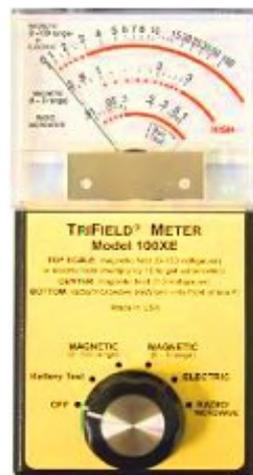
Single Axis Gauss Meter



Gauss Master



Buzz Stick



Tri-Field Meter  
Flat Response



FW Bell Gauss Meter



Magnii Gauss Meter

# Building Biology Safe Exposure Guidelines for AC Magnetic Fields

Building Biology Evaluation Guidelines for Sleeping Areas,  
SBM-2015

AC Magnetic Fields (Low Frequency, ELF/VLF)

|                                 | No Anomaly | Slight Anomaly | Severe Anomaly | Extreme Anomaly |
|---------------------------------|------------|----------------|----------------|-----------------|
| Flux Density in milliGauss (mG) | < 0.2      | 0.2 - 1        | 1 - 5          | > 5             |

# Sources of AC Magnetic Field Exposure

Four major sources of AC magnetic fields in homes:

1. Overhead outside power lines, especially high tension power lines – wires are widely separated



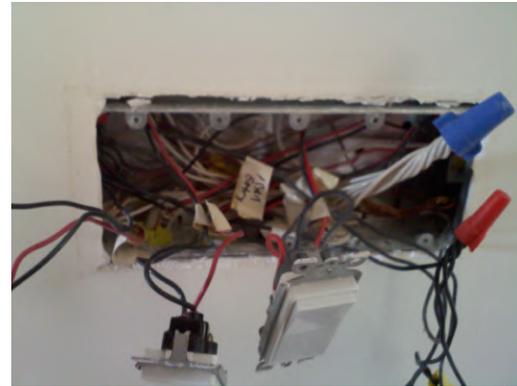
2. Point sources: motors (refrigerator), transformers (black box, inside stereo, TV, clock radio), electric meter, breaker panel



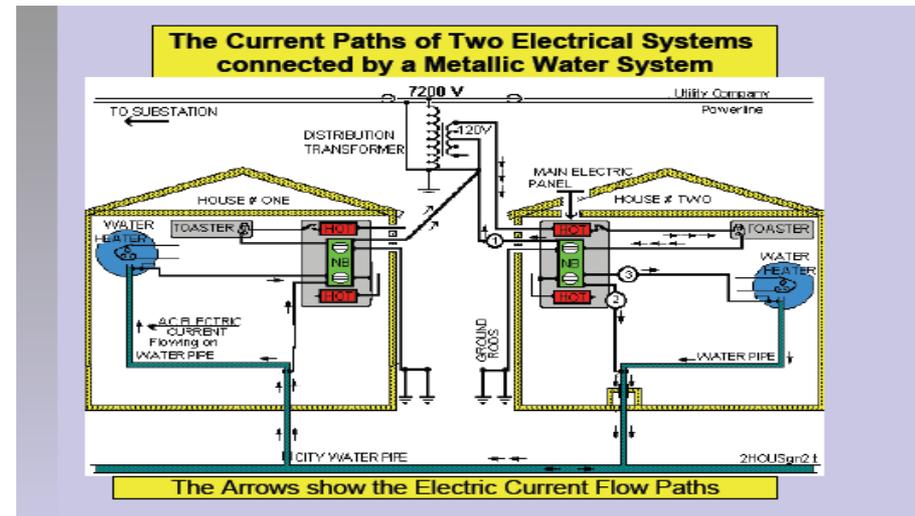
# Sources of AC Magnetic Field Exposure

Major sources in homes (continued):

3. Wiring errors in branch circuits – parallel paths; Knob & Tube wiring – conductors are separated



4. Current on grounding system – parallel return paths to transformer. Flows from neighbor's homes on incoming water pipes; also on cable TV line sheathing

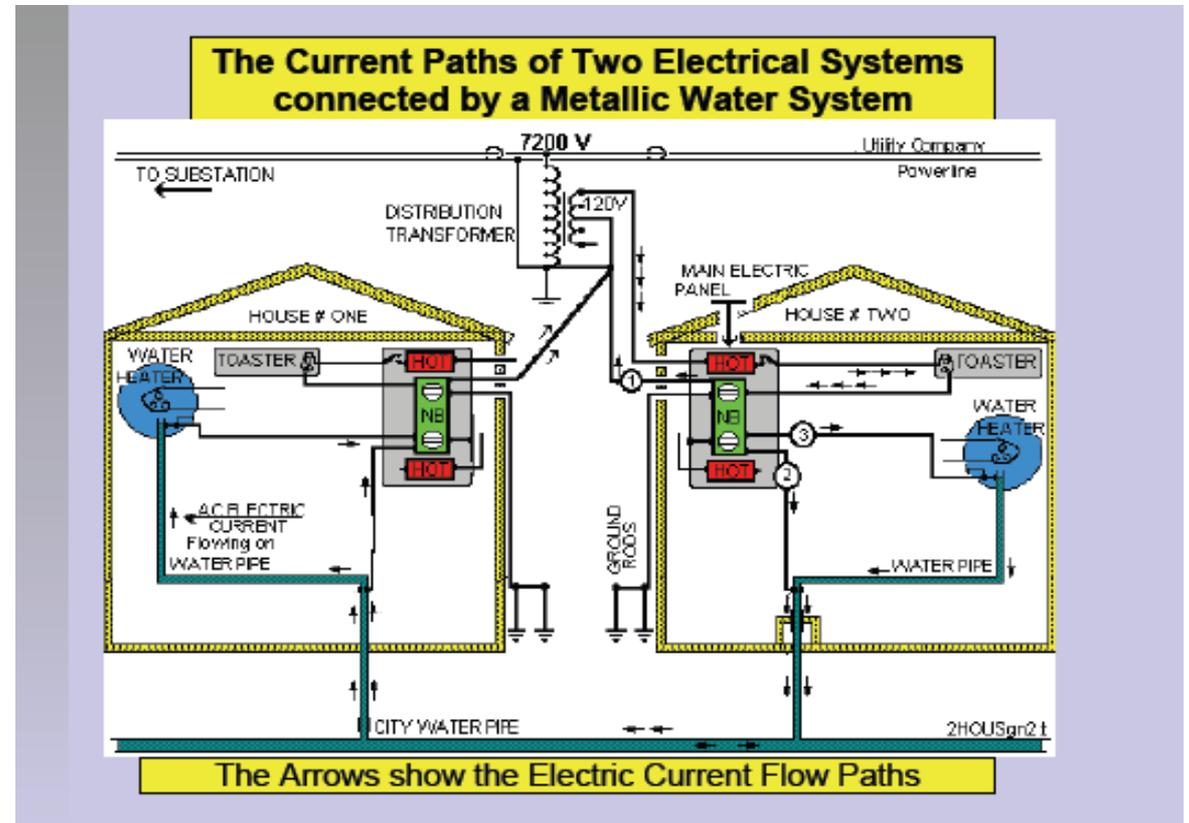


Courtesy Spark Burmaster, EE, BBEC, EMRS

Oram Miller, BBEC, EMRS

# Sources of AC Magnetic Field Exposure

- ▶ Electricity takes *all* available paths
- ▶ Not only the path of least resistance
- ▶ Similar to a stream taking all available paths to flow down a mountain



Courtesy Spark Burmaster, EE, BBEC, EMRS

# Service Drop Configurations



Poor Meter and Panel Location:  
Next to Occupied Space.  
Worse Case: Sleeping Area.



Better: Meter &  
Panel on Garage  
Far Wall.



Best: Meter & First Panel  
Away from House.  
Central Point  
for Feeds to Well  
and Out Buildings.

16

Courtesy Spark Burmaster, EE, BBEC

Oram Miller, BBEC, EMRS

# Reduce Magnetic Field Exposure

- ▶ Do not live near high tension power lines
- ▶ Do not sleep within 4 feet of electric meter (analog or digital) or breaker panel
- ▶ Do not sleep or sit on other side of refrigerator or TV
- ▶ Move transformers and uninterruptible power supply at computer work station 2-3 feet away from your feet and legs
- ▶ Current on return path needs to equal current on outgoing path (neutral must stay in same conduit or “raceway” as hot conductor)
- ▶ Current should only flow on intended paths (insulated wires), not on grounding paths (avoid “objectionable” current on ground)

- M. Spark Burmaster, EE, BBEC, and NEC

# Reduce Magnetic Field Exposure

- ▶ Transformer for halogen track lighting away from beds or sitting areas
- ▶ Do not sleep over fluorescent light fixtures or fan in ceiling of room underneath
- ▶ No motorized or electric beds without plugging into power strip with on/off switch



# Summary of EMFs Basics

- ▶ Flow of current produces magnetic fields
- ▶ Pressure of voltage produces electric fields
- ▶ EMFs found at various frequencies
- ▶ Meters and instruments used as detectors
- ▶ Can cause health problems
- ▶ Design home and office to avoid EMFs in first place

# Summary of Steps to Reduce EMFs Magnetic Fields

- ▶ Keep current on intended paths: insulated hot and neutral conductors within circuits
- ▶ Keep current off grounding paths: water pipes, TV cable sheathing
- ▶ Check for wiring errors prior to occupancy
- ▶ Avoid proximity to point sources: breaker panel, refrigerator, transformer, digital clock at front of stove
- ▶ Do not build on property near power lines

# Summary of Steps to Reduce EMFs Electric Fields

- ▶ Metal clad circuits (Flex or EMT) in and around bedrooms
- ▶ Shut off switch for outlets within 6-8 feet of bed
- ▶ With Romex circuits, use remote shut off switch for circuits
- ▶ Rewire lamps with shielded cord (MuCord)
- ▶ Move unshielded cords away from you at computer desk
- ▶ Use three-pronged, grounded AC power cords for laptops

# Summary of Steps to Reduce EMFs Radio Frequencies

- ▶ Reduce Use
- ▶ Increase distance
- ▶ Favor hardwired connections for Internet, telephone, media, security system, speaker, thermostat, intercom, & baby monitor connections
- ▶ Opt out of smart meters or use shielding
- ▶ Half mile to three-quarters of mile from most cell towers
- ▶ Incorporate shielding when necessary

# Summary of Steps to Reduce EMFs Dirty Electricity

- ▶ Replace CFLs with traditional light bulbs or LED bulbs
- ▶ Prefer straight on/off switches to dimmers
- ▶ Central control system dimmers (Lutron, Crestron) more clean than off-the-shelf dimmers
- ▶ Avoid ECM variable speed HVAC motors
- ▶ Replace smart utility meter with analog meter

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