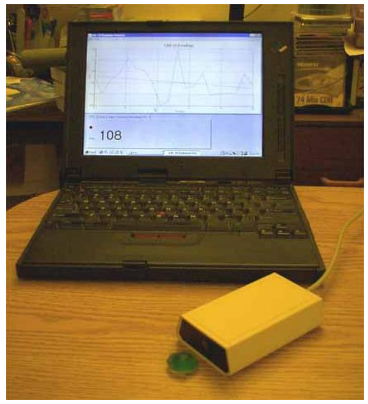
Radiation Monitoring Console

Hand held devices



Central Monitoring

Remote sensors

Hand held devices with USB interface

S.P.I.R.I.T. LAB		
Radiation	5/5/2010	Monitoring

We are finding more and more instances of Gamma radiation (around 350 mR/Hr) during paranormal activity. Do I think there is a correlation between Gamma Radiation and paranormal activity? You bet! Hang on though; it's a long, convoluted story. First let's take a look at radiation so we understand what we are measuring.

Types of Nuclear Radiation

There are essentially four types of nuclear radiation: alpha radiation, beta radiation, gamma radiation, and x radiation. A fifth type, neutron radiation, is also encountered in nuclear power plants and high-altitude flight and emitted from some industrial radioactive sources. For our purposes, unless we are investigating an old munitions factory, or something exotic like that, the First four will be our primary focus.

1. **Alpha Radiation**

(The most commonly encountered in the home or business)

Alpha radiation is a heavy, very short-range particle that is actually an ejected helium nucleus. The key characteristics of alpha radiation are:

A. Alpha radiation is not able to penetrate human skin. In fact, it can't penetrate a piece of paper.
B. Alpha-emitting materials can be harmful to humans if the materials are inhaled, swallowed, or absorbed through open wounds.
C. A variety of instruments has been designed to measure alpha radiation. Special training in the use of these instruments is essential for making accurate measurements.
D. A thin-window Geiger-Mueller (GM) probe can detect the presence of alpha radiation.
E. Instruments cannot detect alpha radiation through even a thin layer of water, dust, paper, or other material, because alpha radiation will not penetrate it.
F. Alpha radiation travels only a short distance (a few inches) in air, but is not an external hazard.
G. Alpha radiation is not able to penetrate clothing.

Examples of some alpha emitters: radium, radon, uranium, thorium.

2. **Beta Radiation**

Beta radiation is a light, short-range particle and is actually an ejected electron. Beta radiation is also encountered during certain paranormal events. Some characteristics of beta radiation are:

A. Beta radiation may travel several feet in air and is moderately penetrating. However, it can be blocked by aluminum foil.
B. Beta radiation can penetrate human skin to the "germinal layer," where new skin cells are produced. If high levels of beta-emitting contaminants are allowed to remain on the skin for a prolonged period of time, they may cause skin injury.
C. Beta-emitting contaminants may be harmful if deposited internally.
D. Most beta emitters can be detected with a survey instrument and a thin-window GM probe (e.g., "pancake" type). Some beta emitters, however, produce very low-energy, poorly penetrating radiation that may be difficult or impossible to detect. Examples of these difficult-to-detect beta emitters are hydrogen-3 (tritium), carbon-14, and sulfur-35.
E. Clothing provides some protection against beta radiation.

Examples of some pure beta emitters: strontium-90, carbon-14, tritium, and sulfur-35.

An SE International Monitor 4 radiation detector can detect Alpha and Beta radiation

3. **Gamma and X Radiation**

   Gamma radiation and x rays are highly penetrating electromagnetic radiation. Gamma radiation is not normally associated with paranormal activity of a haunting nature. Some characteristics of these radiations are:

   A. Gamma radiation or x rays are able to travel many feet in air and many inches in human tissue. They readily penetrate most materials and are sometimes called "penetrating" radiation.
   B. X rays are like gamma rays. X rays, too, are penetrating radiation. Sealed radioactive sources and machines that emit gamma radiation and x rays respectively constitute mainly an external hazard to humans.
   C. Gamma radiation and x rays are electromagnetic radiation like visible light, radiowaves, and ultraviolet light. These electromagnetic radiations differ only in the amount of energy they have. Gamma rays and x rays are the most energetic of these.
   D. Dense materials are needed for shielding from gamma radiation. Clothing provides little shielding from penetrating radiation, but will prevent contamination of the skin by gamma-emitting radioactive materials.
   E. Gamma radiation is easily detected by survey meters with a sodium iodide detector probe.
   F. Gamma radiation and/or characteristic x rays frequently accompany the emission of alpha and beta radiation during radioactive decay.

   Examples of some gamma emitters: iodine-131, cesium-137, cobalt-60, radium-226, and technetium-99m.

Radioactivity and decay

This may be a bit beyond some folks, but I feel it is necessary to understand radiation as much as possible in order to understand what you are in fact measuring. Radioactivity is the spontaneous disintegration of atomic nuclei. This sounds like a mouthful and it is. The nucleus emits Alpha particles, Beta particles, or electromagnetic rays during this process. You can see a possible correlation to EMF spikes which is why this is an important part of the big picture.

Alpha Decay:

Alpha decay occurs when the nucleus spontaneously ejects an Alpha particle. An Alpha particle is really 2 protons and 2 neutrons, or an He nucleus. So when an atom undergoes Alpha decay, its atomic number decreases by 2 and its atomic mass decreases by 4. Alpha particles do not penetrate much material, as we discussed above as simply placing a sheet of paper between the detector and the source will block them. A good way to identify alpha radiation is to place a piece of paper across the detector window, and if the radiation ceases you know you are measuring Alpha radiation. . An example of Alpha decay is the following:

Pu239 →U235 + Alpha particle (He-4 nucleus)

There is a difference in mass between the original nucleus and the sum of the mass of the particle and resulting nucleus. This lost mass is converted into energy using Einstein's famous formula E = mc2; the energy would equal the kinetic energy of the particle and the recoil energy of the resulting nucleus. Remember for every action there is an opposite and equal reaction? Its something like that.

Particles are as a general rule mono-energetic. However, they can have different energies, such as in the case of 226 Ra. This isotope of radium has a small percentage of particles that lack their full energy; consequently the nucleus is left agitated and emits gamma rays. A percentage of these rays will transfer energy to an orbital electron as part of the process known as internal conversion.

Whew! I bet you had no idea the complexities involved with measuring radioactivity!

Beta - Decay:

Beta decay falls into two categories; Beta+ and Beta - decay. Too many neutrons in an atom's nucleus renders it unstable, thus a neutron is converted into a proton to reduce this ratio. During this process, a Beta particle is ejected, carrying the same mass and charge as an electron. The resulting atom and the Beta particle have a total mass which is less than the mass of the original atom, and the logical thought would lead one to assume the Beta particles should have the energy equivalent to the mass lost (again E = mc2). However, remember what assume does to you and me. The truth of the "matter" is Beta particles are not mono-energetic, and radiate over a broad energy spectrum from zero to the possible maximum energy. This is because the Beta particle is accompanied by micro-mass/micro-energy particles called neutrinos, whose kinetic energy makes up for the energy discrepancies that remain. The result of Beta - decay is the atomic number of the atom increases by 1.

Beta + Decay:

If there is an excess of protons in the nucleus, and it is not energetically possible to emit a particle, Beta + decay occurs. This happens because the nucleus becomes stable by converting a proton into a neutron. During Beta + decay, a positron (a particle with the same mass as an electron but with positive charge), and a neutrino are released. Positrons interact with electrons, causing them both to annihilate each other. Two gamma ray photons with the same energy as the mass of the positron and electron are then released.

Electron Capture:
Often, for whatever reason it is not energetically feasible to convert a proton into a neutron by emitting a positron (Beta + decay). In these cases, electron capture, or K capture is the result. The nucleus captures an electron from an inner orbital, usually the K orbital, and uses it to convert a proton into a neutron. The mass differential is converted into a gamma ray and a neutrino.

Internal Conversion:
Internal conversion is a process in which a gamma ray is emitted from the nucleus that collides with an orbital electron. The electron absorbs the energy and is then ejected from the atom.

Gamma Radiation:
Gamma ray emission is usually accompanied with a Beta emission. Gamma rays have no charge or mass, so their emission doesn't alter the chemical make up of the atom. It does, however, result in a loss of radiant energy. Gamma ray emission is the result of an unstable nucleus after the nucleus is often unstable after Beta decay. There are known cases where pure gamma emission occurs, but only when an isotope exists in two forms (nuclear isomers). This means they have the same atomic and mass numbers, but have different nuclear-energy levels. Gamma emission occurs when the isomer swings from a higher to a lower energy level. An example of this is isotope protactinium-234, which exists in two different energy states. The isotope emits gamma rays when undergoing transition to the lower-energy state.

The application of quantum mechanics to a simple model of the nucleus reveals the phenomenon of radioactive disintegration. The statistical nature (possible states) of quantum mechanics allows disintegration as a chance phenomenon without any special hypothesis. It is a possibility once the field collapses.

Everett's many-worlds theory of quantum mechanics invariably reveals an example of a one-time measurement, rather than a continuous process such as detecting radioactive decay with a Geiger counter. The theory postulates that at every moment there is a division into a decay world and a non-decay world, which would produce an infinity of worlds in every time period, however short, and offer no way to deal with half-life and the probability of decay. But WAIT!

We also know that the wave function of the original atom exponentially decays in amplitude while that of the subsequent atoms grows towards unity, exactly as the Schrodinger Equation says it does.

Interestingly, the only difference between Everett theory and Copenhagen interpretation is that, in the former, the amplitude of the observer “not detecting the decay”, decays exponentially as well. Or let’s look at this in a quantum manner.

Wave Functions

I can’t talk enough about wave functions. They are a vital element in bringing the whole process together. The wave function of each electron can be described as a set of three quantum numbers:

A. Principal number (n) - describes the energy level.
B. Altazimuth number (l) - how fast the electron moves in its orbit (angular momentum); like how fast a CD spins (rpm). This is related to the shape of the orbital.
C. Magnetic (m) - its orientation in space.

It was later theorized that no two electrons could be in the exact same state, so a fourth quantum number was added. This number was related to the direction that the electron spins while it is moving in its orbit, either clockwise, or counterclockwise. Only two electrons can share the same orbital, one spinning clockwise and the other spinning counterclockwise.

The orbitals have different shapes and maximum numbers at any level:

A. s (sharp) - spherical (max = 1)
B. p (principal) - dumb-bell shaped (max = 3)
C. d (diffuse) - four-lobe-shaped (max = 5)
D. f (fundamental) - six-lobe shaped (max = 7)

The names of the orbitals were derived from the names of atomic spectral features before quantum mechanics was formally invented. Each orbital can hold only two electrons. Also, the orbitals have a specific order of filling, generally:
s
p
d
f

However, there is some overlap (any chemistry textbook has the details).

The resulting concept of the atom is called the quantum model of the atom.

Sodium has 11 electrons distributed in the following energy levels:

- one s orbital - two electrons
- one s orbital - two electrons and three p orbitals (two electrons each)

- one s orbital - one electron

Currently, the quantum model is the most accepted and realistic vision of the overall structure of the atom. It explains the majority of what we know about chemistry and physics.

And now, the Chemistry:

Elements have different atomic numbers - the number of protons or electrons increases up the periodic table as electrons fill the shells.

Elements have different atomic masses - the number of protons plus neutrons increases up the table.

Rows - elements of each row have the same number of energy levels (shells).

Columns - elements have the same number of electrons in the outermost energy level or shell (one to eight).

Chemical reactions - exchange of electrons between various atoms (giving, taking, or sharing). Exchange involves electrons in the outermost energy level in attempts to fill the outermost shell (i.e., most stable form of the atom).

Followed closely by Physics

Radioactivity - changes in the nucleus (i.e., decay) emit radioactive particles.

Nuclear reactors - splitting the nucleus (fission)

Nuclear bombs - splitting the nucleus (fission) or forming a nucleus (fusion)

Atomic spectra - caused by excited electrons changing energy levels (absorption or emission of energy in the form of light photons).

Inside every atom are three subatomic particles: protons, neutrons and electrons.

Protons and neutrons bind together to form the nucleus of the atom, while the electrons orbit outside the nucleus. Protons and electrons have opposing charges (electrons are negative and protons are positive, and opposite charges attract) and therefore they attract one another and generally the number of electrons and protons are equal for an atom, rendering it neutrally charged. The neutrons are neutral, (no pun intended). Their purpose in the nucleus is to bind protons together. As the protons all hold the same charge and would naturally repel one another, the neutrons act as the "glue" that binds the protons tightly together in the nucleus.

The number of protons in the nucleus determines the behavior of an atom. Say you combine 13 protons with 14 neutrons to create a nucleus and then spin 13 electrons around that nucleus, you have an aluminum atom. By assembling millions of aluminum atoms together you create a substance that is aluminum, allowing you to form aluminum cans, aluminum foil and aluminum siding, automobile bumpers or heat sinks.

Aluminum that exists in nature is known as aluminum-27. The "27" is the atomic mass number, or the sum of the number of neutrons and protons in the nucleus (remember the periodic table from high school science? No?). If one were to take an atom of aluminum and put it in a bottle and come back in several million years, it will still be an atom of aluminum. Aluminum-27 is known as a stable atom. Until about 100 years ago, it was believed that all atoms were stable. We now know this isn't the case.

A lot of atoms occur in different forms. Copper for instance, has two stable forms: about 70 percent of all natural copper is copper-63. The other thirty percent is copper-65. These two forms are known as isotopes. Atoms of both isotopes of copper have 29 protons, but a copper-63 atom has 34 neutrons while a copper-65 atom has 36 neutrons. Each of these isotopes acts and looks the same. Both are also stable.

The part that was not understood until the early twentieth century is that some elements contain isotopes that are radioactive. Additionally, there are some elements in which ALL of the isotopes are radioactive.

Hydrogen is a good example of an element with multiple isotopes, one of which is radioactive. Normal hydrogen, or hydrogen-1, has one proton and no neutrons (because there is only one proton in the nucleus, there is no need for the binding effects of neutrons).

There is another isotope, hydrogen-2, also known as deuterium, which has one proton and one neutron. Deuterium is very rare in nature, making up approximately 0.015 percent of all hydrogen, and although it acts like hydrogen-1 (you can make water out of it for example) it turns out it is different enough from hydrogen-1 in that it is toxic to life in high concentrations. The deuterium isotope of hydrogen is also stable.

A third isotope, hydrogen-3, also known as tritium, has one proton and two neutrons. This isotope is highly UNSTABLE. If you have a container full of tritium and come back in a million years, you will find that it has all turned into helium-3 (two protons, one neutron), which is stable. The process by which it turns into helium is called ***radioactive decay***.

As we have mentioned before, certain elements are naturally radioactive in all of their isotopes. Uranium is the best example of this type of element, and uranium is the heaviest *naturally occurring* radioactive element. There are eight other naturally occurring radioactive elements. These are polonium, astatine, radon, francium, radium, actinium, thorium and protactinium. Pay attention to these names. One or more will pop up again.

All other *man-made* elements *heavier than uranium* are *radioactive* as well.

Now, when investigating a home while using a radiation detector, be it a new state-of-the-art SE International, Inc. Monitor 4, or a surplus Civil Defense meter from the 1960's, chances are you will encounter radiation spikes. Operating in a grid pattern, try to determine the source. Also, be aware of what is around you. Take a careful look around. Americium-241, a radioactive element best known for its use in smoke detectors, is a good example of an element that undergoes alpha decay. An americium-241 atom will spontaneously throw off an alpha particle. Remember, an alpha particle is made up of two protons and two neutrons bound together, which is the equivalent of a helium-4 nucleus. In the process of emitting the alpha particle, the americium-241 atom becomes a neptunium-237 atom. The alpha particle leaves the scene at a high velocity -- perhaps 10,000 miles per second (16,000 km/sec). This is all well and good Dave, but what does this mean?

It means your "Ghost" may be a smoke detector, decaying Americium-241 and therefore creating readable radiation spikes. Now is the time to pull out a sheet of paper and put it over the detector or the radiation meter. If you have eliminated the spikes by this action, you have found the source of the spikes. If not, carry on!

Here is the deal. If you were looking at an individual americium-241 atom, it would be impossible to predict when it would throw off an alpha particle. However, if you have a large collection of americium atoms, then the rate of decay becomes quite predictable. For americium-241, it is known that half of the atoms decay in 458 years. Therefore, 458 years is the half-life of americium-241. Every radioactive element has a different half-life, ranging from fractions of a second to millions of years, depending on the specific isotope. For example, americium-243 has a half-life of 7,370 years.

Again, let me restate this so everyone gets it. Americium-241 can cause spikes in your radiation meter. Eliminate smoke detectors as the source before believing you have a paranormal event.

Tritium (remember, hydrogen-3) is a prime example of an element that undergoes beta decay. Remember, beta decay is the result of a neutron in the nucleus spontaneously turning into a proton, an electron, and a third particle called an antineutrino. The nucleus ejects the electron and antineutrino, while the proton remains in the nucleus. The ejected electron is referred to as a beta particle. The nucleus loses one neutron and gains one proton. Therefore, a hydrogen-3 atom undergoing beta decay becomes a helium-3 atom.

In spontaneous fission (no, not spontaneous combustion), an atom actually splits instead of throwing off an alpha or beta particle. The word "fission" literally means "splitting." A heavy atom such as fermium-256 will embark on a course of spontaneous fission roughly 97 percent of the time when it decays, and in the process, it becomes two atoms. For example, one fermium-256 atom may become a xenon-140 and a palladium-112 atom, and in the process it will eject four neutrons which are called "prompt neutrons" because they are ejected at the moment of fission. These neutrons can be absorbed by other atoms and cause nuclear reactions, such as decay or fission, or they can collide with other atoms, like billiard balls, and cause gamma rays to be emitted. Or you could just have a blinding flash and a really big BOOM.

Neutron radiation can be used to make nonradioactive atoms become radioactive much like rubbing a magnet across the head of a screwdriver makes it magnetic; this has practical applications in nuclear medicine. Neutron radiation is also made from nuclear reactors in power plants and nuclear-powered ships and in particle accelerators, devices used to study subatomic physics. Neutron radiation is not something normally found in a place of residence.

Most of the time a nucleus that has undergone alpha decay, beta decay or spontaneous fission will be highly energetic and therefore unstable. It will eliminate its extra energy as an *electromagnetic pulse* known as a gamma ray. Gamma rays are like X-rays in that they penetrate matter, but they are more energetic than X-rays. Gamma rays are made of pure energy, not moving particles like alpha and beta particles. Gamma rays will also kill you graveyard dead. Gamma Rays are not normally found in places of residence. Neither are X-rays, but you can measure them from the sun.

Speaking of rays, there are also cosmic rays bombarding the Earth 24/7. Cosmic rays originate from the sun and also from things like exploding stars. The majority of cosmic rays (perhaps 85 percent) are protons traveling near the speed of light, while perhaps 12 percent are alpha particles traveling very quickly. It is the speed of the particles, by the way, that gives them their ability to penetrate matter. When they hit the atmosphere, they collide with atoms in the atmosphere in various ways to diffuse into secondary cosmic rays that have less energy. These secondary cosmic rays then collide with other things on Earth, including humans. We get hit with secondary cosmic rays all of the time, but we are not injured because these secondary rays have lower energy than primary cosmic rays. Primary cosmic rays are a danger to astronauts in outer space.

Although they are "natural" in the sense that radioactive atoms naturally decay and radioactive elements are a part of nature, all radioactive emissions are dangerous to living things. Alpha particles, Beta particles, Neutrons, Gamma rays and Cosmic rays are all known as ionizing radiation, meaning that when these rays interact with an atom they can knock off an orbital electron. The loss of an electron can cause problems, including everything from cell death to genetic mutations (leading to cancer), in any living thing.

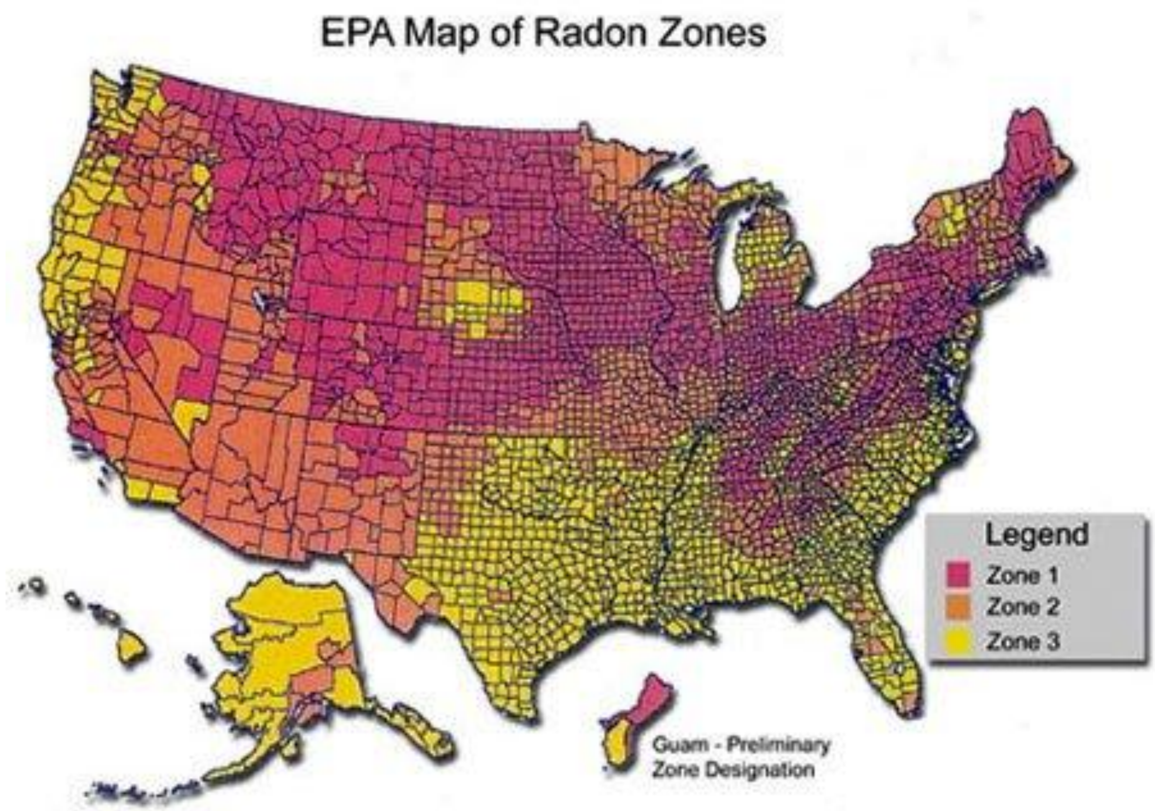
Because alpha particles are large, they cannot penetrate very far into matter. ***They cannot penetrate a sheet of paper***, for example, so when they are outside the body they have no effect on people. If you eat or inhale atoms that emit alpha particles, however, the alpha particles can cause quite a bit of damage inside your body at sufficient levels.

Beta particles penetrate a bit more deeply, but again are only dangerous if eaten or inhaled; ***beta particles can be stopped by a sheet of aluminum foil or Plexiglas*****.** So if you cover your radiation detector with aluminum foil, and you still have spikes, head for the hills! ***Gamma rays, like X-rays, are stopped only by lead shielding.***

Neutral neutrons, because they lack any charge, penetrate very deeply, and are only stopped by extremely thick layers of concrete or liquids like water or fuel oil. Gamma rays and neutrons, because they are so penetrating, can have severe effects on the cells of humans and other animals. You may have heard of a nuclear device called a neutron bomb. The concept of this bomb is to optimize the production of neutrons and gamma rays so that the bomb has its maximum effect on living things, while leaving the buildings intact.

Radioactivity is "natural," and we all contain things like radioactive carbon-14. But all things that are natural do not necessarily belong on the shelf at the health food store.
I want to talk now about the single most cause of false radiation spike positives in paranormal investigation. If you live in certain parts of the United States, you might be aware of the threat that radon gas poses. Radon gas is radioactive, and in tightly insulated houses it can accumulate to concentrations that pose a health threat. If you inhale the gas into your lungs, its decay can increase your chance of getting lung cancer. A study reported in 1990 by the National Safety Council estimated that about 14,000 deaths a year could be attributed to radon, and that the number could range from 7,000 to 30,000.

Now look at your region on the map below. If you are in the red areas, you must test for Radon to eliminate that as a source of your radiation spikes.



Radon
Radon gas, like carbon-14 gas, is completely natural. It forms during the decay of uranium-238, an element with a fairly interesting decay sequence. Radon is often found where there are large concentrations of granite in the ground below a structure.

Let's begin with a uranium-238 atom. This atom has 92 protons and 146 neutrons. It has a half-life of 4.5 billion years. That's right, I said billion. When it decays it emits an alpha particle, leaving behind a thorium-234 atom.

A thorium-234 atom has 90 protons and 144 neutrons. It has a half-life of 24.5 days. When it decays it emits a beta particle and a gamma ray, leaving behind a protactinium-234 atom.

A protactinium-234 atom has 91 protons and 143 neutrons. It has a half-life of 269,000 years. When it decays it emits a beta particle and a gamma ray, leaving behind a thorium-230 atom.

A thorium-230 atom has 90 protons and 140 neutrons. It has a half-life of 83,000 years. When it decays it emits an alpha particle and a gamma ray, leaving behind a radium-226 atom.

A radium-226 atom has 88 protons and 138 neutrons. It has a half-life of 1,590 years. When it decays it emits an alpha particle and a gamma ray, leaving behind, yes, you guessed it, a radon-222 atom.

That radon atom is a gas atom, and it has a half-life of only 3.825 days.

Accumulations of radon atoms from the natural nuclear decay of uranium-238 is where radon gas comes from. That means that radon gas concentrations are higher where uranium is plentiful in the soil. For completeness, here is the rest of the sequence:

Radon-222, with a half-life of 3.825 days, emits an alpha particle to become polonium-218.

Polonium-218, with a half-life of 3.05 minutes, emits an alpha particle to become lead-214.

Lead-214, with a half-life of 26.8 minutes, emits a beta particle and a gamma ray to become bismuth-214.

Bismuth-214, with a half-life of 19.7 minutes, emits either an alpha particle or a beta particle and a gamma ray to become either thallium-210 or polonium-214.

Polonium-214, with a half-life of a 150 microseconds, emits an alpha particle to become thallium-210.

Thallium-210, with a half-life of 1.32 minutes, emits a beta particle to become lead-210.

Lead-210, with a half-life of 22 years, emits a beta particle and a gamma ray to become bismuth-210.

Bismuth-210, with a half-life of five days, emits a beta particle to become polonium-210.

Polonium-210, with a half-life of 138 days, emits an alpha particle and a gamma ray to become lead-206.

Lead-206 is a stable isotope of lead.

Special acknowledgment to Craig C. Freudenrich, Ph.D. for his contribution to the field of nuclear science and who is the central source for this information.

So you eliminate smoke detectors, and radon gas as the possible source of your radioactive spikes, and you are still reading bursts of radiation, often accompanied by an EMF spike, or if you have a sensor and oscope, a low frequency EMF waveform is present, what does it mean?

It is possible that radiation could be a byproduct of matter transference. In other words, we have situations where fields and phenomena appear out of nowhere. EMF fields with no apparent source, radiation spikes with no known source. What if there were portals or wormholes at paranormally active locales that periodically open and close. What if when they open, they facilitate a paranormal event horizon to form? In other words, what if a parallel universe was briefly “connected” to our own, and matter transferred between the two? Visualize two sheets hanging on a clothes-line. A light breeze blows them and they flap a bit, occasionally touching each other in various spots around the sheets. When this occurs, molecules from one sheet transfer to the other, and vice versa. Some paranormal phenomena may be the result of this matter transference. The Gamma Radiation would then be the direct result of matter that is slightly out of phase with our own matter colliding and creating particle annihilations. While we have some preliminary evidence that this may indeed be the case, much more research needs to be performed.

These are just some of the questions that remain to be answered, so go out there and find the answers!

As always, share your findings with the world.