Some specific EMP, HEMP, solar flare, CME information and preps:

There is definitely a great deal of incorrect information everywhere on EMP, HEMP, CME, and solar flares.

First, very often a solar flare is shown as an illustration in context with a CME. They are two different events. A solar flare can send streams of energy at nearly the speed of light. That energy, which will begin to arrive in approximately 8 to 9 minutes after it leaves the sun, and will continue for the time the flare lasts, unless the earth passes the point that the flare is traveling. The energy release usually only lasts a few minutes. So, the event is relatively short lived. But the energy can be very intense, creating problems for satellites, and occasionally the power grid that is under the flare. And, at times, the ozone layer.

A CME, on the other hand, is, as the name states, an ejection of coronal mass from the sun. As it is a mass, it does not travel anywhere near the speed of light. It is moving fast though, and can reach earth's orbit in the matter of just a few days, with the larger and more powerful CMEs travelling the fastest and reach earth's orbit the quickest.

And I am saying reaching earth's orbit for a reason. Because it does take many hours for the mass to reach the orbit, the direction in which the CME leaves the sun is important. If it happens to eject toward the earth, the earth will be well past the point where the mass crosses the orbit when it gets there.

Only if the ejection is on a trajectory that is ahead of where the earth is at the time of the ejection, will it impact the earth when the two reach the same point in space at the same time. Since the CME might last for up to hours, it could impact much of the earth as the earth rotates while still in the path of the CME.

Okay, that gets a CME to earth. A CME does, in fact, create an EMP. However, it is not the same as a nuclear induced EMP. Especially a HEMP. While the energy in a CME does excite the electrons in the upper atmosphere, there is not the extremely intense effect that creates the E1 part of an EMP. There is a bit, but not much. There is a bit of E2 component, as well. But the largest problem is the huge, longer lasting E3 part of the pulse.

The E3 component is much longer lasting in the first place, even from a nuclear EMP device, lasting on the order of a couple to several seconds. Add in the fact that a CME, unlike nuclear EMP or HEMP devices, which are an immediate action, over in a fraction of a second that creates a seconds' long E3 component of an EMP, the CME will be a continuous event that could last for several hours, creating and maintaining an E3 component all that time.

So, instead of a few seconds of activity, it could be minutes or even hours of energy pouring into earth's atmosphere, being picked up and carried by pretty much anything metallic that is linear in shape. Including power lines.

Things not connected to a power line will not be affected much, unless they have a truly long conductor that can pick up the energy directly. The amount of energy that will be induced into power lines will be enough, if it is a large CME on the order approaching that of the Carrington Event or larger, to destroy the actual lines, not just things attached to them. But that will take long enough for most of the things attached to be affected to some degree, up to being destroyed, as well.

Since the majority of computers in use will be attached to a power line, most of them will go down. Vehicles with computers should not be affected except under extremely unlikely circumstances. Radios not connected to the grid might or might not be affected, depending on the length of the antenna, and the severity of the CME. Not likely, but not impossible.

That brings us to the preps for a CME. This assumes, of course, that a really big one hits us. Since the primary effect is going to be the loss of the electrical grid, there will be a vast number of effects resulting from that loss. Pretty much the entire infrastructure of modern society will come to an end, or at least a halt.

There really are not any very specific preps for CMEs that are not already a part of preps for other things. Since the loss of electrical power is one of the things most preppers have made provisions to deal with, that should already be covered. And in the same vein, many of the other effects that EMPs, solar flares, and CMEs produce are also produced by other types of disasters that preppers are already making provisions for.

Even some physical components of the infrastructure will be destroyed in addition to the electrical grid components, due to other effects. Highways would still exist, for example. But they can be damaged or blocked by vehicles that run out of fuel, or damaged if fuel leaks catch fire and burn. Bridges can be blocked in the same way.

Due to lack of electricity, firefighting will be very problematical almost immediately, since there will not be very much water available, since the city water supply pumps will not be working.

The more fires, the more they will spread, and this is likely to make some transportation avenues unusable.

Lots of other pumps will not be operating, either. Besides water, sewage is usually handled with electrical pumps. Fuel is pumped with electrical pumps. Since these things can happen for other reasons, most preppers have plans in place to deal with them.

All those listed should be routine for preppers. There are, however, a few preps that apply to EMPs, solar flares, and CMEs that are not that common to other events.

The CME could affect the magnetosphere, distorting it for a short period. It is not likely to destroy it. But, because the magnetosphere is weakening now due to factors within the earth, if the CME happens at a time when the magnetosphere is already extremely weak, the amount of energy reaching the earth could be much higher than it would be right now. Or would have been in the past.

And not only would a CME of any size be worse due to a weakened magnetosphere, so would the effects of a solar flare. And simply the normal levels of radiation coming from the sun and other space based objects, exposure to hard radiation, as well as various UV bands could result in not only serious sunburns, eye problems, and future cancers, but the loss of crops and food animals.

If the magnetosphere continues to weaken, as it seems to be doing, a future CME of significant strength and duration, could result in enough destruction to result

in a post-apocalyptic world situation. Certainly not an absolute, but when it comes to preps for a CME, your basic PAW preps just might be needed, and thus should be considered.

One of the other effects that are likely with EMP, solar flares, and CMEs is potential damage to the ozone layer. Holes, such as have occurred before, could be created, and/or the layer could be reduced in thickness from a bit to a bunch.

This is a real danger and can be a major disaster in itself. The ozone layer helps protect the Earth's surface from hard radiation, along with the magnetosphere. What this means is that a hole develops over inhabited areas, or the overall layer gets really thin, that additional radiation getting through will have from minor to serious effects on humans, animals, and plants.

Not only will there be mutations because of the radiation, the higher levels of the UV spectrum of light will cause sunburns of humans, animals, and plants, as well as eye damage. Humans can wear wide brim hats, UV protective glasses, sunscreen, long sleeves, long pants, and full coverage shoes to protect themselves from this type of radiation.

Other than keeping animals under some type of roofed enclosure, or keeping them inside and letting them out only at night, there is not much that can be done for them. Same thing for food crops. The only thing I know to do to reduce the level of damage is to use sun screening systems, probably with a misting system to not only block some of the intense sunlight, but to cool things down enough to compensate for the heat gain the more intense sunlight will cause.

Expect to become somewhat nocturnal to avoid the higher levels of ionizing radiation and UVA/UVB/UVC radiation. Apply 30SPF sun blocker, wear a wide brimmed hat, UVA/UVB blocking glasses, long sleeves, long pants, full coverage shoes, and gloves if you must be outside during daylight hours.

Because UVC is currently being blocked almost completely by the atmosphere, there are not too many protective items available for it. It may or

may not be a factor. But I do intend to look for protective glass that include UVC protection as well as UVA and UVB.

Some additional recommendations:

1. It would be a good idea to have some sun blocking, and even hard radiation blocking, overhead shelters in the area, in case people are caught out and cannot get to other shelter during the day, especially when the sun is high in the sky.

2. I cannot stress enough that once well into the PAW, you will not be able to resupply much of anything from outside sources. So, having equipment that will last, with plenty of repair parts, the tools to make the repairs, and the knowledge (even if just the manuals or instruction books) to do the repairs, is just as important as having the means to resupply yourself consumables that will not be otherwise available. Literally everything must be considered and a determination on how to do without something, substitute something else, be able to make it or the substitute, or have some other way to provide for the need the item fills, is vitally important.

3. Do not forget that there will likely be more down time when people will not be able to be outside. You will need some open space so people can get away from each other, do medium to large projects in protected space, and be able to entertain and/or occupy themselves from time to time. Having a stock of movies, music, stout versions of board games, craft projects, a karaoke system, musical instruments, a huge library, and such will help keep people from developing bad habits that affect other people adversely.

4. Also do not forget that the results of the effects from EMPs, solar flares, or CMEs might wind up being trigger events for many other really bad things that can happen.

There are probably some other things that might need to be done that have not occurred to me. If anyone things of any, please post them up.

Just my opinion.

Some of my additional thoughts on: EMP information

Now, I am not an electrical engineer, and never having been exposed to an EMP, and not having access to the still-secret reports on EMP the government has, this is all just my opinion, based on years of research, using the most reliable sources I have been able to find.

This is a group of posts I have made at various times in various prepper forums. I did try to eliminate duplicate information, but I am pretty sure there is still some here.

EMP/HEMP is a controversial subject. It has been discussed many times in many venues. And there is much difference of opinion about the subjects. I have researched it for many years. Still, I strongly recommend that everyone do their own due diligence research on the subject. Do not take my advice as the last word on the matter.

During the 1950s and 1960s, during some 20 nuclear weapons tests conducted by the US and the Soviets, the effects of Electromagnetic Pulse were first observed. While much of the information is still classified, it is known that these detonations at 30 to 50 kilometers above the surface affected electrical power grids.

It must be noted that during the atomic testing in the 1950s and 1960s there was not that much recorded damage. But there were some recorded happenings.

Some 300 street lights were fused and burglar alarms that went off in Hawaii during Pacific tests. In the Soviet Union 570 kilometers of telephone wire fused and a power station burned down. This was caused by a 300-kiloton warhead detonated at 290 kilometers of altitude. The radio frequency range of these types of EMPs was in the 15 to 250-megaHertz range.

The effects from a Coronal Mass Ejection or CME that hits the earth with just the right conditions will affect the electrical grid. On March 10th 1989 a massive CME erupted from the sun and it hit the Earth two days later. At 2:44 AM on March 13th the Quebec power grid went down from the loss of a transformer due to electrical currents coming from the ground. Shortwave radio

went down and satellites lost command control. The blackout affected over 6 million people. The power was back on in 9 hours or so. Definitely an event of note, but not the end of the world.

In 1859 Richard Carrington was observing the sun and detected large solar storm activity. A large CME was recorded. On September 1st and 2nd, the European and North American telegraph systems were affected and failed.

I am one of those that believes that EMP/HEMP are credible threats. Also, CME induced EMP. Dealing with the possibility is part of my preps. I have not gone hog wild. I do not have a copper-enclosed room. Well, not yet, anyway.

So here goes.

EMP, while a known effect of nuclear detonations, and producible by other means, is a difficult subject for preppers. Yes, it does exist, but will it be as catastrophically damaging as some say, or more a non-event, as others say? Will it, or even can it, actually be effectively used? These are tough questions for a prepper.

There are actually two major factors involved in dealing with EMP. The actual possible damage to electrical and electronic equipment and how we as preppers will deal with the aftermath of that damage.

If the damage is slight, with a loss of power for a few days, and some damage to some especially sensitive computer-based electronics, that is one thing. Most unprotected electronics are inoperable and irreparable, modern vehicles with electronic or computer chips in them going dead where they happen to be, and a total long-term collapse of the grid with the resulting collapse of modern infrastructure is another thing entirely.

For the first situation, we will just shrug, and go about dealing with whatever it is that caused the EMP, whether a natural cause, or an EMP attack that failed, or some other attack with nuclear weapons that did not produce a destructive EMP.

The second situation is the kicker. The results of a successful EMP attack or event goes far beyond the loss of some electronics. Our discussions of what will happen if the grid goes down for an extended period of time address that problem. And it is already a scary one without the addition of the near total lack of modern transportation if the EMP does, in fact, incapacitate the vehicles. The same goes for the loss of much of our communications system, that would otherwise allow for coordination of the recovery.

Even without major destruction from other forms of attack, as would probably be the case in a HEMP attack, the loss of those two infrastructures will be debilitating to the country as a whole. For us, as preppers, we will most likely be in a position to take care of ourselves for a much longer-term than the rest of the society, with those resulting problems. It could be one of the worst disasters we could face.

That is not to say that we cannot protect some of our own systems from EMP. Just like that it is a known fact that nuclear weapons, especially purpose-built EMP weapons, and very large CMEs can generate EMP, it is a known fact that electronics, and especially electrical items, can be protected from the EMP effects.

Fortunately, the CME induced EMP is significantly different from nuclear induced or electronically induced EMP in that it will not affect computers and such that are not connected to a power grid or long antenna. Only long runs of cable will be affected in that situation, such as the power grid and some above-ground communications wire cabling systems.

There is no doubt that preparing for the worst effects of EMP, even on a small scale, if they turn out to be effective to any significant degree, can be rather expensive, depending on the degree of protection you might want for various electronic items. Protecting some radio gear does not have to be expensive and will allow preppers to maintain communications with each other. Owning an older model vehicle without major electronics, or converting one to that state, will most likely eliminate local transportation problems for preppers.

Having those capabilities can increase the problems of other people becoming upset with us for having them, when they do not. That, however, is another subject.

How does one go about protecting against EMP, other than having an old vehicle? A Faraday cage was developed by Michael Faraday in 1836 as an experiment on the properties of conduction of AC energy. It turns out that this Faraday Cage is an effective means to protect some electronics from EMP. And there do exist some electronic components that can be used to protect in-use equipment to a fair degree.

There are several ways to protect potentially sensitive electronics. Here is my list:

1) Faraday cages. (some as described above)
2) In a well-designed underground bunker or home.
3) In a well-designed earth-sheltered above-ground structure.
4) In deep caves/underground mines.
5) In underground caches fairly deep.
6) In an all-metal, reinforced floor, no/very small metal screened openings, with every component correctly electrically bonded together, room.
7) Wrapped in two or more sets of grill foil & bubble wrap and placed in a protective box or cabinet. (Fairly small items)
8) An all-metal container with continuous metal-to-metal bond along every seam, without any gaps or holes larger than the equivalent of 20opi mesh, will act as a Faraday cage. If it is totally isolated from any sort of ground, including being close to anything that is grounded, it does not need to be grounded itself.

For communications gear, that can be put away for long-term storage, it is actually fairly inexpensive and easy. Box the item in cardboard, wrap the box in bubble wrap, wrap a layer of heavy-duty aluminum foil around the whole thing, and then repeat the bubble wrap and foil wrap layers twice more, and finish off with a final layer of bubble wrap and put the big ball into another cardboard box and place in a metal cabinet of some sort.

Generators, for instance, can be put on insulators inside a large steel box and a lid with a metal mesh gasket can be bolted on, and the box put on pallets to insulate it from the ground.

Every container, to be an effective Faraday Cage, must be protected all the way around, and on the top and on the bottom. You can put solid sheet copper all the way around a building, and over the roof, solidly connected at all the joints, but if there is no protection under the floor, solidly connected to the copper walls, it is not a complete Faraday Cage.

The same goes for doing a Faraday cage with penetrations for air, water, sewer, electrical, communications, etc. Anything. It can all be done, but there are very specific techniques to do so.

If a Faraday container has any type of ground connection, such as sitting on a concrete garage floor, or on a basement floor, it should be grounded. Grounding Faraday cages to protect against EMP is a highly specialized process, and I would suggest that any moderate-size Faraday cage or box or trash can be placed on a good insulating mat of some type. If there is no type of connection with the ground, and there is a good airspace or insulation between the cage and any grounded surface, no grounding is needed.

The problem is that if there is any grounding, then appropriate grounding is paramount.

Any Faraday cage that is close to a grounded item, or in any way is even partially grounded due to siting, must be well-grounded. Far more than a simple 8' grounding rod and #6 wire to the thing. Grounding for EMP enclosures is not all that difficult, or even expensive, but it must be done just so.

For simply storing electronics and electrical gear, either do it individually or collectively, with a sealed container that will be opened only after the risk of EMP is past. Or to take out something and then reseal to the same standards as originally.

Plastic EMP bags have been mentioned for the protection of some electronics from EMP. I do not quite trust them myself. They look like electronic

component static discharge protection bags. If that is the case, then I am not sure if they would be enough protection. Most of them are quoting meeting the Military Standard for EMI Shielding, MIL-B-81705-Rev-C, which calls for >40db attenuation between 1 and 10 GHz.

This IS NOT the government military standard that applies to EMP protection of critical operations items and infrastructure items. Those standards are MIL-STD 188-125-1 HEMP Hardening of Fixed Facilities, and MIL-STD 188-125-2 HEMP Hardening of Transportable Systems.

There are some other standards that apply to specific aspects of lower levels of energy, but to protect against a full-out HEMP (High Altitude Electromagnetic Pulse), which is coming almost straight down over most of the country, requires setting things up to the MIL-STD 188-125-1 (& -2), which is protection of >80db attenuation of energy levels between 1 and 10GHz.

Nesting multiple ESD (electrostatic discharge) bags, even if done properly, does not always mean the two 40db protection levels are added together to provide >80 Db protection. There are many factors that are part of the determination of how much protection is being provided by any given system. I prefer going for the most protection using the most well-tested methods.

For some small items like my backup prepper cell phone/laptop computer, that need to be kept handy but protected, I use these products:
http://www.mobilesecsolutions.com/#!products/c1i41

There is even some limited use of the items in specific circumstances while in the cages. And though it does not say to, I put the items in bubble wrap, just to keep the metallic parts of the items isolated from the metal mesh.

Going much beyond these relatively simple solutions becomes more and more expensive and difficult, though doable. But do you want to spend the money and make the effort? That is a huge investment in both to protect against something that may or may not happen at all, and even if it does happen, may not be nearly as destructive as some people believe. It will be up to each of you to decide for yourself just how much you want to prepare for the actual EMP effects on your electrical and electronic gear. The preps for the effects a major

and effective EMP attack will have on society are pretty much a given. They are the same preps we are all making now, for all the other disasters.

This is a complex subject, with no easy answers. For more information there are a few respected, and generally considered reliable, sources of information.

One of these is the US government, in its various publications on the subject that are not restricted, such as TR-61, TR-61A, and TR-61B that are available, sometimes, online. I have copies of the publications and will loan them out to anyone that wishes to peruse them, upon the guarantee of their return in good condition by the borrower.

A couple of newer publications are the 2008 EMP Commission Report: http://empcommission.org/docs/A2473-EMP_Commission-7MB.pdf and the 2010 National Academy of Engineering Report on Nuclear Dangers: http://www.nae.edu/File.aspx?id=20575

Another, much easier to use source of information, one that I have obtained information from, is Jerry Emanuelson at http://www.futurescience.com/emp.html.

Another source, that I often refer to, is the book *EMP – Protect Family, Homes, & Community*, by Donald R. J. White. I also have this book and will loan it out under the same conditions as the government publications.

Some additional notes on EMP:

Almost all nuclear weapons produce an EMP spectrum. Some much more than others, of course. However, a nuclear HEMP device does not have to be 'big' or expensive. The most effective EMP devices are relatively simple fission devices (or 'atom' bombs), with some enhancements, not the complex thermo-nuclear fission-fusion-fission devices (or 'hydrogen' bombs) used in today's warheads.

A few kilotons of power to a few hundred kilotons of power is all that is necessary for these EMP enhanced devices to generate the massive electromagnetic pulse that can destroy much (but not all) of our electrical system

and electronics devices. Compared to blast weapons, EMP weapons are pretty cheap.

These lower-yield, specially constructed devices are, by far, the highest producing types, when considering total investment, material usage, delivery possibilities, shielding, transport, and a few other things.

Though megaton plus devices produce more EMP in total, the other destruction they cause tends to outweigh the EMP, because they are too expensive and difficult to deploy in the manner which maximizes the EMP effects. Which is a high altitude burst at the edge of the atmosphere to take advantage of the enhancement effects of the magnetosphere and chemical composition of the upper atmosphere.

So, small devices, high in the atmosphere, that have no effect on the ground under them except the EMP, can take out electronics and the electrical infrastructure over a huge area, with no direct physical damage.

Power lines and railroad tracks can carry enough of the EMP to affect things otherwise out of range of the direct effects, depending on the direction of the power lines and tracks to the direction the pulse is spreading, and how long those lines and tracks are, and where a failure point occurs that stops the current from continuing to travel down that particular power line or railroad track.

EMP does penetrate into the ground, depending on its strength. Deep enough to interact with underground metal pipes and metallic cables. And like RR tracks, the current can be dangerous some distance away from the point where the EMP has charged them. We are only talking only two or five feet, unless right under or very near the EMP source.

Every container, to be an effective Faraday Cage, must be protected all the way around, and on the top and on the bottom. You can put solid sheet copper all the way around a building, and over the roof, solidly connected at all the joints. Because if there is no protection under the floor, solidly connected to the copper walls, it is not a complete Faraday Cage.

If you use an ammo can, remove the rubber gasket, polish the groove and the can edge. Install a flexible copper mesh gasket or stainless-steel mesh gasket in place of the rubber one. That will make the coverage complete. Without it, there is a 1/4" or so gap between the lid and the bottom, even though they are grounded together by the hinge. There has to be continuous coverage and connection to all the parts of the ammo can.

It is best to line the can with thin plywood or non-conductive hard foam to keep anything inside from touching the metal. I would still do the bubble wrap/foil for each individual item, however.

Much the same applies to metal garbage cans used as Faraday Cages. Though the lid will fight tightly, and will have electrical continuity with the can, that does not mean that there are no gaps in the electrical seal of the lid to the can. It is best here to use a metallic mesh gasket to ensure there are no gaps that could act as slot antennas at some frequencies.

One way to make a gasket is to get some automotive door gasket strips, thick enough to be a friction fit inside the garbage can lid, and wrap it with several layers of heavy-duty aluminum foil. This will make a suitable gasket that will last for several open/close cycles, and can be refreshed as needed with new aluminum foil. Or one can buy conductive gaskets made for just this type of situation.

<u>There are a few things that come up regularly. Here are my responses to them:</u>

1) Just use a microwave oven with the cord cut off as a Faraday Cage – No. Is not a good Faraday Cage, even if the cord is left on, the power blades pulled and the ground blade plugged in. Some, and I repeat that, SOME older microwaves had some limited protection value at certain frequencies when the power cord was cut off. Finding one of those and being sure it is one of those is too iffy for me to risk my gear when other, almost as easy to make and use alternatives are available.

2) Use a cell phone to test your Faraday Cage – Better than no test. If it rings, you do not have a Faraday Cage. But even if it does not ring, that is no guarantee that the Faraday cage is effective.

3) A Faraday Cage has to be solid metal/A Faraday Cage has to be copper sheet metal – No, it does not. Not either one. Copper is best, and is easy to work with to get good electrically solid joints. But 20 OPI (openings per inch) copper or aluminum screen, if bonded properly, will work just fine. https://www.twpinc.com/wire-mesh-material/copper However, steel or galvanized steel mesh window and door screen does not. High-quality stainless steel mesh is usually acceptable.

4) Removing batteries from sensitive electronics, or unplugging them will prevent EMP damage – No, it will not. The EMP induces a current in devices with sensitive electronics. Being connected to a power line does make it worse, and disconnecting is good, but it will not stop the pulse if the device is sensitive and otherwise exposed.

5) Photovoltaic solar panels ARE susceptible to EMP/Photovoltaic solar panels ARE NOT susceptible to EMP – I simply do not know. I do know the associated wiring is susceptible to EMP

6) Solar PV panels cannot be protected from EMP, if they are susceptible – Yes, they can. Using 20 OPI copper mesh, two layers, a base can be put down, the panels and electronics installed, and then two layers of the 20 OPI copper mesh can be placed over the panels, shifted slightly off-center of each other, and draped down to connect all the way around with the copper mesh on the ground. The power line leading from the unit must either be disconnected, or run in metallic conduit to an EMP-protected power distribution box inside. If that distribution box has appropriate EMP protection, then things will be safe.

7) There is no way to protect an entire house from EMP – Yes, there is. It is not particularly difficult or even expensive. But it must be done during construction, and like all Faraday cages, every Faraday component must be bonded to the adjacent ones, with no gaps. *EMP – Protect Family, Homes, & Community* explains the process, as it does the PV panel protection process.

8) You can line a garage with chain link fencing and ground it and protect everything inside the garage – Chain link fence is not an adequate Faraday cage. A Faraday cage does not have to be solid material, but mesh must be 20opi or smaller openings.

9) There is no point in using a Faraday cage, since you can just as easily put your electronics inside your home and just unplug it. Only stuff connected to long lines will be affected – I do not believe this is true. It does depend on the source of the pulse, and the actual item(s) in question. An event with an E1 component in the pulse will affect disconnected electronics such as TVs and computers. The EMP from a coronal mass ejection (CME) does not create much of an E1 component, therefore disconnecting items from long runs of wire or other conductive elements will protect them from a CME-induced EMP.

On a discussion about EMP/HEMP on one of the prepper forums:

I usually stay out of the EMP/HEMP discussions because of so much incorrect and misunderstood information about it.

From my research, since I have no practical experience with EMP:

1) All it takes for a major EMP is a simple fission device, of low power (10kt - 20kt) with an appropriate casing to enhance the EMP effects, especially E1, detonated outside the atmosphere. This actually gives more EMP bang for the buck than Fission/Fusion/Fission hydrogen devices.
2) Some things will not be damaged, due to sheer circumstance.
3) Many things can be shielded, even sensitive ones.
4) A Faraday Cage does not have to be solid metal.
5) A Faraday Cage does not have to be copper.
6) It is much simpler to protect stored equipment than equipment in use. Triple insulate individual items with aluminum foil and bubble wrap, with no gaps in the foil, place in a stout container, and put it on a shelf away from anything that could conduct EMP close to it.
7) Grounding is a double-edged sword. Do it right and maintain it properly and it helps. Do it incorrectly or let it degrade, and it makes things worse.

8) Solar panels and their associated gear can be protected from EMP, but it is spendy. Two layers of 20 openings per inch copper mesh surrounding the entire Solar Power system will do it. Above the panels, down the sides of the structure and under the floor. All 6 sides. At about $5.34 per square foot of mesh. If you keep the room or building small, it can be done. But all six sides must be shielded adequately, and all input and output lines must also be shielded appropriately.

9) There are cheaper ways to protect large spaces, but they are a matter of scale and do not make much sense unless one is building a new place, or specifically retrofitting a single room or small building.

10) If these whole house or single room methods are done, they must include shielding for input and output lines of all types, including air handling, water, sewer, electrical, phone, telemetry, etc. And everything must have a continuous bond, including the floor or under the floor. Windows can be shielded the same way as the solar panels. Two layers of 20 openings per inch copper mesh, bonded all the way around the window frame to the shielding of the building.

11) Some solar events can produce E1 currents in the earth's atmosphere, but they are the one in the one-hundred-million-year type events. Even moderately large solar events produce E3 currents on the surface of the earth and can do great damage to the grid. Massive damage if the event is massive.

As I mentioned before, EMP is a controversial subject. So, people will know they need to seek other opinions, and do their own research, I will first list the controversial elements of the subjects, the subjects being EMP/HEMP and EMP/HEMP protection. And then I will post some of the Tips, Tricks, Hints, and Kinks that I know to deal with them.

The controversial elements:

1) Does EMP even exist?

2) Can a CME cause EMP/a CME is the same thing as an EMP/CMEs do not cause EMP

3) Does EMP even pose a danger to us, at the levels it exists?

4) If it is a danger, just how great is the danger?

5) Even if EMP is a danger, a HEMP device is not really possible, and if it is will not be a big one.

6) If it is a big danger, is there even anything we can even do about it?

7) If it causes widespread damage and takes down the grid for a long period of time is there even a need to protect radios and other communications gear since no one else will have any, anyway?

8) If we can protect things, just what can we protect and how much will it cost/not much is needed to protect things and it is cheap.

9) Just put things in an old microwave oven with the cord cut off/A microwave oven will not work as A Faraday Cage

10) If we have to use a Faraday Room, it has to be solid copper/other metals will not work/mesh will not work.?

11) A Faraday has to be grounded to be effective/A Faraday cage should never be grounded.

12) Solar PV cells are not affected by EMP/Solar PV cells will be destroyed in an EMP, PV panels cannot be protected against EMP.

13) You cannot protect a whole house/a generator/your vehicle from EMP.

Okay. There you have some of the questions and statements that cause the controversies. I am not going to get into my opinions of and explanations about them here. (Now, is that not a surprise!) I am just going to give a couple of tips, tricks, hints, and kinks for those that do think the EMP problem exists, that one can be a problem, and that there are ways to protect gear that they think will be useful after an event.

This applies to radios and associated communications gear, and computers, cell phones, and other fairly small consumer electronics.

To protect smaller items from an EMP/HEMP event:

1) Put the item in a sturdy cardboard box of appropriate size and tape it closed.

2) Wrap the box in bubble wrap (thinner stuff with small bubbles is ideal) and tape it closed.

3) Wrap that package with heavy-duty aluminum foil (Reynolds Grill Foil is best), making sure to not puncture the foil anywhere, and be very careful to make solid, tightly folded seams.

4) Add another layer of bubble wrap.

5) Add another layer of foil.

6) Add another layer of bubble wrap to protect the top layer of foil.

7) Place the package into an appropriately sized cardboard box and tape it closed.

8) Place the box in a metal file cabinet, metal storage cabinet, purpose-built metal container, or some other container to protect it physically.

That item is now protected from EMP unless the device is right on top of you.

Some have recommended using a GI ammunition can to protect small items. If you want to do that, here is what I suggest:

1) Clean up the can inside and out and paint it if there are any bare metal areas.

2) Remove the rubber gasket from the lid.

3) Line the inside of the can with cardboard, all four sides, the bottom, and the lid.

4) Sandpaper or emery cloth the gasket groove to bare metal.

5) Sandpaper or emery cloth the rim of the ammunition can to bare metal.

6) Buy (or make) a metallic or other conductive gasket the right size to fit the gasket groove of the lid.

7) Place the items to be protected inside the can. (For extra protection, you can do the bubble wrap/foil technique on the items before putting them inside, but with only a single layer of foil.)

8) Close and latch the lid. There should be at least some resistance to the latch if the gasket is adequate.

Here are some additional thoughts and pieces of information that might be helpful.

1) Since many people do make Faraday cages from trash cans, finding one that is highly effective is important. The Behrens brand of locking-lid trash cans have features that make them especially useful as Faraday cages. I am not sure as to size availability. I do know they make at least a ten-gallon size. I am not sure of larger sizes.

2) To seal trash cans most effectively, when a supply of stainless-steel wool mesh is not available, a metallic tape with conductive adhesive can be used. The adhesive needs to be conductive, as slot antennas can be created if the lid of the trash can is not making full contact all the way around. 3M brand tape, part number 3340 is such a tape.

3) If the trash can needs to be accessed from time to time, using tape can get expensive, and pretty wasteful. Instead of the tape, if you can get a supply of stainless-steel steel wool the steel wool can be worked up under the lid between the body of the can and the lid.

4) It is always good to have nested Faraday cages. Using the foil and bubble wrap method with cardboard boxes adds that extra layer of protection.

5) Do make sure any of the heavier and/or larger Faraday boxes or cages are well away from any potential grounding surface and electrically insulated from them. Garbage cans and metal drums need to be well above the floor of concrete-floored rooms such as garages and basements. A thin layer of rubber may not be enough. Even a four-inch pallet might not. Two layers of pallets with the thick rubber mat, place well away from any wall that has any wiring inside of it or on the other side of it, should be safe. However, I cannot and do not guarantee that.

6) The importance of properly grounding a Faraday cage if there is any chance of it becoming only slightly grounded, or being close enough to arc if the EMP E1 pulse current energizes the outside of the Faraday cage and it is not drained quickly enough through a grounding system designed for it, the arc of electricity can easily burn a hole through several layers of metallic protection, which then allows the EMP entry. This all happens within nanoseconds of time.

7) Any Faraday cage that is not totally sealed must have any penetrations designed to maintain that EMP protection. There are ways to do this. It is beyond the scope of this article to describe them adequately, but be aware that they do exist and look for information online.

8) For actual electrical, electronic, and antenna lines entering the cage, EMP shielding devices are available from PolyPhase and Amphenol companies that are put in the lines, at the outside of the Faraday cage, and they are connected to the special grounding system. This is just one example. Plumbing lines, air handling ductwork, and everything else must have some sort of protection.

9) To enhance the effectiveness of the set of ground rods that will need to be used in a properly grounded Faraday cage, the use of bentonite clay made into a slurry and poured down the hole into which the copper/copper clad grounding rods are inserted will greatly increase the grounding ability of dry, hard, and other soils that are not overly conductive. This does mean a hole must be dug or drilled, and simply driving the rods into the ground is not adequate.

10) One other thing that can help, though it is certainly not a stand-alone solution is to use a series of Type 61 ferrite bead snap-on protectors on electrical

and electronic devices that must be kept in use. Add them as close to the device as possible. They do need to be Type 61 ferrite, rather than the more common Type 43. The Type 61 ferrite beads can be found at Mouser Electronics.

Some useful links and suggested reading (some are already listed in the body of the article):

(Since the standards I quoted in the article can change from time to time, I am not putting the links here. Do a search for the listed standard and the most recent revision will come up, or the older version will have information on where to find the newest one.)

The Mobile Solutions metal mesh, magnetic strip closed, Faraday bags I prefer:
http://www.mobilesecsolutions.com/#!products/c1i41

Gaskets:
http://www.hollandshielding.com/
http://omegashielding.com/index.php
http://www.spira-emi.com/

Copper wire mesh:
https://www.twpinc.com/wire-mesh-material/copper

A couple of other potentially useful sites:
http://www.lessemf.com/mag-shld.html
http://www.majr.com/

This double-sided foil vapor barrier could be used to create a full-room Faraday cage, or even used, if installed properly to create a 6-sided bonded edge box during the home construction, with appropriate window, door, vent, and other penetration treatments, to have a full EMP resistant home.
https://foustco.com/all-products/home-environment-products/dennyfoil-foil-vapor-barrier/dennyfoil-vapor-barrier/

US Government publications:
TR-61, TR-61A, and TR-61B

I have not found them online. I do have copies of the publications, and am willing to meet with anyone so they can look through them.

A couple of newer publications are the 2008 EMP Commission Report: http://empcommission.org/docs/A2473-EMP_Commission-7MB.pdf and the 2010 National Academy of Engineering Report on Nuclear Dangers: http://www.nae.edu/File.aspx?id=20575

Another, much easier to use source of information, one that I have obtained information from, is Jerry Emanuelson at http://www.futurescience.com/emp.html.

Another source, that I often refer to, is the book *EMP – Protect Family, Homes, & Community*, by Donald R. J. White. I also have this book and will loan it out under the same conditions as the government publications.

20 OPI copper mesh specifications from TWP Inc. website.

Specifications		
Specs	U.S.	Metric
Mesh Size	20 per in	20 per 2.54 cm
Wire Diameter	0.016 in	0.4064 mm
Opening	0.034 in	0.8636 mm
Opening Microns	864	864
Opening %	46%	46%
Weight / sq. ft	0.3900 lb	0.1771 kg

Another issue that I just saw come up recently involves how current flows in conductors and devices. Now, I am not an electrical engineer. I was a residential, business, and light commercial electrician for many years. Still does not give me direct experience with EMP. However, I have studied the subject for years, including every government publication I could find. And keep looking for more as time passes.

I have also done extensive research online. And there is a bunch of it. However, in going through all of it, and comparing to US Government publications, including protection systems for EMP/HEMP events and attacks, much of this new online information is anywhere from hard to understand, somewhat misleading, to outright incorrect.

With that all having been said, the issue I want to address is about how an EMP E1 pulse affects conductors and devices. While the various comments and assertions that any induced current in wiring will flow both ways are correct under normal circumstances, such as shorts, crossed wires such as when things get damaged during an earthquake and similar events, is correct, the EMP E1 pulse works a bit differently.

The timing is also often mentioned as a primary factor. And it is, but not in the way indicated by some of the comments. Yes, it is in the nanosecond area of time that the current flow from the E1 component of an EMP exists.

Remember, however, that this pulse is traveling, from the point where the EMP was created, outward from that point, for whatever distance that the power of the EMP will push it.

When it intersects with anything in which current can flow, such as wires, powerlines, railroad tracks, metal piping & conduits, electrical and electronic components, the energy of the EMP E1 pulse induces current flow into those items.

While normally, when a current source connects, directly or by some form of induction process, it will flow through the conductor both ways from the point of the contact or where it was induced. Both ways away from that point.

However, with the EMP E1 pulse, this is only a very minor factor. Some of the energy might flow in the direction opposite of the direction in which the pulse is traveling, but the overwhelming majority of any current that the pulse creates in the conductor will be traveling in the same direction as the pulse, since the pulse is continuing to create current flow in the conductor as it travels, continually increasing the total amount flowing as the pulse adds to what was

induced at any given point as that current flows. Again, in the same direction as the pulse is traveling.

In conductors and devices where the pulse crosses them rather than is traveling in line with them, it is somewhat different. That nanosecond timeframe of the E1 pulse means it is there and gone, unless there is additional conductors that are connected to the conductors that are not in line with the pulse. The current will be flowing both directions in those conductors. Only for that fraction of a second. Unlike conductors that are in line with the direction of the E1 pulse.

This difference in how the EMP E1 pulse affects conductors, along with several more, is what makes EMP effects in total so difficult to predict. There will be things that one would think would be unaffected that get fried, and other things that one believes to be extremely vulnerable will not be affected at all.

Blanket statements, which I do try not to make myself, tend to be wrong at least half the time, since they actually do not apply to many things in many instances. So, does the induced current from an EMP E1 pulse flow both ways in wiring? Well, it can, but it does not in many cases. Therefore, expecting a protective device to protect wiring on both sides of it (with the proviso that there is nothing else that could affect the current flow on the conductors), is highly risky.

The EMP E1 pulse is traveling at that extremely high speed, approaching the speed of light initially, which is the reason that the timeframe for it affecting conductors at any given point is in the nanosecond range. Now, as stated, if the direction of the pulse is along the path of the conductors, it continues to affect that conductor for a much longer length of time, even if any given point of the conductor is affected for only a nanosecond or so. And the overall effects are cumulative. Ergo, massive damage in many instances, with the amount going up as the vulnerability of any individual device goes down in relation to current flow.

This is why I believe that EMP protective devices must be installed at a point where everything beyond them (in terms of exposed wiring or devices being on the other side) is within an EMP shielded area, such as a Faraday cage, cabinet, or room.

Installing a protective device in line with conductors where there is no enclosed protection on one side of the protective device, in my opinion, is very close to worthless. In part because it gives a false sense of security. However, mostly because I do not think they provide any real protection, the possibility of current flowing both ways in the conductor on which the device is installed beside the point.

If anyone has any questions feel free to ask here in the forum, or PM me and I will respond as soon as I can.

Remember to do your own due diligence research, as everything here is:

Just my opinion.