QST Magazine's 4-part series on EMP Protection -- including 2 parts where they built a massive EMP simulator and tested various electronic devices.

Back in 1986, QST Magazine (the official magazine of the ARRL -- for those who are not ham radio operators, this is the biggest ham organization in the U.S.) did a four-part series on EMPs... What they are and how they affect gear, how to protect yourself from them, and most importantly, they built an EMP simulator and exposed various electronic gadgets to varying intensities of EMPs. Note that they built a pretty large simulator capable of delivering a pretty stunning EMP (likely larger than any non-direct nuclear detonation).

The results are EXTREMELY interesting... and show that most AVOWers may want to adjust their level of concern related to EMP preparedness.

Part 4 also provides some very specific guidelines on protecting communications equipment from an EMP event. These articles were written at the height of the cold war when an EMP was a very real possibility.

Part 1: How EMP works and its effects on antennas, equipment, phone lines, etc.
QST August 1986 pp 15-20, 36
http://www.arrl.org/tis/info/pdf/88615.pdf

Part 2: Tests of EMP & transient protection devices.
QST September 1986 pp 22-26
http://www.arrl.org/tis/info/pdf/98622.pdf

Part 3: More tests of EMP & transient protection devices
QST October 1986 pp 38-31
http://www.arrl.org/tis/info/pdf/108638.pdf

Part 4: Procedures and products to protect your gear
QST November 1986 pp 30-34
http://www.arrl.org/tis/info/pdf/118630.pdf

The Simple Reality of EMP -- Different Than You Might Expect, by Andru

http://www.survivalblog.com/2009/07/the_simple_reality_of_emp_diff.html

One topic I have paid close attention to for the past 10 years has been our nation's risk to Electromagnetic Pulse (EMP). There are a few points I would like to make that are often overlooked—mostly dealing with the magnitude of the threat. I don't claim to be an expert on the subject, but I have consumed as much information as possible that doesn't delve into the high-level physics—the kind of knowledge required to truly be an expert. What may set me apart the most is the simple fact that I actually read the 181 page Critical National Infrastructures (CNI) Report released in April of 2008 and in my opinion, it has shed more light on the subject of EMP effects than any other research conducted since EMPs were first discovered more than 60 years ago.

Had this information been available a few years earlier to authors like William R. Forstchen in his novel *One Second After* would have likely painted a different picture of the effects of an EMP and how it would impact a society. His lessons are still valid, but a little more accurate information can have a huge impact on our preparation decisions.

Anatomy of an EMP:
Among the most commonly listed elements that determine the magnitude of an EMP, one deserves special emphasis and that is altitude. In most discussions, altitude is correctly identified as a significant factor in EMP effectiveness as a weapon but there are two distinct reasons why altitude is so important. The first and most obvious is the LOS (line of sight) influence of electromagnetic pulse. The higher you go, the greater distance the pulse can affect across the curved surface of the Earth. However, the point that most people don't understand is the impact the atmosphere has upon the strength of an EMP. Logic would suggest that the closer you get to an EMP, the greater the impact upon sensitive electronic equipment. This is not necessarily the case and this is why a high altitude detonation not only increases the range of the EMP, but actually increases the magnitude as well.

An EMP is actually created when gamma particles from a nuclear explosion interact with the earth's atmosphere at a sufficient altitude to cause a uniform disturbance in the earth's magnetic field. It is the fluctuations of the earth's magnetic field that causes the EMP and not the nuclear explosion itself. If the detonation occurs within the earth atmosphere, the gamma particles are absorbed by the air before creating a significant enough fluctuation in the earth's magnetic field. Generally speaking, a detonation within the earth's atmosphere will not produce a significant EMP beyond the actual radius of the nuclear blast. In other words, the radiation will kill you before the EMP fries your I-pod.

To be most effective, the detonation needs to be outside the earth's atmosphere—even higher than the International Space Station and many satellites. This allows the gamma rays to interact with the earth's atmosphere (and magnetic field) over a broad area at roughly the exact same time.

We could spend time discussing the three different types of EMPs generated by a nuclear detonation (E1, E2, & E3), but suffice it to say that E1 tends to quickly damage sensitive electronics, E2 is slower and not so much of a threat with modern fuses and surge protectors, and E3 is slow but massive and turns the earth's magnetic field and any long continuous conductors (long-distance power lines) into a huge electrical generator—overpowering surge protection and destroying connected transformer equipment on either end of the line. Individuals tend to be concerned with the E1 pulse and infrastructure professionals tend to be concerned with the E3 pulse.

Consumer Technology Risks:
Most people think that anything with a computer chip will be wiped out by an EMP attack. The findings of the commission who produced the CNI Report actually prove otherwise. While the most sensitive equipment almost always failed, the failure was sometimes resolved with a re-boot, or with the replacement of a few damaged parts. Due to the unpredictability of the EMP effects, we can assume that many televisions and radios would still work and public broadcasting capabilities of one degree or another will likely be available—if not immediately, then shortly after an event for as long as power can be supplied for the broadcast. This can also be attributed to the fact that the strength of the EMP will vary from one place to another. For example, **the further north you travel, the more intense the earth's magnetic field and resulting EMP**. You could expect the impact felt in New York would be more intense than that of Atlanta.

According to the CNI Report, **modern automobiles are not nearly as susceptible to EMP as previously thought**. It seems that while equipment and circuitry has become more sensitive, manufacturers have also beefed up the shielding on these components to reduce electromagnetic interference from non-EMP sources thus reducing susceptibility to an actual EMP. According to the report, **only 10% of the vehicles on the road will stop functioning even temporarily after an EMP** and one third of all vehicles won't even suffer any nuisance failures such as a blown fuse or damaged radio (pg. 115 of the report). The risk here is still significant, but mostly overstated when compared to other risks. For instance, we've all seen what one accident does to rush-hour traffic. Now imagine 10% of the cars on the road shutting down at the same time—accidents would result and gridlock would be intense on the major highways—stranding even those with operable vehicles. But if your car was parked at work at the time of an EMP, chances are you would be able to start your car and at least attempt to drive home.

What are the Real Risks:

To put it simply, there are really two big threats we face as a society when it comes to EMPs. The first involves the entire electric grid as long-distance power lines convert the slower E3 pulse into extremely high-voltage power surges. These surges subsequently blow out transformers at either end of the lines and render the grid virtually useless until these custom-designed transformers can be repaired or replaced. Based upon the current rate of production for these transformers worldwide, **it would take 20 years to replace all the high-capacity transformers in the US power grid** (see report pg 49). Now imagine the difficulties of trying to make these repairs in a society that has collapsed.

The other significant threat posed by EMP lies in a commonly used automated control system called supervisory control and data acquisition (SCADA). In essence, SCADA systems are similar your typical computer except that they are designed for specific uses—such as monitoring and controlling our electric grid, telecommunications infrastructure, oil and gas transmission lines, and even our water treatment plants. Under the testing conducted by the EMP Commission, every SCADA system failed to one degree or another (see report pg. 6). While some failures might be as simple to fix as rebooting, others would permanently disable a particular control unit. Taken together at the exact same time, **this combination of minor and major failures becomes catastrophic to whatever infrastructure these SCADA units control.**

The Reality of a Post-EMP Attack:

Obviously, the risks to our electrical and utility infrastructures are sufficient to categorize an EMP attack as TEOTWAWKI. However, the picture painted by most EMP alarmists doesn't do us any favors as we consider our own personal preparations. I'm convinced that many preparations are either completely ignored, or resources are allocated in less-effective ways because we haven't focused clearly on what a post-EMP society will look like.

First of all, **the lights will likely go out; and for most of the grid they will stay out for a long time.** However, most of the cars we drive will keep working with minor electrical problems. **Most gas-powered generators will start up**, and as long as the back-up power supply holds out, we might even have land-line and perhaps even cell phone telecommunications. If service stations have back-up power generation, then **gas will still be pumping** (plan on paying with cash though) until the tanks run dry. **A national priority will be getting the gasoline distribution lines back up** and running and with back-up power at key points, this could be accomplished in a matter of weeks or months. If we can get the gasoline flowing, then harvesting equipment will work, the food supply will begin flowing again, and crews will be able to repair the electrical grid.

Don't get me wrong, an EMP attack would be catastrophic and would probably be the worst attack ever to affect our nation. Millions would die as a result, but I don't expect it to be the end-game that some make it out to be. It should be entirely survivable for a well-informed and well-prepared groups and individuals.

Lessons for Preppers:
Preparing for an EMP can be overwhelming—especially when one fully grasps our reliance upon technology. Few of us are in a position to buy and move to a resource-rich piece of farmland and then be able to plow, plant, and harvest a decent crop with nothing but 19th century farm implements. The good news is that even after an EMP, society may remain intact—at least initially. And just like we see in the novel *Patriots*, some areas of the country can be expected to escape societal collapse indefinitely. For those of us who can't relocate to a retreat property, the proper selection of our current residence can play a significant role in how we might fare after an EMP attack. Here are some considerations:

- **Do you know where your power comes from**? How far does it travel before it gets to you? Hydroelectric, nuclear, and wind -powered generators will likely be back online soon and have enough supplied fuel to run indefinitely. If you live close enough to one of these, then less equipment needs to be repaired before getting your town or city back online.
- **Do you know where your water comes from**? How much treatment is required to make it suitable for human consumption? Those living in mountainous areas will likely see minimal impact to their water supply after an EMP. Fresh gravity-fed water usually requires less chemical treatment and no electrical pumps to fill water storage tanks. Those living in flat areas and who rely upon treated river or ground water pumped into water towers will likely suffer the most from water shortages after an EMP. Hygiene-related diseases will spread quickly; and if you also happen to live in a relatively dry climate, then dehydration deaths will soar as well.
- **Do you know where your gasoline comes from**? Do you live close to a refinery, or does your fuel come from a combination of pipelines and tanker trucks. If you live close to a major gas pipeline terminal then your location will likely be better supplied than areas located off the main trunk lines. Refining capacity will be limited and gasoline will be rationed, but expect those towns closest to the source to be in better shape than those further away and to be among the first areas where order is restored—if lost.
- **Do you know where your food comes from and could your area be food self-sufficient if needed**? Those living on the fringes of America's bread basket will be better off than those living in the large cities on the East Coast. Your grocery store has about three days worth of food without an EMP and about three hours worth of food with an EMP. Regional food distribution warehouses carry about 30 days worth of food—much of which is dependent upon refrigeration. Do you know how close you live to one of these regional warehouses? Living close to the regional food distribution centers could buy you and your town some time, but the best solution is to live close to a productive agricultural region—supplemented with your own stored food. The apple you eat today could have been picked 3,000 miles away almost 8 months ago. It has been stored in one of these warehouses in a carefully climate-controlled environment. How will your location be affected by a lack of modern food distribution?
- **Do you know the kind of people who live in your area**? Not all demographics are created equal when it comes to EMPs. Do you live in an area where people are looking for an excuse to riot or loot or do you find yourself among hardworking, religious people who tend to support each other? Notice the different responses between a tornado hitting a small town in Oklahoma and a flooded neighborhood in New Orleans, or even something as inconsequential as a national

basketball championship in Los Angeles? Not all big cities are created equal and not all small towns are created equal either. If there is a large number of welfare-dependent residents in rental housing nearby, I would seriously consider moving. A demographic with a low-income, highly liberal population will pose different threats than a demographic with a high-income, conservative population after an EMP. Populations who support a larger role of government in providing security and livelihood tend to react negatively when neither is provided on demand. A good resource to analyze these risks on a state by state and county by county basis is the book Strategic Relocation by Joel Skousen.

When it's all said and done, we need to accurately understand the threats we are preparing for in order to make wise decisions regarding our limited resources. An EMP would be catastrophic for sure; but **the reality of life "post-EMP" is likely to be much different than the most-common pictures being painted these days.** Do your own due diligence, research the risks and how they affect you specifically, and you will be much better off than just taking the arm-chair advice of even the loudest prognosticators—this author included.
