

## EMP and Solar Flares

EMP and solar flares have been of concern to many people for quite a while due to the risk they pose to damaging our electrical infrastructure. Although both events can cause electrical damage they do so through different mechanisms. The disruption of our electrical infrastructure could have devastating consequences due to our society's dependence on electricity. Loss of electrical infrastructure/electronics would interfere with communication, banking, logistics, command and control mechanisms for utilities, health care, food storage, transportation and so many any other areas. There is almost nothing that is made today that does not involve electricity. It is hard to even imagine a day without electricity.

A congressional task force testified that prolonged damage to our electrical grid could result in death of 90% of Americans through starvation, disease, and societal collapse. There has been increasing interest in developing and deploying technologies that could help protect our electrical grid from damage but at this time the application of these technologies has been minimal. Understanding the risks to our electrical infrastructure/electronics can aid in our own personal efforts at mitigating those effects.

**A solar flare/coronal mass ejection** results in the expulsion of huge quantities of charged particles from the surface of the Sun. If this cloud of plasma impacts earth, then powerful electrical currents can be created in the atmosphere and in the ground. This is known as a geomagnetic storm and is not a theoretical event. In 1859 the Carrington Event occurred where a powerful coronal mass ejection impacted earth. This was at a time before countries were significantly electrified and the only susceptible technology at the time was the telegraph system. The geomagnetic storm generated tremendous power surges in the telegraph lines which melted areas of the lines and started fires.

**Geomagnetic storms** tend to generate electrical power surges within the long conductors such as electrical power lines, metal water and gas pipes, and other similar structures. Short length conductors such as those found in computer/electronic chips tend not to be directly damaged from geomagnetic storms however they could be damaged from a power surge if plugged into affected electrical power lines. The equipment that is not plugged in to the power grid would likely not be damaged during a geomagnetic storm from a solar event.

Unfortunately long power lines could develop huge power surges within them that could damage transformers. Unfortunately many mega transformers are custom built and may take a year or longer to manufacture. How could a mega transformer even be manufactured if the electrical grid was down? There has been some interest in developing a strategic transformer reserve and a recovery transformer program that would keep some transformers protected and deploy them where needed if a solar storm were to cause damage portions of the electrical grid. How would your life change with a prolonged electrical grid failure that could last for years?

**An EMP (electromagnetic pulse)** is the result of a nuclear explosion. Gamma radiation is released with a nuclear explosion. When those gamma rays collide with the atoms in air then electrons are often stripped away leaving areas of positive and negative charges within the atmosphere (Compton effect). This results in electrical currents that produce an electromagnetic pulse. It is this electromagnetic pulse that can damage electrical systems. Generally, the higher the altitude of a nuclear blast then the larger area of atmosphere that can be affected by the gamma radiation released from the blast (it is a line of sight phenomenon). A high yield nuclear explosion about 200 miles above the center of the continental United States (in space) would expose the entire continental United States as well as southern Canada and northern Mexico to an EMP. This effect was identified during nuclear testing in the 1950s and 60s where electrical systems were damaged in Hawaii (800

miles from the site of the nuclear testing in space). The relatively crude electrical systems in the 1950s and 60s were much less susceptible to fluctuations in power than the electronic systems of today. An EMP can generate powerful electrical currents in both long and short length conductors. This means that in EMP can directly generate damaging power surges in long conductors like power lines as well as the tiny conductors within computer/electronic chips. *An EMP can therefore damage computer/electronic devices that are not plugged into the electrical grid.* Consider the degree of computer/electronic chips that are in items we use every day (cars/trucks, LED flashlights, cell phones, computers, Internet routers, credit cards, radios, refrigerators, microwave, etc.). Think about how your life would change if those items and the electrical grid were suddenly gone and perhaps gone for years.

Not every item containing an electrical chip would necessarily be damaged due to an EMP since there would be variations in the power of the pulse which could result in survival of some scattered and random items and some chips shielded with metal may survive. The effects of an EMP on vehicle electronics is uncertain since the metal vehicle body might offer some shielding.

How can someone go about protecting themselves and society from a damaging solar flare or EMP? Notify your federal and state government officials about your concern with regard to susceptibility of our electrical grid to EMP and solar flare damage. Outside of pushing our government to make changes to protect the grid we can only try to protect our small portion of it. Unplugging devices will prevent solar flare power line surges from damaging those devices. Surge protectors may also help. Standard surge protectors may be effective against solar flare power line surges but an EMP power line surge can be so rapid that a standard surge protector may not be effective. There have been improvements in surge protector technology with some claiming to stop EMP induced power line surges. Unfortunately an EMP can directly damage the electrical circuitry of your items even if not plugged in (provided that they are not additionally protected).

**A Ferriday cage** is a metal enclosure within which items are protected from electromagnetic pulse damage. A Ferriday cage can be something as simple as a metal trash can with tight fitting lid, aluminum foil covered cardboard box, or a popcorn/cookie tin. A Ferriday cage may be as complex as a metal sheathed room or a steel building. Better protection occurs when the container (Ferriday cage) completely envelops the items to be protected and is lined with an insulator to prevent electronic devices from touching the metal of the container. The Ferriday cage does not need to be grounded to be effective against EMP or solar flares. Items to protect might include: Communications equipment (such as GMRS/CB/shortwave radios), lap tops, tablets, ebook readers with bulk storage of reference materials and personal information / photos, replacement/repair electronic parts for vehicle/generator, solar panels, charge controllers, battery chargers, invertors, LED flashlights/lights, night vision equipment or other electronic optics, electronic perimeter alarms, cordless tools, electronic diagnostic/repair equipment, radiation detection equipment, drone and drone control equipment, electronic watches or clocks, digital camera, DVD player, and digital thermometer, glucometer or other medical equipment.