

Extreme Geomagnetic Storm Societal Impacts

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Outline

- **Geomagnetic Storms**
- **Infrastructure Interdependencies**
- **Infrastructure Vulnerabilities**
- **Societal Consequences**
- **Options to Deal with the Threat**
- **Recommendations**

Quote from US EMP Commission Executive Report

“EMP is one of a small number of threats that can hold our society at risk of catastrophic consequences. It has the capability to produce significant damage to critical infrastructures and thus to the very fabric of our US society as well as to the ability of the United States and Western nations to project influence and military power.”

Impact of an Extreme Geomagnetic Storm

- **An extreme geomagnetic storm has a high probability of resulting in a major shut down of modern power grids on a continental scale.**
- **In the likely event of an occurrence of an extreme geomantic storm, the power grid recovery process will be very complex and extremely lengthy ranging anywhere from weeks, months, years or longer.**
- **The extended recovery period will in turn lead to a shut down of virtually all industries, commerce, and day-to-day business operations and lead to many deaths due to lack of food, potable water and failure of other infrastructures essential for life support.**

INFRASTRUCTURE DEPENDENCIES/INTERDEPENDENCIES

- **Transportation needs fuel, fuel needs transportation, power needs both and everything/everyone needs power, water, food, fuel telecommunications, etc.**
- **Because of interdependencies and resultant cascading effects, we need to ask what are the interdependencies and what are the elements within critical infrastructures that can cause them to spiral out of control bringing other infrastructures down with it.**
- **There is a common assumption that our infrastructures are so vast and robust that there is no way, short of a direct nuclear attack, to take them down – EMP or an extreme geomagnetic storm can do it. Cyber attacks are also an issue.**

CONSEQUENCES

- **YOU DO NOT WANT TO KNOW AND ESPECIALLY YOU DO NOT WANT TO EXPERIENCE IT**

Power Restoration

- Overall, power restoration will very likely take years due to the significant amount of damage to the extra high voltage (EHV) transformers and the world wide transformer manufacturing capacity limitations.
- Comprehensive economic recovery may in fact take decade or longer and while today we can predict some of the consequences that we will face as a society, the true complexity of the situation as it relates to cross-industry and infrastructure inter-dependence warrants much further examination of consequences and options of addressing this threat.
- The situation addressed here is unprecedented in modern society in that it is very likely to throw our quality of life back into the nineteenth century due to the fact that despite all of our vast modern technology based infrastructures, we will not be able to use them due to the loss of electricity. It will be a lot worse in that due to our dependence on our infrastructures and electricity we will not be able to produce the food or distribute what we have in time to sustain our city populations.

For Life Sustainment Modern Societies Need:

- **Power**
- **Water**
- **Food**
- **Sanitation**
- **Fuel**
- **Transportation**
- **Medical and health services**
- **Communications**
- **Government - (national security, emergency services, law enforcement)**
- **Financial Services**
- **Work Force**

CHALLENGES

- **To a large extent both the government and private sector do not adequately understand the EMP and geomagnetic storm vulnerabilities, the interdependencies of our critical infrastructures and the potential cascading effects, which can result from an EMP or a geomagnetic storm event. This understanding is necessary for planning for infrastructure protection, critical resource reallocation as well as consequence management.**
- **Major education effort needs to be initiated by the government for the public and the private sector on the severity of the threat, its implications to the nation, the international community and the need for joint private sector and government effort to deal with it**

Just in Time Production Delivery and Use

- **The competitive market has driven many industries including the power grid to operate close to the edge at times pushing the limits of its capacity**
- **Considering the threats and consequences were facing I believe that the burden/cost and urgency of protecting our critical infrastructures, public and private to a large extent will fall on the government.**
- **A way will need to be found to get the private sector cooperating with the government to protect critical infrastructures**

Summary

The apartments and houses will have no electricity, no running water no operating toilets, no refrigeration, no heat in winter, no means of boiling water for cooking or water sterilization, no natural gas available, no means of body disposal. There will also be those who will need to leave their homes and apartments because raw sewage will be overflowing from their toilets or spilling into the low lying sections of cities.

Summary cont'd

Considering the combined effects of infrastructure failures from a 50-100 year extreme geomagnetic storm it is hard to imagine the devastating effect it will have on our society and the world. Hope that our friends and allies would come to our help may just be so much wishful thinking

Not considering the physical effects on our society discussed above, the psychological aspects that will affect individuals and families will significantly add to the trauma, fear, uncertainty, hopelessness and inability to cope likely leading to many suicides. Many people will die in the process and depending on the duration of the power loss and other infrastructure recovery timelines the loss of life in the cities will be unprecedented

What are Our Options to Deal with These Disasters for Individuals and Families

- **Plan, prepare, prepare ahead of time**
- **Organize with family, friends, neighbors, community to include local authorities, unless you are prepared and can isolate yourself. It is risky doing it on your own**
- **Potable water or means to make water that can be made safe for drinking is the key to your survival as well as non perishable food**
- **If you have a place outside the city and have fuel pack up and try to reach it, do not wait for panic to set in. In most cases your chances of survival even with limited supplies outside the city are likely better.**
- **Talk to your local authorities about having community plan for emergency power, water, food, fuel, or a way to process water**
- **Unless someone triggers a panic I believe you are likely to have 8-18 hours before panic gradually sets in in the cities and people will become desperate.**

What are Our Options to Deal with These Threats

- **There are things we can do to mitigate the effects of a 50-100 year Geomagnetic Storm.**
- **The first is to harden the power grid so that it does not fail in a catastrophic way. It is not enough however to harden the power grid because populations need other critical infrastructures to support life.**

Options cont'd

The following infrastructures are essential for life sustainment in the cities and need to be hardened against EMP and Geomagnetic Storms:

Power

Water

Food

Sewage Treatment Plants

Transportation

Essential Communications

Heat during winter

It is also essential to store enough consumables (i.e. chemicals, lubricants, etc.) on hand to support their operations until re-supplies can be obtained

Options cont'd

In the event of this type of scenario the choice is clear we either harden the above mentioned infrastructures or lose the cities and a significant portion of their population. I have tried to avoid reaching this conclusion by saying that people can stock up on food, water and other essentials and this still would likely work to some extent outside the cities, but when you lose city's critical infrastructures the city cannot support the population and there is no infrastructure outside the city that can support the significant number of people attempting to flee the city.

Recommendations

First the national and city governments need to get their best people on each of their critical infrastructures present them with this scenario, get solution recommendations and initiate planning.

EMP hardening technology is available and there are new technologies that are going to be available in the near future to significantly simplify hardening

We need to work together internationally on a joint goal to help each other to mitigate this threat.

Other Considerations

- **Based on case studies from nuclear disposal to large scale chemical contamination it is obvious that effective risk communication must not only take into account the psychology of how ordinary people perceive risks, but also allow for the necessary actions of all planers and intermediaries to deal with threats.**
- **Accordingly this presentation is meant to help bring some focus on threats and the complexity and problems associated with emergency planning and risk management.**
- **You will note that the topics discussed are seldom addressed by the media or our political leadership and they should be in these serious times. This is a beginning. Thank you for the opportunity to be here.**