Vladimir Gurevich

Protecting Electrical Equipment

Good Practices for Preventing High Altitude Electromagnetic Pulse Impacts

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Annotation

V. Gurevich
Protecting Electrical Equipment. Good Practices for Preventing High Altitude Electromagnetic Pulse Impacts. – De Gruyter, Berlin, 2019.

This unusual book recounts the history and development of military nuclear programs in the USSR and USA; the role of intelligence services in the development of nuclear weapons; discovery of electromagnetic pulses (EMP) caused by high-altitude nuclear explosion; and numerous tests of nuclear weapons. The book contains numerous previously secret documents and photos that have been recently declassified and approved for public release.

Using approachable language for the nonspecialist in nuclear physics, the book describes the formation process of EMPs caused by high-altitude nuclear explosions (HEMP) and discusses numerous factors affecting the HEMP strength and other of its parameters. Also discussed is the impact of nuclear EMPs on electronic components and devices and also on electrical power equipment.

The main part of the book describes only practical (and not theoretical, as in hundreds of existing scientific reports) protective methods and protection means, as well as methods for effective evaluation of the protective measures.

Due to its breadth of scope, timeliness, depth of coverage and the practical importance of described protective means, the book may be considered as an encyclopedia of HEMP, having no equal on the book market.

The book is intended for electrical engineers dealing with the development, design and operation of electronic and electrical equipment, and it will also be useful for university lecturers and students. Much interesting material will be found here, also appealing to fans of the history of technology.

Theme of the book corresponds to the “Executive Order on Coordinating National Resilience to Electromagnetic Pulse”, signed by President D. Trump at March 26, 2019.

Introduction

The electromagnetic pulse resulting from a high-altitude (30–400 km) explosion of a nuclear charge (HEMP) is a quite strange and extraneous phenomenon in the context of both physical processes and informational contradictions. Initially, the phenomenon was detected as a side-effect of the first nuclear-test explosion in 1945. That side-effect disrupted the registering and the measuring equipment and prevented obtaining numerous important data about the parameters of a nuclear explosion. For a long time, it has been impossible to gather clear and accurate EMP parameters due to the correlative impact on the equipment.

Numerous misunderstandings and calculation mistakes made by the leading physical scientists of that time hindered the efforts to build HEMP's theoretical models. However, recently, it appears that the theory of the process actually had been developed in 1925, well ahead of the detection of the phenomenon.

The informational contradictions result from the fact that, during the decades since the initial detection of HEMP, the phenomenon has been described in meticulous detail in hundreds of extensive reports, unclassified only 20 or 30 years ago (today the reports are freely available on the internet) many of them describing HEMP impact on electronics. However, over the decades, the phenomenon has not become known or clear to the majority of civil experts in a critical national industry such as the electrical power infrastructure. It seems like they live in a parallel universe: While there exist large groups of military experts working on this problem, the leaders in the electric power industry, as well as

engineers and technicians, in the best case, have only appeared to have heard something about a problem related to the electromagnetic pulse. However, the problem is really severe: HEMP acting on the unprotected microelectronic and microprocessor components of the control, telecommunication and relay protection systems commonly used in the modern power industry, can cause a power disaster over a vast area. Consequently, this will result in the suspension of the water supply, sewerage systems, communication, etc.

The carelessness of government agencies, and primarily the leaders of the electrical power industry, endangers the strategic national interests and provokes potential enemy countries to develop specialized nuclear weapons with intensified HEMP (so-called Super-EMP).

More than ten years ago, in 2005, I raised for the first time the question of electromagnetic security in the electrical power industry in an article published in the journal Public Utilities Fortnightly and, later that year, in articles published in Russian-language technical publications. In Russia, after my first publications, I was confronted with total misunderstanding and furious antagonism by electrical power engineering experts. They were unaware of the problem and perceived it as something outrageous and contradictory to their conventional perception of the world.

The Western world, including the US, perceives it somewhat differently. Today, there are dozens of governmental and non-governmental entities in the US working on the protection of the national infrastructure against HEMP. There are scores of booklets alarming about the consequences of HEMP impact on the housewife's level. A lot of such populistic scary stores can be found on Internet sites and in on-line book shops. Unfortunately, numerous of those entities produced publications by academics

about the damage resulting from the global collapse that inevitably results from HEMP impact. Fundamentally, the only difference between those reports and the above booklets is that the reports are written with addition small amount of technical and economical details for frighten the Congress and the Senate, not the housewives.

It may seem strange, but in parallel and completely independently of the above, there is a pattern of complete disregard and concealment of the problem in some of the professional journals in the field of the electric power industry. However, this is not a harmless pattern of behavior because the absence of appropriate knowledge about the existence of the HEMP problem by specialists in the field of the industry leads to hazardous decisions, sharply increasing its vulnerability. This is a very dangerous trend, but the people who have a certain commercial interest in all respects support it, limiting the transmittal of knowledge about the dangerous effect of the HEMP on digital microelectronic devices for protection, automation and control. Very often the apologists of digitalizing everything, including everything in the electric power industry, simply manipulate public opinion.

"*Digitalization – Yes or No*?"—appears very popular international journal "Protection, Automation & Control World" (PAC World) in September 2018 issue (in the section "Last word", p. 98), and continue: "*This is a question that many people in the electric power industry are asking themselves*". Furthermore, the journal editor invented his own interpretation of the term "digitization" and asked the reader to accept it and say "Yes": "*Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; if we just think about this definition, it is clear that the answer should be Yes*".

"*Many other questions cross our minds*" – writes the editor next – "*but they don't stop us from moving forward and taking advantage of*

the digital technology… And it is the time to get to the office, bring your team together and say – Let's go digital!"

Paraphrasing the author of these lines:

"the *dangers to HEMP are off interest to us and they will not stop us on our way forward*".

Such continued expanding uncontrolled use of digital microelectronic technologies in the electric power industry that are **unprotected against HEMP** is a tragedy of a national scale that must be prevented.

This is the main mission of the book.

Also, there are numerous companies thriving on specialized expensive training materials only developed to scare the staff of power-generating companies. Are such publications and trainings helpful when it comes to the protection of the national infrastructure? The answer is obvious. This answer motivated me to write a code of practice actually helpful to a power-system staff willing to protect their facilities against HEMP, instead of just being afraid of HEMP's consequences.

Certainly, to understand the nature of all the recommendations made in the book and to apply them appropriately under a specific electric equipment operation, the elementary theory of HEMP must be explained. That is why it is included in the book.

Finally, to make the book both interesting and inspiring, I included recondite historical facts about the creation and testing of nuclear weapons the USSR and the US, as well as photocopies of the previously classified documents of the USSR Committee for State Security (KGB) and the CIA.

Finally, I hope my readers will find much new, interesting and useful information in this book.

Important document "Executive Order on Coordinating National

Resilience to Electromagnetic Pulse", recently signed by the President D. Trump gives hope that the book will be in demand by many specialists responsible for protecting the infrastructure against HEMP.

Author

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