

## ABSTRACT

### EMP Protection of Control Centers and Substation Control Houses

Michael Caruso

Resiliency of Critical Infrastructure Segments has become a growing concern and has become an especially high priority for electric utilities. The elevated consideration for resiliency across all segments has rapidly expanded to include the impacts of High Power Electromagnetics threats. In particular, High Altitude Electromagnetic Pulse (HEMP) and Intentional Electromagnetic Interference (IEMI) have become the focus. HEMP can occur from a nuclear weapon being detonated in outer space (higher than 18 miles) and IEMI threats can easily be created by terrorists and criminals utilizing High Power Electromagnetic Weapons to attack power system assets. As further evidence of the evolving concern over HEMP and IEMI (from this point jointly referred to as "EMP"), on December 23, 2016, the White House signed the 2017 National Defense Authorization Act (NDAA) which includes the complete language of H.R. 1073/S. 1846, Critical Infrastructure Protection Act (CIPA), that was awaiting a vote in the U.S. Senate. The CIPA language amends The Homeland Security Act of 2002 and addresses the need for Electromagnetic Pulse (EMP) and Geomagnetic Disturbance (GMD) protection of all 16 critical infrastructure segments. This presentation will identify the EMP threat, the potential issues in current designs, the expected EMP impact on the critical components and equipment, mitigation opportunities for existing facilities and design recommendations for planned facilities.



## **Michael A. Caruso (Mike)**

Mr. Caruso is an independent consultant, formerly Director, Government & Specialty Business Development for ETS-Lindgren. He is a recognized leader in the RF Shielded Enclosure/EMP Protection/Anechoic Test Chamber Industry with 34-years' experience in project management, engineering, technical applications and business development. He has participated in business opportunities involving, start-ups, product launches, budgeting, proposal preparation and project management. He has a reputation for assisting customers with technological interpretations, developing strategic partnerships and creating value for customers. Mr. Caruso gained extensive Electromagnetic Compatibility (EMC) testing experience in running an EMC Laboratory as VP of Operations. The primary responsibility of the Laboratory was to test and certify the Power Electronics of the Boeing 787-8 aircraft. This experience adds to his depth of knowledge of real-world electromagnetic challenges. Mr. Caruso chaired ETS-Lindgren's HEMP/EMP Market and Product Development Team and was the driving force for ETS-Lindgren's Red Edge™ product development. He has lectured in EMP workshops dealing with Critical Infrastructure issues throughout the United States, South Korea and Israel. Mr. Caruso has led EMP facility evaluation teams, published several white papers and articles and has recently testified before the U.S. Congress on the need for EMP Protection of the Critical Infrastructure. He is a charter board member of the FBI sponsored INFRAGARD Midwestern EMP SIG.

Michael A. Caruso  
Principal Consultant  
847-226-8849  
[Carusomi54@gmail.com](mailto:Carusomi54@gmail.com)

# **Presentation on GIC to Delaware Valley Power Quality Group**

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## Presentation

Over the years, significant Geo – Magnetic Disturbances (GMD) caused power system blackouts in North America and other regions around the world. These events had created a certain level of concern in the electric power industry about the implications of Geo – magnetically induced Currents (GIC) flowing into the neutrals of large power transformers. The presentation will cover the following topics:

- How GIC currents are induced
- Effects of GIC currents on Power Transformers and Power systems
- Factors that influence the magnitude of the impact of GIC
- Methods to mitigate and protect against the effects of GIC
- Recent Industry Standards in this area
- Tools provided by ABB to assist Electric Utilities in North America comply with the requirements of the FERC order TPL – 007 – 1.

## Biography



Dr. Ramsis S. Girgis (IEEE Fellow) is presently the Technology Development manager at the Power Transformer Division of ABB located in St. Louis, Missouri. He is also the leader of the global ABB Technology Development activities in the areas of “Transformer Core Performance” and “Transformer Noise”. Dr. Girgis has 50 years of Technology Development experience mostly in the Power Transformer area. He has published and presented over 60 scientific papers and has been leading a number of IEEE and IEC Standards Development activities for Power Transformers. He is also the past Technical Advisor representing the US National Committee in the IEC Technical Committee 14. He was recently awarded the IEEE Transformer Standards “Life Achievement & Service” Award.

Dr. Girgis’ first association with GMD started on March 13, 1989; the day the highest GMD storm hit the Northeast region of North America. He was the lead engineer then who studied the impact of GIC on the Power Transformers at Salem Power Station. Over the past 6 years, Dr. Girgis has lead the ABB global development effort in the area of impact of GIC on Power Transformers and development of magnetic and thermal GIC Assessment models for power transformers; both core form and shell form. He was the principal contributing member of the recently published IEEE GMD Guide and a contributing member to the NERC GMD TF.

*Dr. Ramsis Girgis*

*Power Transformer Technology Development manager*

*314 – 679 – 4803*

*Ramsis.girgis@us.abb.com*