CIGRE Study Committee C4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP[1]

WG N° C4.54	**Name of Convenor:** William Radasky (USA)
Strategic Directions #[2]: 1	**Technical Issues #[3]: 6**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: 1, 2 and 3	
Title of the Group: Protection of high voltage power network control electronics from the High-altitude Electromagnetic pulse (HEMP)	

Scope, deliverables and proposed time schedule of the Group:

Background:

Over the past 10 years a new threat to substation relays, controls and communications has emerged, especially due to the increased use of solid-state electronics in high voltage substation buildings. It is known as the High-altitude Electromagnetic Pulse (HEMP) that is produced by a nuclear detonation in space. While this threat is considered to be a low probability event, there has been concern expressed in recent years that power networks could be damaged, if such an event occurred. It is important to evaluate the threat to high voltage power networks with a voltage level of 70 kV or above throughout the world, and to develop transient mitigation techniques and test methods within an Electromagnetic Compatibility (EMC) framework to deal with the threat.

Fortunately, substantial work has been performed by the International Electrotechnical Commission (IEC) under IEC SC 77C to evaluate the general threat of HEMP transients to electronics and to recommend generic mitigation methods. What remains to be done, however, is to apply these standards and reports to the specific problem of the electronic control of the high voltage power grid, especially within HV substations.

Scope:

1. Evaluate the available information from previous substation work in Study Committee C4, including TB 600 “Protection of High Voltage Power Network Control Electronics Against Intentional Electromagnetic Interference (IEMI)” and TB 535 “EMC within Power Plants and Substations” and new standardization work in the IEC dealing with HEMP.

2. Evaluate the range of HEMP conducted and radiated electromagnetic environments that can reach the electronics in a HV substation.

3. Evaluate categories of electronic equipment to determine their susceptibility to the HEMP induced transients.

4. Determine the HEMP mitigation methods (using EMC technologies) that could be applied to raise the immunity level of the electronics to HEMP.

5. Recommend EMC test methods to evaluate the sufficiency of the mitigation methods.

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report ☒ Tutorial[5] **Time Schedule**: start: January 2019 **Final Report**: December 2022
Approval by Technical Committee Chairman: **Date**: November 16th, 2018

Notes: [1] or Joint Working Group (JWG), [2] See attached Table 2, [3]See attached Table 1, [4] Delete as appropriate, [5] Presentation of the work done by the WG, [6] See attached table 3

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (ref. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Preparation of material readable for non-technical audience

Table 3: Potential benefit of work

1	Commercial, business or economic benefit for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical direction
5	Guide or survey related to existing techniques. Or an update on past work or previous Technical Brochures
6	Work likely to have a safety or environmental benefit