MHD-EMP EFFECTS ON LONG LINES.

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A nuclear detonation, high above the earth atmosphere causes a fast rising electromagnetic pulse (EMP) on the surface over a vast area. This pulse is followed by a much slower pulse that produces similar effects as a geomagnetic storm: the MHD-EMP (Magneto-Hydro- Dynamic EMP). An EMP couples large currents into electrical conductors and threatens the connected electronic systems. The magnitude, the direction and the time history of the produced MHD-EMP is rather complex. The amplitude differs according to the exact location. For a "reasonable worst case" analysis, however, small areas can be identified around the ground zero point of the burst over which the field strength is constant. The frequency spectrum contains only low-frequency components, typically below 1 Hz. So, the electromagnetic field will couple preferably with a system of large dimensions. The electric power system and the telephone system, both using long lines, are potential victims. Coupling of the MHD-EMP can essentially be modelled with a DC excitation on a DC resistive network.

Figure 1 shows an example for a typical part of the power grid. The large near-DC currents that are induced by MHD-EMP in above ground power lines cause problems to the connected power transformers. The extra magnetization current shifts the transformer working point which yields harmonic generation and possible insulation damage. Triangle-switched 3-phase transformers isolate the induced currents.
Long shielded underground telephone cables are relatively unaffected by MHD-EMP as long as a good ground connection is provided on both cable ends. The current on the inner wire pairs can be isolated by a signal transformer if need be.

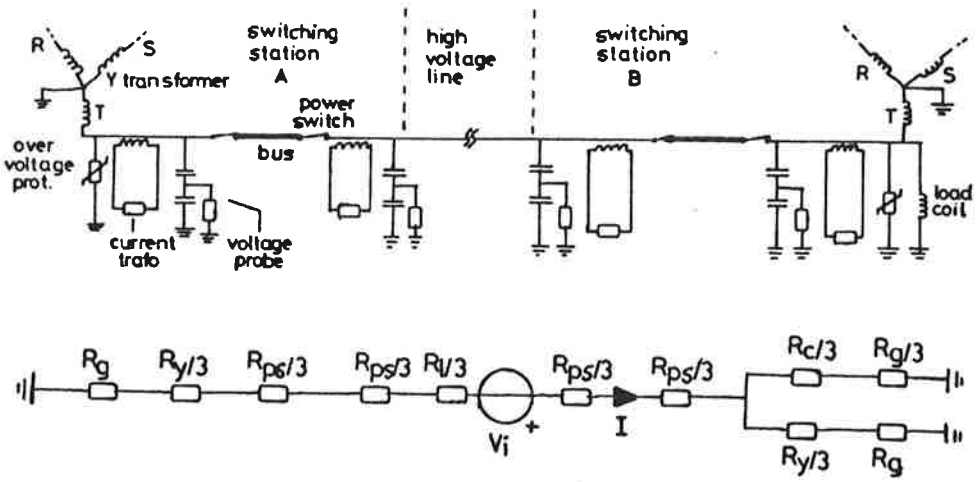

Figure 1. Quasi-static MHD-EMP model of an electric power grid.

Reprinted from: Program and Abstracts, 1991 North American Radio Science Meeting URSI, The University of Western Ontario, 24 - 28 June 1991, London, Ontario, Canada.