

Analysis of Biological Effect inside Human Body Exposed to Extremely Low Frequency due to Overhead Transmission Lines

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In Thailand, the extra high voltage 500 kV and 50 Hz overhead transmission lines have been installed by Electricity Generating Authority of Thailand (EGAT) both of single-circuit and double-circuit due to the rapid increasing of electrical power demands. The electromagnetic field will be generated and propagated to the environment in the area around overhead transmission lines. The intensity of electric field and magnetic field are proportional to the voltage of transmission lines. There is concern about the harmful effects on human which is exposed to electromagnetic field due to these overhead transmission lines. The biological effect on human body in case of high voltage and extremely low frequency electric field is induced current density. Some human organs, such as hearts and brains, are able to function by utilizing weak electricity. There may be some harmful effects to these organs if the current density exceeds the safety limit. The safety limit values of electric field and current density were set by the International Commission of Non Ionizing Radiation Protection (ICNIRP), electric field is 5 kV/m and current density is $2 \mu\text{A}/\text{m}^2$ for general public exposure. In this work, the numerical analysis base on Finite Element Method is used to calculate the electric field intensity around overhead transmission lines and induced current density on human body standing under overhead transmission lines. Therefore, the induced current density on several organs such as lungs, heart, liver and intestine inside human body exposed to extremely low frequency electromagnetic field at 13 positions under single-circuit overhead transmission lines are investigated. These values will be compared to the safety limits. It is found that the incident electric field on human body and induced current density on some organs inside human body are higher than those of the safety limits for general public exposure, especially the body at mid-span of the tower.

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