One Day Course On "Lightning"

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Lightning terminates on the surface of Earth at an average of 45,000 strikes per day, equating to over 16 million strikes a year. In an average year, this fury of nature costs billions of dollars (USD) worth in damages including considerable number of fatalities and injuries to personnel. The course provided an overall understanding of lightning, its impact, and lightning protection solutions such as direct strike protection, surge protection and grounding system.

IEM Electrical Engineering Technical Division organised a one day course on "Lightning" on 14th April 2016 at Wisma IEM, Petaling Jaya, Selangor. The speakers were: Dr. Zen Kawasaki, an educator in universities with more than 30 years of experience, he is the President of International Committee of Atmospheric Electricity (ICAE) and is also a member of IEE Japan, American Geophysical Union and Meteorological Society of Japan; Ms. Ong Lai Mun, an electrical engineer with more than 12 years of experience in conducting audit services and undertaking projects related to lightning protection, surge protection and grounding; and Mr. Jeremy Wong serving as the Director of R&D of Hitachi Critical Facilities Protection, Singapore.

Dr. Zen started with an overall introduction to climate change due to global warming and the current trends of the Earth's climate. He further presented the correlation between global warming and lightning activity, that the increase of greenhouse gas emissions has caused the Earth's surface temperature to rise together with lightning activities. As temperatures continue to rise, more and more water vapour could evaporate into the atmosphere, and water vapour is the fuel for storms. Dr. Zen noted that these storms have greater potential to develop into more intense or severe storms which could give rise to more intense lightning activity.

Ms. Ong continued with the importance of understanding lightning and its impact. She showed that Malaysia has one of the highest rate of lightning activity in the world as it lies near the equator where the weather is hot and humid almost all year round, and that these conditions are favourable for the development of lightning producing thunderstorm clouds. Selangor, South Perak, South Pahang, North of Kedah, and South Johor have the highest regional stroke density in Malaysia which is between 50 to 100 strokes per square kilometre per unit time. The participants were then asked why are these areas prone to high lightning activity? She explained that these areas are high population density territories with high levels of urbanisation, automobiles, and industrialisation which leads to temperature increase, then convection of rising hot air, air breakdown and subsequently the initiation of lightning.

Under the thunderstorm, everything gets charged up (electric-field or e-field) over time regardless of metal or wood. There are 2 factors affecting lightning strikes: Stepped Leader (extends down from the clouds) and Upward Counter Leader (extends upwards from objects on ground to meet the Stepped Leader). Meanwhile, there are also 2 effects of lightning: direct-strike effects and secondary effects. Direct-strike effects cause damage to property and assets, and cause injuries and death to people. Secondary effects cause step potential, bound charge, earth current transients, atmosphere transients, electromagnetic pulse, and electrostatic pulse.

The International Standards on Lightning Protection reviewed were IEC/BS EN 62305: Protection Against Lightning and NFPA 780: Standard for the Installation of Lightning Protection System. The standards provide the general principles to be followed in the protection against lightning of structures including their installations, contents, as well as persons, and the services connected to a structure.

Mr. Jeremy later introduced the secondary effects of lightning strikes where he emphasised on surge protection which is caused by high amplitude, short duration overvoltage. This situation should not be confused with temporary overvoltage and can be positive or negative polarity. Causes of surge or transients are lightning, switching of load and source, and arching and flashover. Surges caused disruption and downtime, degradation of microelectronics and motor insulation, destruction of microelectronics and motors, etc. Hence, surge protection forms a key part of a lightning protection system against the secondary effects of lightning. In this case, lightning induced transient overvoltages (surges).

Ir. Gan Tian Eng (left) presenting a token of appreciation to Dr. Zen Kawasaki (right).

Ir. Gan Tian Eng (left) presenting a token of appreciation to Ms. Ong Lai Mun (right).

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