COMMENTS TO IEEE Std 1410-2004 GUIDE FOR IMPROVING THE LIGHTNING PERFORMANCE OF ELECTRIC POWER OVERHEAD DISTRIBUTION LINES.
JULY 2005

The following comments are related to ***section 4.1 Lightning incidences*** in the sense of taking into account that equation (1) which relates GFD values to keraunic levels is only valid in temperate regions. The mentioned equation, developed by Anderson and Ericksson and based on lightning measures obtained from Lightning flash counters located in South Africa, has shown good results when they are compared to Lightning data in temperate zones but not necessarily in tropical regions. This circumstance has motivated the creation of a new CIGRE Task Force (TF C4.04.04) dedicated to the study of Lightning parameters in Tropical zones, especially in Colombia, Mexico and Brazil which have collected lightning data from their own Lightning Location Systems.

Relationships Ng vs Td obtained from Colombian LLS data and Anderson's equation were evaluated finding great errors that show the necessity of developing new adequate equations to Colombian lightning behavior [1]. In addition, other relationships Td vs Ng were found in mountainous tropical regions of Mexico and Brazil as follows:

$$Ng = 0.024 \cdot Td^{1.12} \quad \text{México}$$
$$Ng = 0{,}0030.Td^{1{,}12} \quad \text{Brazil}^{1}$$
$$Ng = 0{,}0017.Td^{1{,}56} \quad \text{Colombia}$$

The similarity between the relations found in Brazil and Mexico may be attributed to the comparable location in terms of latitude (Mexico [16–28^0 North] and Minas Gerais-Brazil [18-22^0 South]). However, the relation found in Colombia (2-10^0 North) which is located closer to the equator presents a different behavior. The errors found in applying equation (1) in Colombia have reached values up to 1568%[1].

Moreover, a different behavior of Lightning parameters in tropical zones has been observed for both mountainous and coastal regions, therefore, different equations have been obtained for each type of region [1][2].

PROPOSAL

Based on the above reasons which are further described in references [1][2] It is proposed the following change to the draft:
Original Lines 11 to bottom page 6

"This GFD may be estimated in several ways.

The GFD may be estimated from the keraunic level [B5] using equation (1).

$$Ng = 0{,}04Td^{1{,}25} \qquad (1)$$

[1] F. de la Rosa, K. Cummins, L. Dellera, G. Diendorfer, A. Galván, J. Husse, V. Larsen, C.A. Nucci, F. Rachidi, V. Rakov, H. Torres and M.A. Uman. "Characterization of lightning for applications in Electric Power Systems" *Technical Brochure No. 172, CIGRE WG. 33.01.0*2, December 2000.

Where
Td is the number of thunderstorm days per year (the keraunic level)"

Proposed Lines

"GFD may be estimated in several ways.

The GFD ***for temperate regions*** *may be estimated from the keraunic level [B5] using equation (1).*

$$Ng = 0{,}04 Td^{1{,}25} \qquad (1)$$

Where
Td is the number of thunderstorm days per year (the keraunic level)

In the case of ***tropical regions****, the GFD may be estimated from the keraunic level using the results found in mountainous regions of Mexico, Brazil and Colombia [B78] as follows:*

$$Ng = 0.024 \cdot Td^{1.12} \quad \text{México}$$
$$Ng = 0{,}0030 . Td^{1{,}12} \quad \text{Brazil}$$
$$Ng = 0{,}0017 . Td^{1{,}56} \quad \text{Colombia}$$

Where
Td is the number of thunderstorm days per year (the keraunic level)"

The new proposed reference [B78] corresponds to reference [1] in this document.

REFERENCES

[1] TORRES H, *"Ground Flash Density : definition of the appropriate grid size and a proposal of relationship Ng vs. Td for Tropical zones" Activity Report Of Tf C4.01.02-B. Working Group C4.01 "Lightning". CIGRE Dallas, Tx., Usa, September 2003*.
[2] YOUNES C. "Evaluation of Lightning parameters in Colombia from LLS and Satellite data" MSc. Thesis, National University of Colombia, Bogotá, 2002.
[3]F. de la Rosa, K. Cummins, L. Dellera, G. Diendorfer, A. Galván, J. Husse, V. Larsen, C.A. Nucci, F. Rachidi, V. Rakov, H. Torres and M.A. Uman. "Characterization of lightning for applications in Electric Power Systems" *Technical Brochure No. 172, CIGRE WG. 33.01.02*, December 2000.