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Volcanic ash impacts on the dielectric strength of HVAC Outdoor Suspension Insulators: the case of Cotopaxi and Tungurahua volcanoes (Ecuador)

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The length of the insulators strings determines the insulation level of electric transmission towers. The electrical insulators behave differently depending on environmental conditions. Particle pollution is one of the most important to consider for the degradation of electrical insulation but it is difficult to estimate. Recently, Cotopaxi and Tungurahua volcanoes located in central Ecuadorian Andes were in eruption producing ash clouds traveling hundreds of kilometers from the vents. The Electricity Corporation of Ecuador (CELEC) has several overhead transmission lines in the ash fall high-risk areas (e.g. Santa Rosa - Mulaló). It is well known that the salts adhered to ash particles react when mixed with water and humidity increasing their conductive properties. This higher conductivity directly affects the insulators causing electrical discharges in the transmission lines that could produce blackouts in several parts of the country. In order to emit early warning alerts to the transmitting power company (CELEC) to prevent power disconnections in the country, we tested the degree of ash fall affection in electrical insulation level on ANSI C52-3 type insulators. For this we considered different scenarios by changing the time of voltage application, voltage level, humidity conditions and ash accumulation. We used the ash of Cotopaxi volcano emitted between August - November 2015 (phreatic / phreatomagmatic scenario) and the ash emitted by Tungurahua in February - March 2016 (magmatic scenario). Finally, we obtained several curves of minimum flashover voltage according to Equivalent Salt Deposit Density (ESDD) in real time. These curves will be used to determine an indicator of the limit of ash accumulation in the high voltage insulators in order to send a warning to CELEC.