ENVIRONMENTAL EFFECTS ON POLYMER INSULATORS PROPERTIES

Prepared for

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SUMMARY

This is the final report of the study entitled *Environmental Effects on Polymer Insulators Properties,* which started on March 1, 2003. It is sponsored by Saudi Electricity Company (SEC), Riyadh, Saudi Arabia. The study was conducted by Center for Engineering Research of the Research Institute in cooperation with the Electrical Engineering Department of Petroleum and Minerals, Dhahran. Saudi Arabia.

The study investigated the technical performance of polymeric insulators with specific reference to the environmental parameters such as humidity, dust, temperature, UV radiation and contamination and aimed to finally assess the suitability of the insulators for practical applications on transmission lines.

The polymer insulator is constructed from two basic components, a core and weather shed. The core consists of a glass-fiber reinforced resin rod coupled to metal fittings at both ends. The rod is protected against external agents by polymeric sheds, which also provide the shape and leakage distance required for the rod to withstand electrical stresses. The working and environmental conditions such as mechanical stresses, electrical fields, moisture, ozone, UV light, surface arcing, and contamination affect to a certain extent the performance of the polymeric insulators. Therefore, the selection of a polymeric insulator for a given site must be based on careful analysis and testing.

To meet the objectives effectively, the research team conducted an extensive literature survey and investigated the utility service experiences with polymeric insulators inside the Kingdom, regionally and internationally through carefully prepared questionnaire, direct contacts and from the published literature. Different international leading insulator manufacturers were approached to participate in this project. Eight suppliers from Europe, Asia and USA provided insulator samples for pollution testing and aging, in addition to material samples for aging at the weathering chamber. The study dealt with both naturally and artificially contaminated insulators. Electrical performance was studied to offer comparison among different polymeric insulators and to compare performance with that of conventional porcelain insulators. Moreover, polymeric insulators were exposed to accelerated aging using various techniques. Various measurements to identify the occurrences of aging were made to finally assess how polymeric insulators will perform in actual service.

Through a careful analysis of obtained data, relative ranking among different polymeric insulators has become known. Moreover, performance comparison was made with ceramic insulators.

As an outcome of this study, it was observed that all types of polymeric insulators have electrically performed superior to conventional porcelain insulators for the same degree of pollution. This has been attributed to the hydrophobic characteristics of polymeric surface in addition to more uniform voltage distribution as compared to conventional insulators, which by design have highly stressed locations to achieve higher leakage distance. From the analysis of aging data, it appears that silicone rubber insulators will give quite satisfactory performance on outdoor transmission

lines in the Kingdom of Saudi Arabia. These may offer a good substitute for conventional porcelain insulators which require extensive maintenance quite frequently. It also noticed that the insulators performances are related to the type of the insulator's shed material, manufacturing techniques and end assembly. Accordingly, careful selection and thorough testing is a must to identify the right insulator.

It is further recommended that the suitability of polymer insulators shall also be investigated under DC voltage to generate useful data on the suitability of the insulator for upcoming DC transmission networks in the Kingdom.