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Evaluation of tree retardant XLPE(TR-XLPE) and EPR insulated 35 kV cables after 17 years of field service

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**Abstract:** 35kV cables insulated with TR-XLPE and EPR have been evaluated after 17 years of field service. Both the AC breakdown strength and Impulse breakdown strength of the TR-XLPE cables were found to be higher than that of the EPR cables. A comparison of the breakdown data to previously published breakdown data for similar constructions of EPR and TR-XLPE insulated 35kV cables after 7-9 years of service, indicates that both cable materials exhibit good relative stability of AC and Impulse breakdown strength after 17 years of field service.

**Keywords:** field-aged cable, AC breakdown, water trees.

#### 1. Introduction

The Galleria Mall, located just south of Birmingham Alabama, has been one of the largest shopping malls in the Southeastern United States since its construction in the mid 1980s. At the time of pre-construction planning, the area had been designated by Alabama Power for extending its newly developing 35 kV service. The Galleria Mall was to contain about 200,000 sq meters of retail space and have an estimated demand of approximately 20 MVA. At the same time a new cable insulation was being introduced as TR-XLPE, which was a modified crosslinked polyethylene (XLPE) containing a tree-retardant additive. Also being offered was a new filled-conductor cable construction that utilized a viscous mastic-like material that was extruded within the interstices of the conductor strands to block water migration within the conductor. The new cable specified for the Mall was expected to increase cable reliability as compared with standard XLPE that had been in use for many years.

At the time of cable installation there was some concern about the possibility of excessive shrink back on the TR-XLPE cables, so utility engineers decided to use Ethylene Propylene Rubber (EPR)

**Résumé:** Des cables de distribution de 35 kV de constructions semblables et isolés avec du TR-XLPE et de l' EPR sont analysés après 17 ans de service. Il est montré en particulier que les rigidités diélectriques résiduelles en alternatif et en choc du cable TR-XLPE sont supérieures à celles du cable EPR. Une comparaison est faite entre ces valeurs de rigidité diélectrique et celles publiées auparavant sur les même cables après 7 et 9 ans de service. Elle montre, pour les deux types d'isolation, une bonne stabilité des mesures depuis les précédentes après 17 ans de service.

**Mots clés:** cable en service, rigidité diélectrique en alternatif, arborescences

insulated cables in half of the circuits serving the mall. EPR cables had been used for many years and had proven reliable. The system was designed to allow either the TR-XLPE cables or the EPR cables to serve the mall.

Recently, after 17 years of service with no failures of either cable, there was interest in determining the remaining reliable service life in each cable type. Of secondary interest was the determination of the performance of the TR-XLPE cable compared with the EPR cable. A partnership was established between the Southern Company Research Committee and The Dow Chemical Company to remove and evaluate sections of the Galleria Mall cables. The tests made on cables from the Galleria installation were unique, since they represented a snapshot of cable characteristics after almost 2 decades of service, which could not have been predicted from the initial type testing required by current specifications. The test program was conducted at the National Electrical Energy Testing, Research and Applications Center (NEETRAC) in Atlanta, Georgia USA. (Southern Company is the parent company of Alabama Power. Union Carbide Corporation, a subsidiary of The Dow Chemical Company, is the manufacturer of the TR-XLPE cable compound.)