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COLLABORATIVE PROJECT TO ASSESS THE EFFECTIVENESS OF BORON RODAS A SECONDARY PRESERVATIVE TREATMENT IN WOODEN POLES

For

Eastern Electricity Plc
Bio-Kil Chemicals Ltd

Initial Ten Year Report

December 1994

Introduction

The service life of creosoted wood poles depends on several factors, particularly the quality of the initial preservative treatment. The long term benefit of the initial preservative treatment is limited by its inability to protect the heartwood and this can result in internal decay in the pole. Such internal decay can occur at any time. It often occurs early in the life of the pole if there is also poorly treated sapwood present and particularly if pretreatment infection is carried over into the pole in service.

Previous studies (Morris 1984) have fully documented the mode of failure due to internal decay and it is now generally accepted that if an effective secondary treatment can be applied to inner untreated timber then where the conditions suitable for internal decay arise it will be protected. Such treatments have been under test and in use for several years now but little is known as to how long these treatments will actually last in service.

Initial studies by Imperial College of Science Technology and Medicine, London, and Eastern Electricity Plc, reported in March 1988, have indicated that boron rods offer great potential as a secondary or complementary preservative treatment. The use of such systems in general pole maintenance was outlined by Dickinson and Calver in 1993.

Boron Rods are formulated from inorganic borates which are water soluble, diffusible chemicals. When inserted into poles, primarily into untreated heartwood at the groundline, they are dissolved by any moisture present and distributed by diffusion to areas at risk from decay. If the pole is dry and free from risk of decay then the rod remains intact until conditions change. The preservative distribution is regulated by the moisture regime of the pole as is the risk from internal decay.

Experimental

In 1985 a long term trial was initiated at four sites in the Eastern Electricity Plc region. Treatments from this trial were examined in great detail at six years. The summary of this report is reproduced below.

Executive Summary of Six Year Report

The use of boron rods as a potential secondary preservative treatment in wooden poles has been investigated, in a project originally devised by Imperial College and Eastern Electricity Plc. The results of the first stage of the project were reported in March 1988, and an overview presented in Distribution Developments, March 1989.

The second stage was undertaken jointly by Imperial College, Eastern Electricity Plc, and Bio-Kil Chemicals Ltd., to assess the effectiveness of the boron rod treatment over a 6 year period, within a 10 year project. The results obtained indicate that the application of boron rods provides very good remedial or secondary preservative treatment.

- Visual and chemical analyses demonstrate that the boron preservative is distributed to the area of the pole which is at greatest risk to decay, i.e. the area about the groundline.

- The distribution of the boron is generally regulated by moisture within the pole, with highest levels recorded in the wettest regions, i.e. those most susceptible to decay.

- A substantial reserve of preservative, as undissolved rod, remains in the pole. The amount of reserve present as a solid rod, is influenced by the moisture regime in each pole.

- A vigorous biological challenge in the laboratory has shown that, when boron is sufficiently well distributed from the rods in the poles, it protects the wood by preventing colonisation by decay fungi.

- An initial treatment of boron rods can afford additional or supplementary protection for at least 6 years, and indications are that there is sufficient chemical remaining to provide protection for a much longer period. An assessment at 10 years should be undertaken to establish if and when further retreatment would be required.

The main conclusion was that treatment with boron rods had the ability to protect poles in service well beyond the six years. This original field trial was designed to run for ten years but, in hindsight, should have been designed to last very much longer.

In view of the excellent results and predictions being made at six years it has been decided to re-design the final stages of the trial. The following protocol is therefore proposed for the final stages of the trial.

A small, but representative sample of the remaining poles be examined for the presence and distribution of boron in year nine. If the levels of boron appear to be less than at six years then a full "biological challenge" should be carried out to determine if the poles are still protected at 10 years. If, however, the poles appear to be essentially the same as they were at six years and the evidence points to the treatment lasting very much longer than the predicted 10 years then the experiment should be terminated and a full chemical analysis of the poles made in order to make predictions well beyond the 10 year period.

Representative Sampling at Year Nine

Seven poles were removed from the field site and each pole was cut 0.5 metres above and below the groundline. Each 1 metre length was further cross cut at 100, 200 and 300mm above and below the groundline and original treatment level. The distribution of the boron was determined by spraying with a curcumin reagent which turns red in the presence of boron.

Moisture contents were checked across each disc. These were graded into dry wood, i.e. below 25% and indicated by white dots in the photographs, 25% to 30% indicated by blue dots, and above 30% indicated by yellow dots.

Results

Two of the poles were dry inside with a moisture content below 20%. No movement of the boron had occurred and the rods were intact. These poles had not become wet in the trial and were not at risk from decay.

Pole 50 (Figure 1)

This pole was wet below ground and up to 200 mm above ground. The curcumin reagent showed a deep red colour indicating a high level of boron present, i.e. 2-4 Kgm^{-3}, Boric acid (McCormack and Dickinson, 1993).

Pole 19 (Figure 2)

This pole showed excellent distribution of boron above the groundline. Below ground the pole was drier at 200mm and showed a corresponding lower level of boron.

Pole 7 (Figure 3)

This was a relatively dry pole but clearly showed a good distribution in the moist columns of wood present in the cross sections.

Pole 30 (Figure 4)

This was a very well creosoted pole but still had a wet heartwood at and below the groundline. Boron was well distributed in the wet wood and corresponding less so the drier wood above ground.

Pole 26 (Figure 5)

Although this was a relatively dry pole boron was clearly present in the wet columns of wood. Experience has shown that decay follows these columns of wet wood in untreated poles.

Recommendations and Conclusions

The large amounts of boron preservative present in the poles examined at this time confirm that the treatment will last beyond the 10 year period. In dry poles the rods remain intact until such time that the wood becomes wet and at risk from fungal infection.

It is, however, not possible to predict the actual life beyond 10 years although it is confidently felt it will be considerable. Assessments of the remaining poles could be made at 15 and 20 years but this is considered too long to wait. Since we are now confident that the system will work in excess of 10 years it is proposed to carry out a total chemical analysis of the remaining treated poles. This will establish the likely life of the treatment beyond 10 years from a single application of the boron rods.

References

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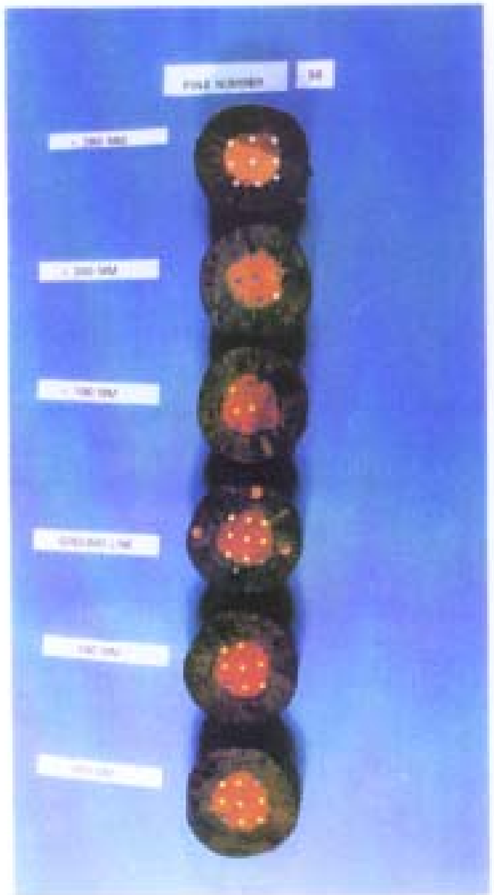

Figure 1

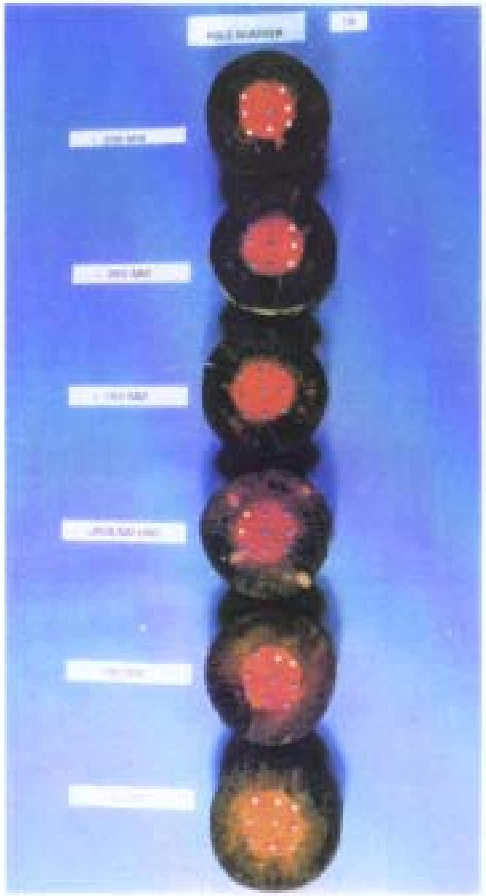

Figure 2

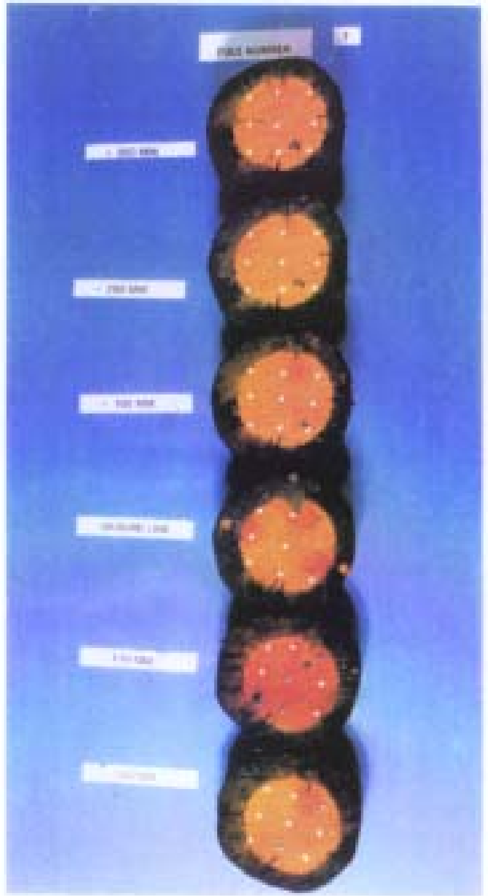

Figure 3

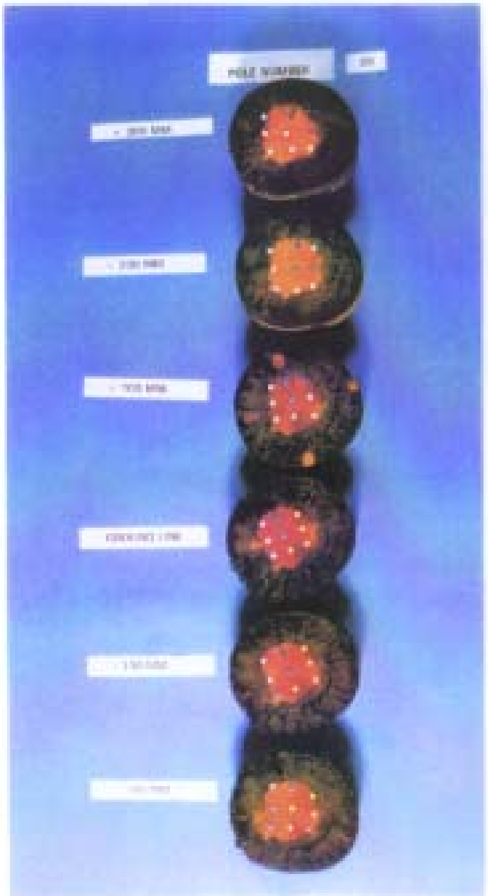

Figure 4

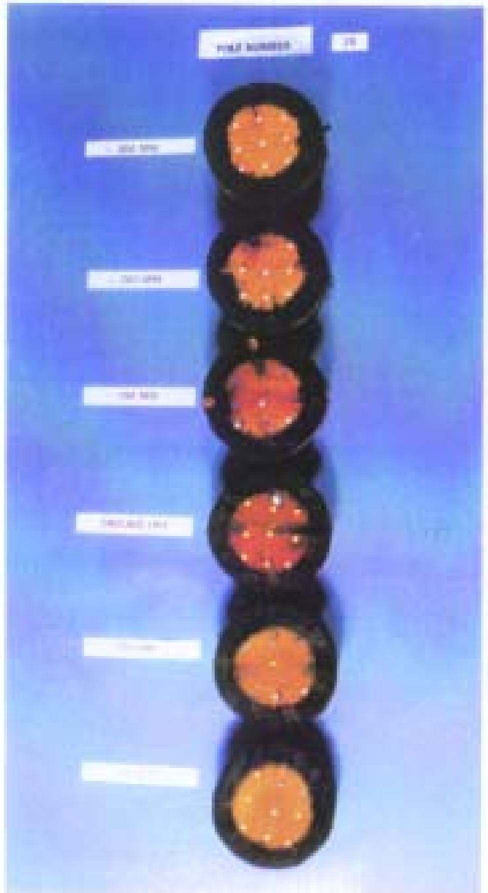

Figure 5