Wood Pole Remedial Treatments: Past, Present & Looking Forward

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Wood Utility Poles have been with us for a long time. Initial treatment of Wood Poles became necessary. Remedial treatments to extend pole life were a logical next step since they are:

- Durable
- Longevity
- Cost Effective
- Available,
- Initial Treatment
- Remedial Treatments

Wood Poles When Inspected & Remedial Treated Last Even Longer. Pastes: During the early 1930s, Dr. Carl Schmittutz, from Germany, invented a process and formula for the preservation of wood. With complications in pre-war Germany in moving financial assets out of the country, the Woolworth Company purchased patents for the Osmose process of wood preservation from Dr. Schmittutz and organized the General Osmose Corporation. On November 13, 1934, the Osmose Wood Preserving Co. of America, Inc. was organized in New York State to market this patented wood preservation technology in the United States and Canada.

The original Osmose patents described a preservative process using sodium fluoride, potassium bichromate, sodium arsenate, and dinitrophenol. This preservative was known in the industry as "FCAP." Penetration of preservatives was achieved through the process of diffusion or "osmosis" into green wood or wood of high moisture content. Another early use was the development of a paste formulation of FCAP preservative for in-place treatment of utility poles in the ground line area. This is where it all started and the processes we use today as then are mostly still valid. Externally applied pastes lacked the ability to migrate deep into the wood and were ineffective against internal decay.

In Europe, the application of water-soluble preservative salts under pressure or the addition of solid rods containing these same chemicals into drilled holes in the pole were evaluated. In North America, the application of highly volatile compounds which could migrate through the wood was used to control internal decay. In general, these were agricultural fumigants normally used to sterilize the soil. Methyl Bromide and chloropicrin were popular. Also, sodium n-methyl dithiocarbamate, Vorlex (20% methyl isothiocyanate. All these applied the to ground lines through steep drilled holes plugged with wooden dowels.

Internal Fumigants: Volatile agricultural chemicals (fumigants) such as chloropicrin (trichloronitromethane) and sodium n-methyl dithiocarbamate have been used since the mid-sixties for controlling decay in large dimension wood in North America. The widespread acceptance of pastes and fumigants by utilities reflects the tremendous investment savings realized by extending pole service life.

However, some of these pastes and fumigants had a drawback in terms of worker safety, the environment, and efficacy over time. Safer and more effective remedial treatments are now being used extensively. Although fumigants are still widely and successfully used. Many formulations now make use of Borate and Borate/Copper formulations. These are much safer to use and apply, carry little to no environmental impact and provide a regimen that will last for many years. I believe that going forward remedial formulations will be hybrid systems using a combination of treatments.

Early pole replacement is due to many factors some of which are planned such as road widening or line upgrades. Other factors for replacements would be for vehicle impacts or lightning strikes or fires. Pole Decay is by fare responsible for most early replacements.

Test and Treat Process

The Test and Treat Process is very important to the extension of service life to a wooden pole. Proper evaluation and recording of pertinent data are very important to a well-managed wood pole program. Age, height, species, any cracks of checks, noting and measuring any mechanical damage as well as what attachments are on a pole are all important factors. The climatic zone and the placement of the pole are also, of importance factors to know when evaluating a pole.

A good visual from the ground up to the top is necessary. Sound and bore has been the standard for many years and is very effective when done by a competent and knowledgeable inspector. Hammer sounding is done by sounding the pole in 4 quadrants from about 8 feet up down to the ground line taking careful note of the sound attenuation of the hammer strikes and the feel of the wood when struck. If drilling is required, then this is done using a predetermined drilling pattern. The holes will be drilled at a steep angle downward towards the center of the pole. The tester will note the shaving coming from the hole as well as the feel of the drill as it works its way into the pole. The size of the pole will determine the number of holes. Holes a are then probed to check for shell thickness and any voids. All this is noted in the inspection data. If treatment is required, then the application of the preservative is done through the drill inspection holes or larger holes to facilitate the preservative.

Various Pastes have been used successfully treating wood poles externally for many years. External bandages have been in use for over 30 years. Early pastes were sodium fluoride, potassium dichromate, sodium arsenate, and dinitrophenol. Later, we saw OSMOPLASTIC which has been very popular. It contained 45.62 % creosotes, 44.42% sodium fluoride, 3.1% Potassium Dichromate and 2% Dinitrophenol. Evolution to MP 400 EXT with a combination of tebuconazole and bifenthrin for insect and fungi control with micronized oxine copper technology for soft rot, and borax. The evolution of pastes progresses with 5 readily available Borate Copper formulations, all equally as effective. The first being CuRap 20 and then CuRap 22, CuBor, MP 500 EXT. and CuB.

Looking Ahead

- Better Inspection techniques and process
- Better preservatives building on diffusible technologies

We have got very good at initial pole treatments and we know supplemental remedial treatments of ground lines will extend the service life of poles. In some situations, we are seeing a shifting of the treatment area above the traditional treatment zone. As we get better at the ground line the issue moves up to some degree. Since moisture is the medium for fungal decay growth I feel the future is in diffusible type systems.

The next step is addressing other pole life cycle limiting issues. The Pole Top, insects, birds and animal issues.

Wood Poles: A Comprehensive Study

- T&D utilities face challenges uncommon to other industries and which add to the complexity of assessing the condition of the asset:
    - A large number of aging assets covering wide geographic and climatic regions.
- Long intervals between observations (inspection cycles). Hidden and indirect observations and defects. The long interval means we do not know when the "trigger events" occurred.
- Many inspection techniques focus on just a few elements and attempt to identify good (keep) or bad (replace), without a long-term view.
- Some approaches are too "subjective" in nature leading to significant variations in how poles are classified.
- Incomplete information as to the decay model specifically related to wood poles. This results in an inconsistent assessment of the current and future condition of the pole.

The complete wood pole inspection program covers a variety of elements from planning, program management quality control, data collection tie with other systems (GIS, SAP, etc.) and reporting.

The impact that this asset class has on the stability and performance of the Distribution & Transmission Network means that a Utility needs to better understand the risks and how to address them. The drivers include:

- A better understanding of how poles age, in effect of the aging model of a wood pole.
- How to assess the condition of the pole from quantitative (measured) and qualitative (assessed) elements of decay observed on the pole.
- How do the condition assessment and retreatment process impact both the individual asset and the whole network.
- Assessing the risk both at the time of inspection and its likely state at the next inspection (the probabilistic aspect).

Therefore, the process to integrate the "mechanical" and "probabilistic" aspect in the field gives you the ability to forecast predictable pole health.

A mechano-probabilistic approach allows a utility the ability to evaluate both categories (quantitative and qualitative damage).

- The first step was determining the "natural aging" curve.
- Then calculating the mechanical aspect (quantitative) would allow us to calculate the reduction (as a percentage) in pole capacity.
- The qualitative elements are modeled using a probabilistic approach giving each qualitative factor a "weighting".
- The model would then estimate both the current condition and where the pole would be by the next inspection cycle (in our case 10yrs).
- Data could eventually be used to model/compare different feeders to see how they would perform during severe weather events.

3 different Stages to consider on a baseline-aging curve:

- **Initial State (0 to 30/35yrs):** Coincides with a very high survival probability due to the fact of its young age and that the initial treatment is fully effective. Any losses in this state are more than likely due to external factors or poor initial treatment. The slope of the curve is almost flat.
- **Transition State (30/35yrs 50/55yrs):** In this phase, the effectiveness of the initial treatment falls below the minimum level required to protect against the various type of fungi that causes natural decay. In addition, an accumulation of minor damage (checking, impact damage) may have exposed the unprotected wood to the start of natural decay. This phase also will tend to show the rise of poles requiring replacement due to natural decay (as opposed to external factors). This phase will also demonstrate an increased rate of loss due to natural decay.
- **Terminal State (50/55yrs and onwards):** The steepest part of the curve representing an increasingly rapid loss rate primarily related to natural decay.