

Triangle Laboratories Wood Treatment



**The biotechnology
approach to preserving
wood in the environment**

Wood Rot Basics



- Rot is inevitable- delay not eliminate
- Rot map- from Duke Power Co.
- Ground-line rot biggest problem
- Main decay organisms are fungi
 - aerobic organisms
- Wood receives initial and re-treatments
- Treatments involve hazardous chemicals

Treatments Used



- Initial
 - CCA
 - Pentachlorophenol
 - Creosote
- Retreatment
 - Copper naphthenate
 - Boron rods
 - MTSI, Chloropicrin
- Comparison matrix

Pole Treatment



- New deregulated environment puts premium on pole maintenance
- Wood poles likely to remain
- Treatment options all involve hazardous materials
- Goal:
 - Provide an effective, easy to apply by a variety of workers, value effective treatment with no environmental or human safety concerns

Rot Microbiology

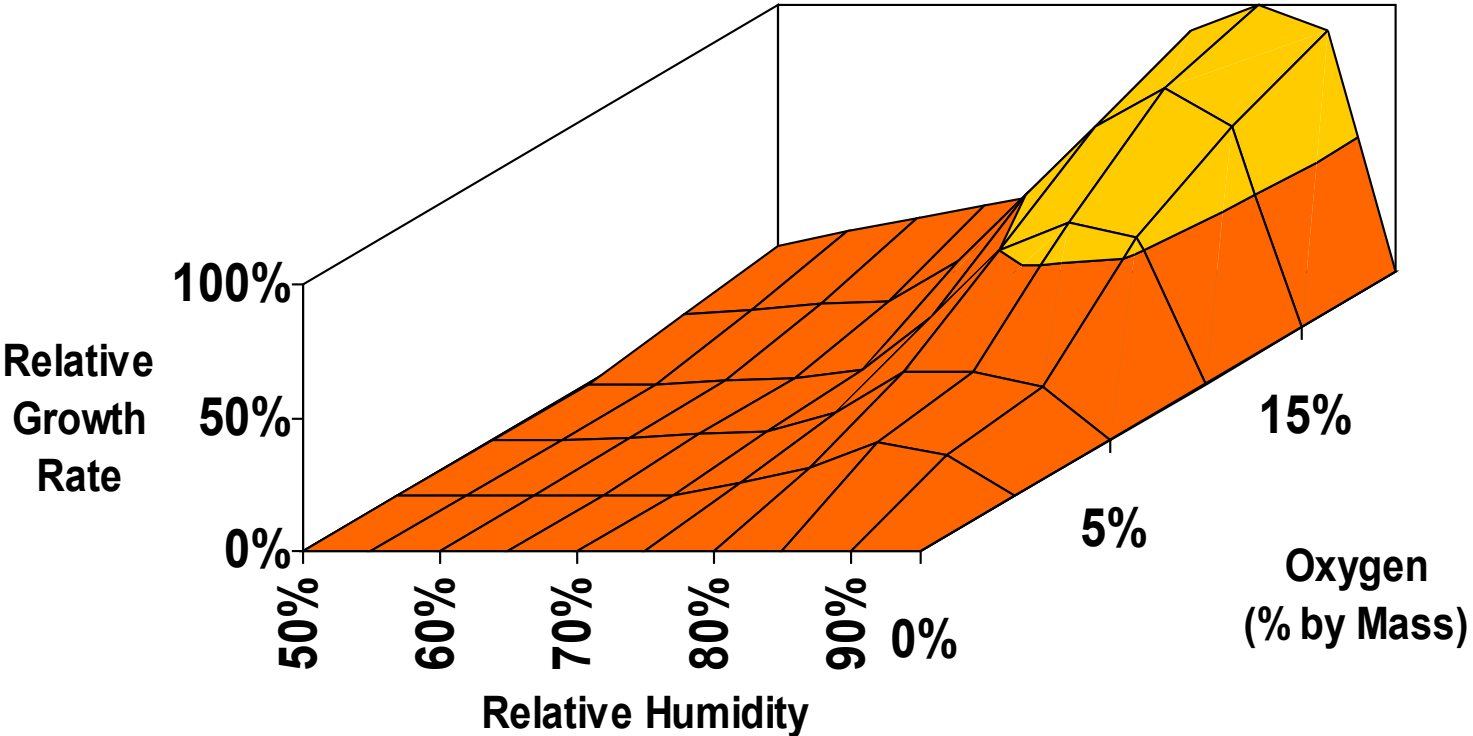


- Ground-line decay due mainly to fungi
- Rate dictated by a variety of environmental factors
- Microbial communities can be manipulated
- Bacteria generally rot wood slower than fungi
- Anaerobic processes are always slower than aerobic

Environmental Factors Affecting Wood Decay

- Temperature
- Soil Structure (Clay, Sand, Loam, etc.)
- Organic Matter Content
- Moisture
- Oxygen

The Effect of Moisture and Oxygen on Microbial Growth

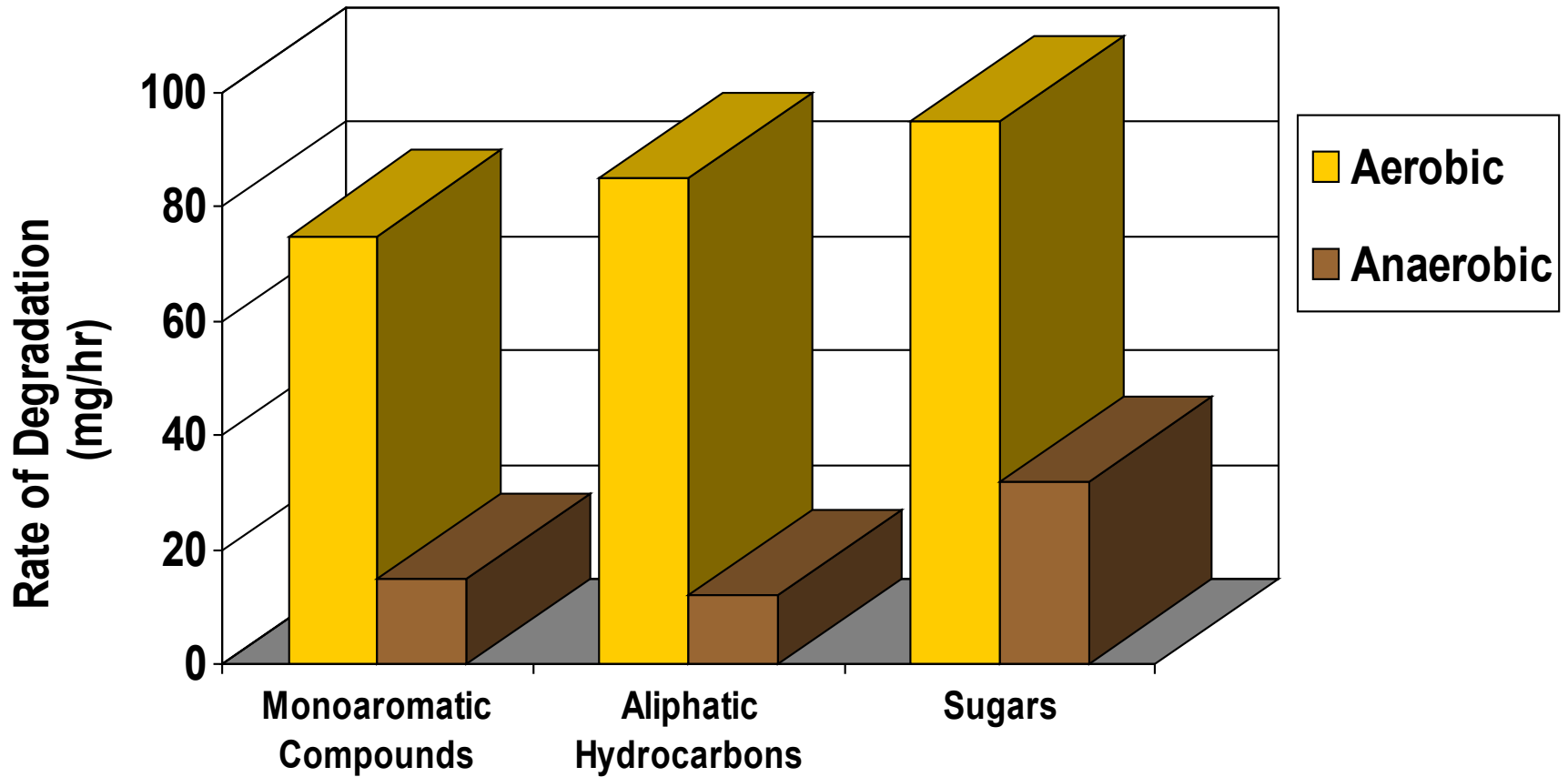


Oxygen Diffusion Rates



- The Diffusion of Oxygen Through Air:
 - $D = 1.6 \times 10^{-1}$ sq.cm/sec.
- The Diffusion of Oxygen through Water
 - $D = 2.0 \times 10^{-5}$ sq.cm/sec.
- Diffusion through Water is 4 Orders of Magnitude **Slower**.
- Wet and dry cause variation in Oxygen status

Controlling Decay by Controlling Oxygen

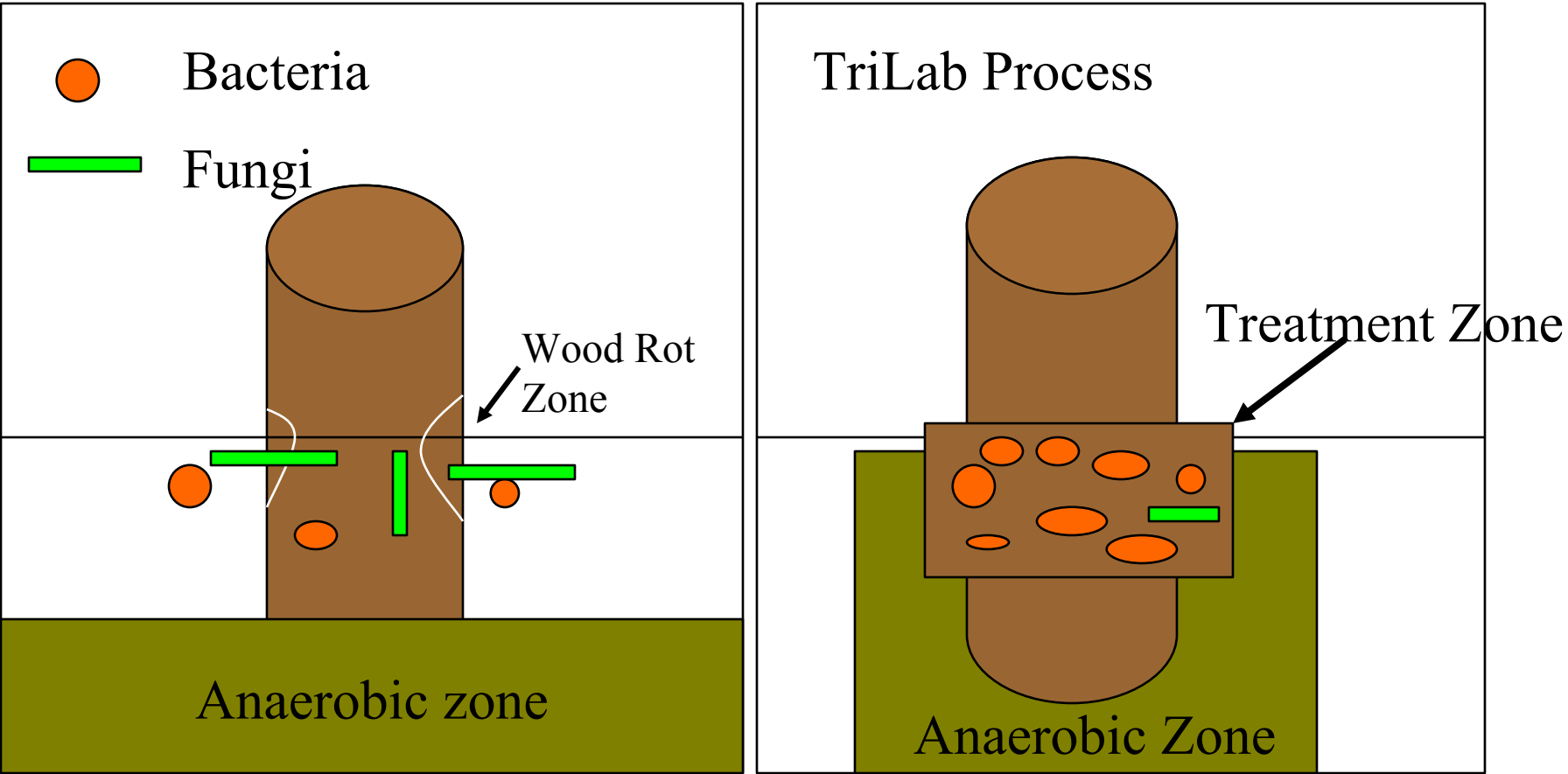


Biotechnology Approach to Pole Life Extension

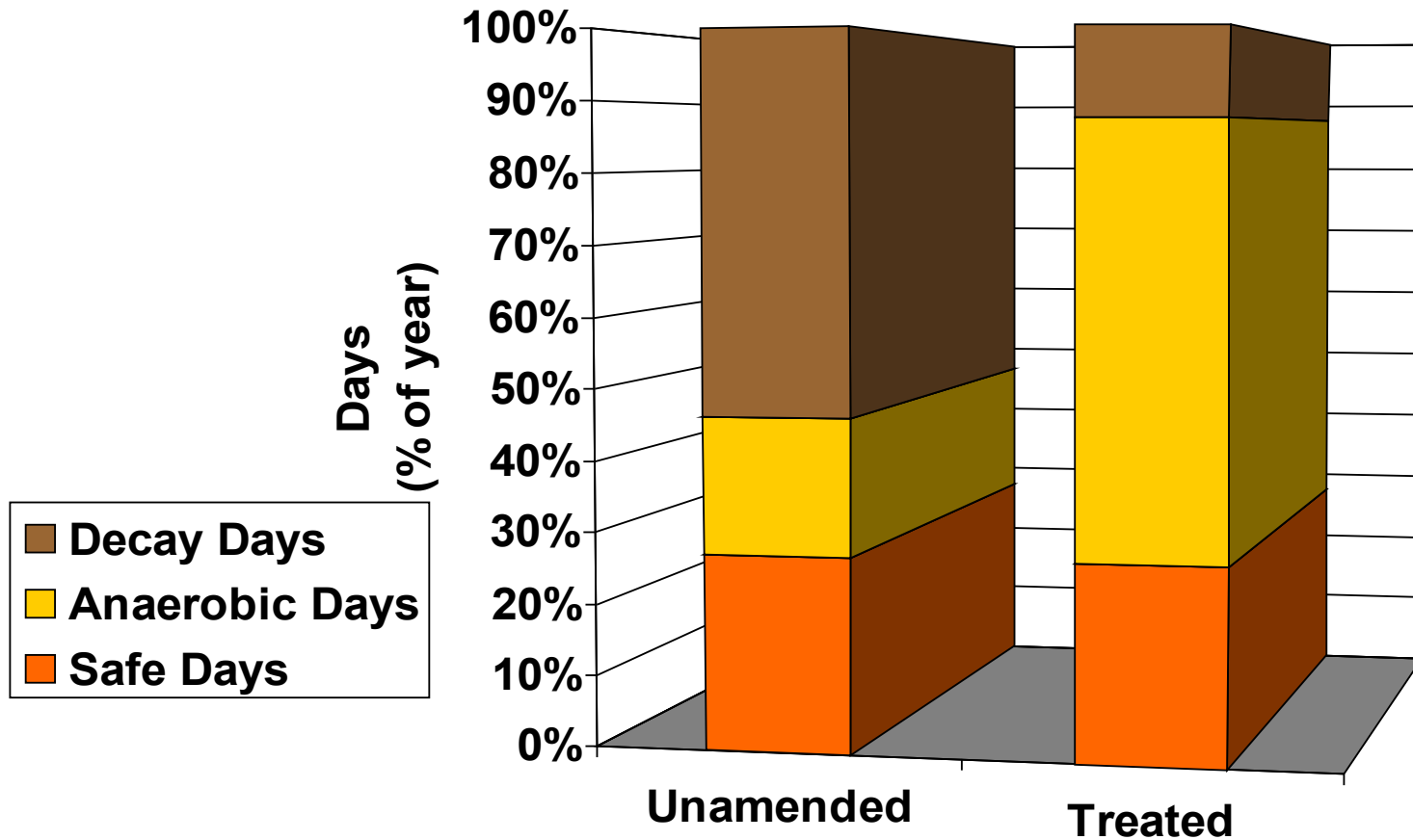


- Add readily used carbon and sulfur source
- Has multiple effects
 - decrease O₂ concentrations when wet
 - Shifts the community from fungal to bacterial
 - Produce H₂S (insect repellent) under anaerobic conditions
- Bottom Line- less days of active rot

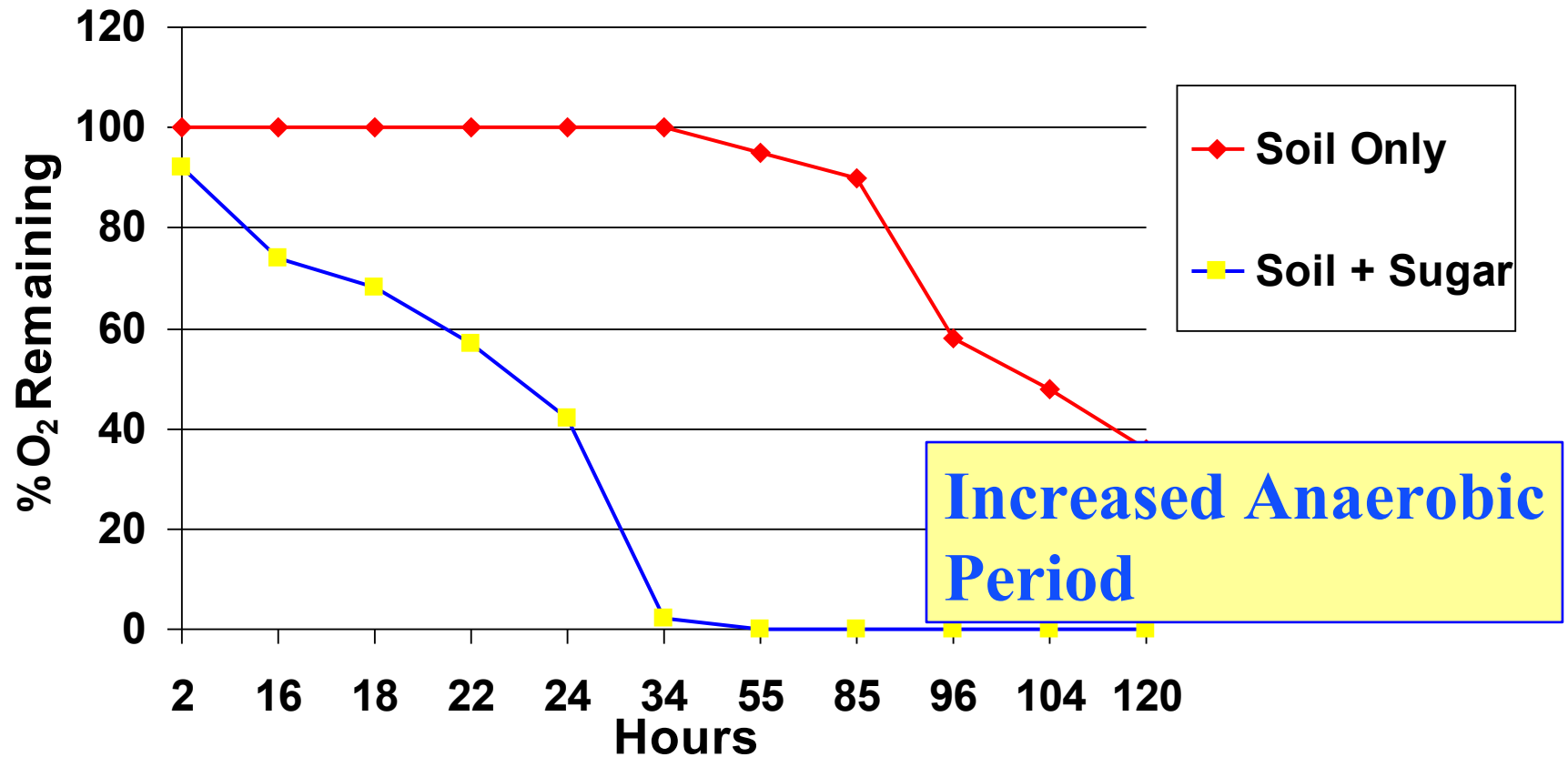
Wood Rot in Soil



Estimate of Annual Decay Days



Oxygen Depletion Data



The Product

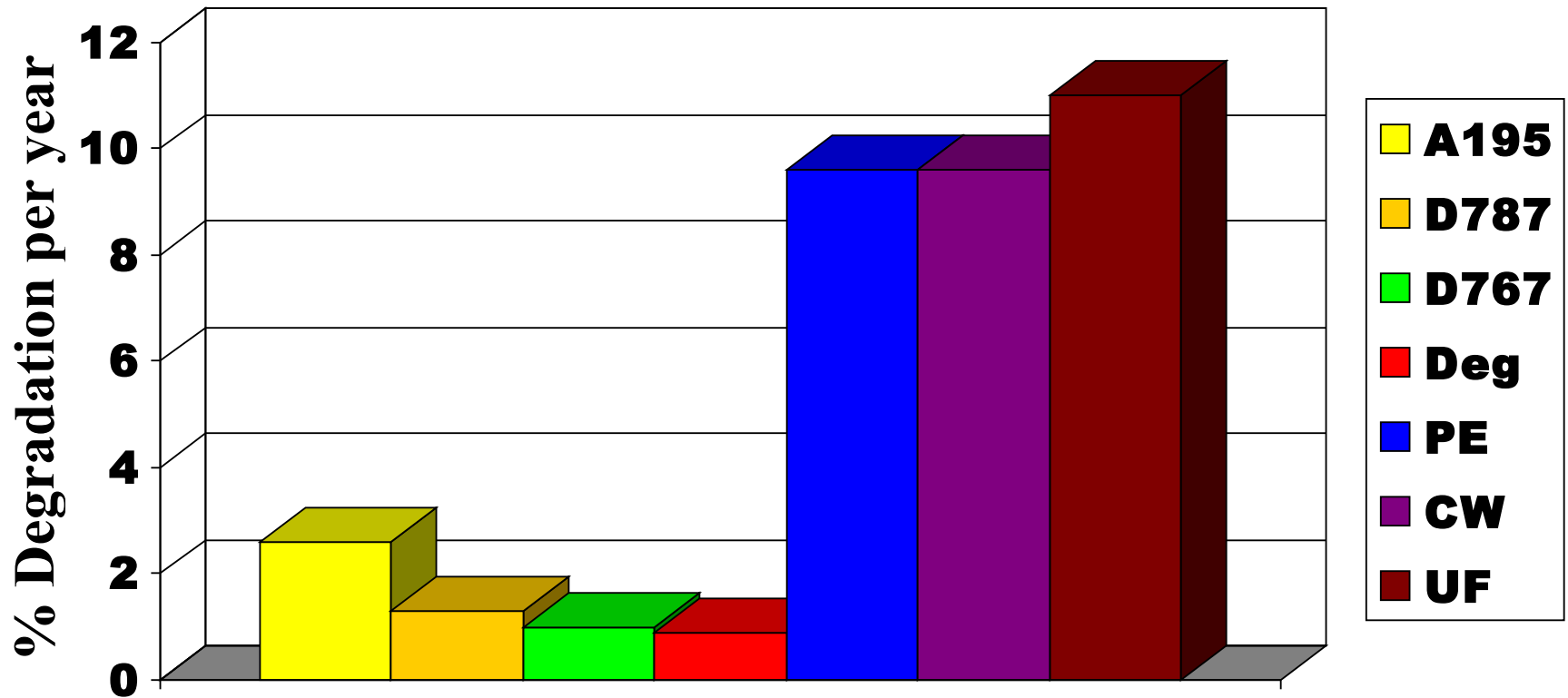


- Add readily used carbon source (+)
- Encase carbon source in slow release form to give 5-7 years treatment life
- Use biodegradable material as carrier*
- As carrier degrades the carbon source is released
- Can regulate rate of release of carbon source by formulation of carrier

+ US Patent 5,770,265

*** Patent Pending**

Matrix Degradation



Product Ingredients



- All natural materials
- Food grade ingredients
- On Generally Regarded as Safe List of the FDA
- Carbon Source
- Biodegradable Matrix
- Calcium Sulfate

Application Scenarios



- As part of regular re-treatment program
- Ease of installation and safe materials means anyone visiting pole can do treatment- no digging
 - linemen
 - inspectors
- Can be tailored to needs of your company

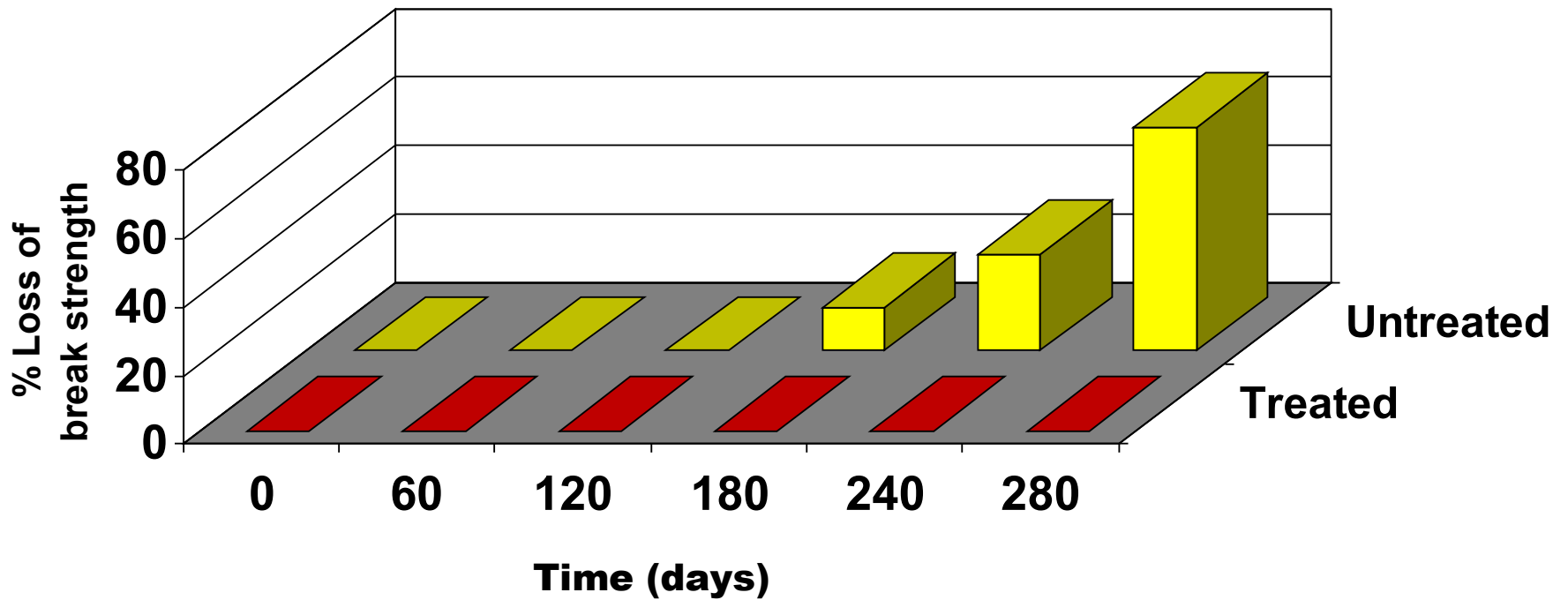
Current Status



- Testing underway-
 - Major Power Company
 - Oregon State University-Jeff Morrell
 - Model poles in laboratory and field tests
 - Cost modeling with Major Power Co.
- Quantity production methods being developed
- Application method being investigated

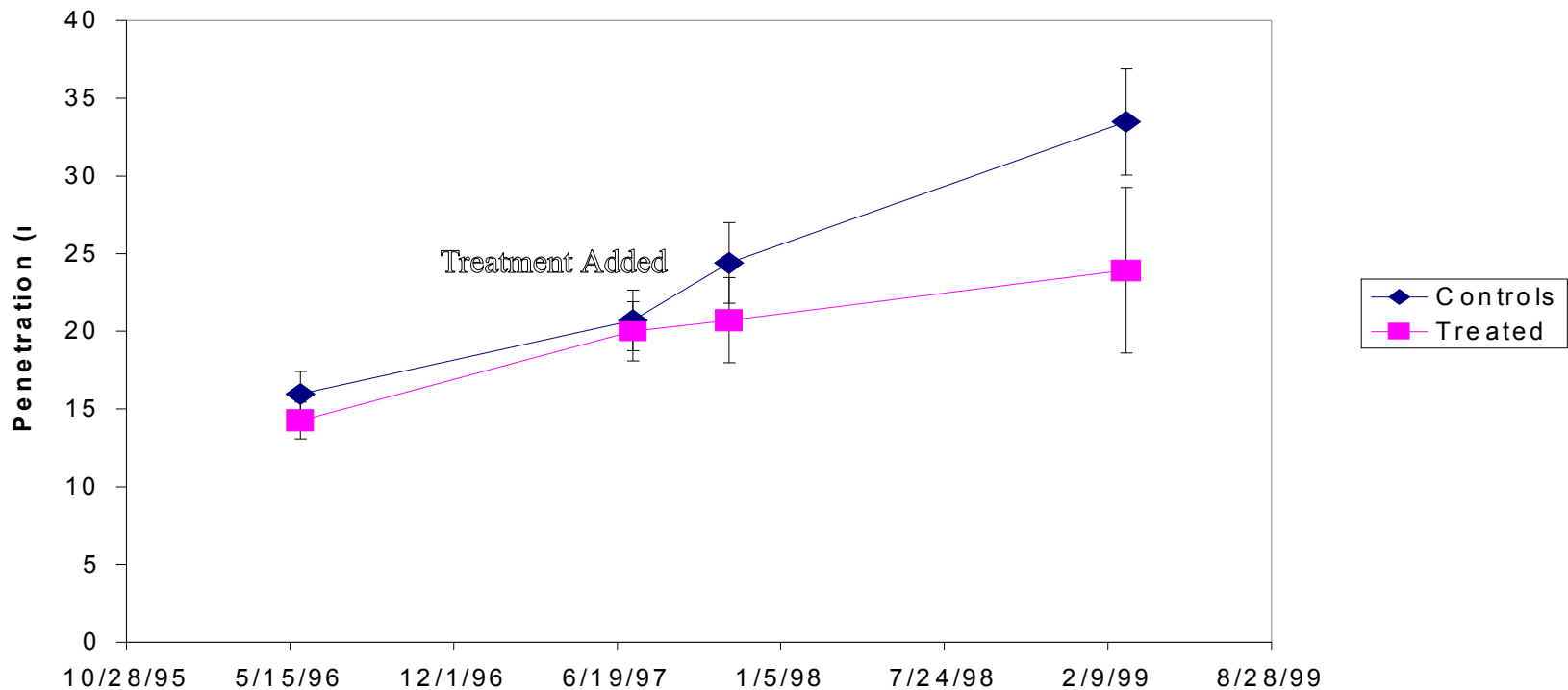
Laboratory Data

Loss of break strength in laboratory microcosm studies using 0.5" untreated southern yellow pine



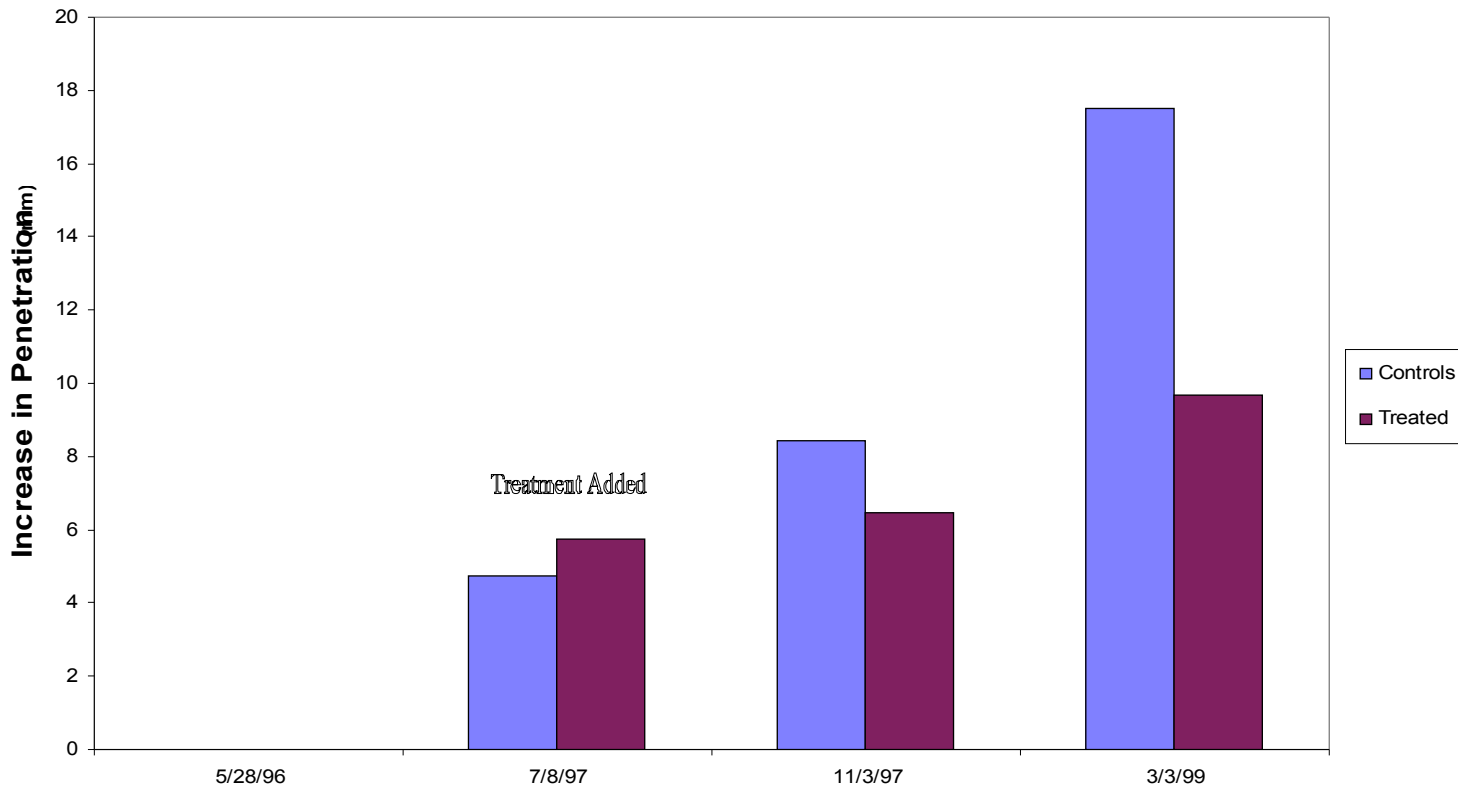
Duke Power Pole Testing

Weighted (values not in previous time point removed [c6,p1])

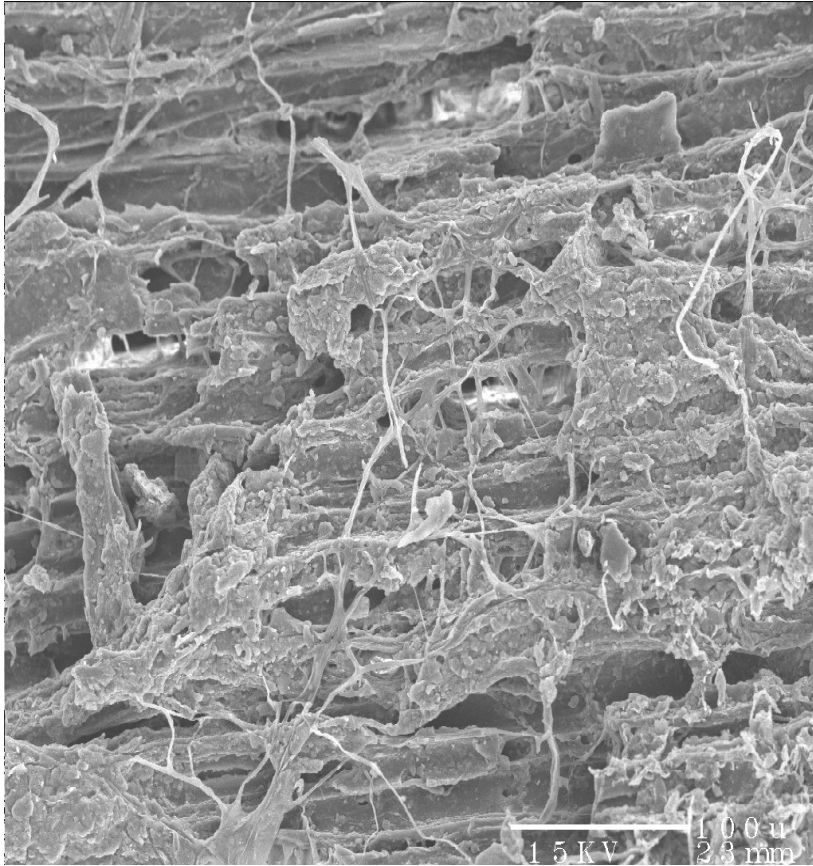


Duke Power Pole Testing

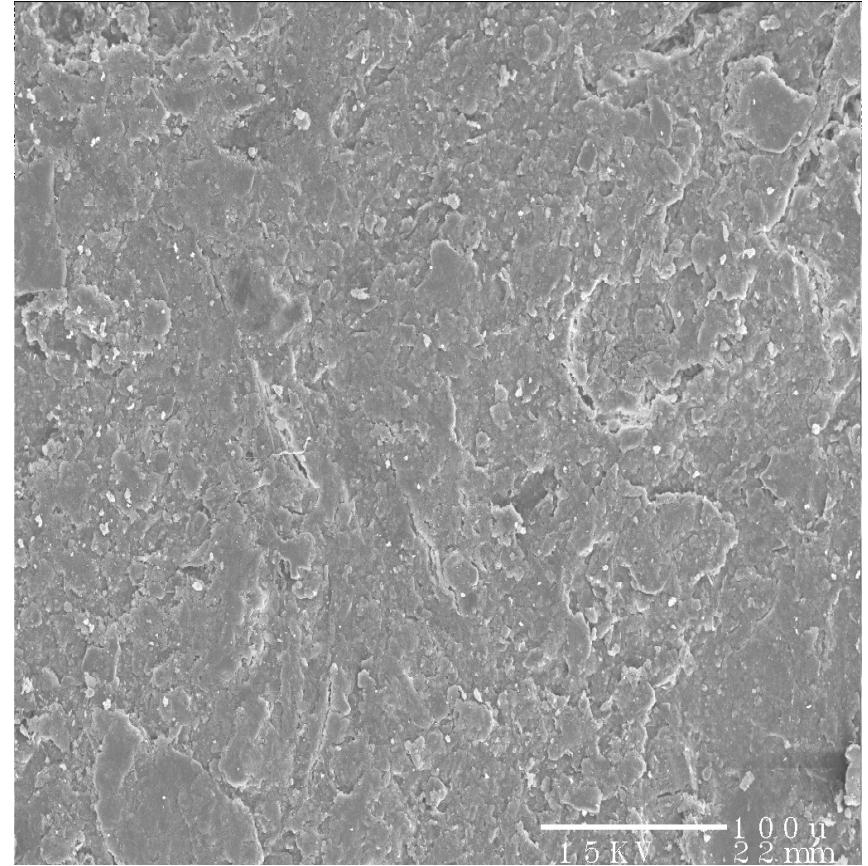
Change in Pilodyn Penetration with and without Treatment



Scanning EM of Poles from Duke Power Testing



Untreated



Treated

Summary



- Effective process for prolonging pole life
- Ease of installation cuts treatment costs- no digging
- Designed to be part of proactive pole maintenance program
- Worker and environmental safety
- Value effective

Field Testing- Full Size Poles with Major Power Co

