TECHNOLOGY DIGEST

Timely Technology Transfer

OPTIONS FOR DISPOSAL OF CROSSTIES AND OTHER TREATED WOOD

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Summary

Information on current and potential practices for disposal of used ties and treated wood is presented in a new technical publication prepared by Tetra Tech Inc. titled *Management Practices for Used Treated Wood*. The work was co-sponsored by the Association of American Railroads, the Electric Power Research Institute, and the Utility Solid Waste Activities Group.

A major concern addressed in the report is the viability of continued disposal in landfills given the recent changes in the drinking water standards and in the performance standards for solid waste landfills. Several analyses were performed for selected soil and ground water scenarios. These showed the new drinking water and performance standards will be met when the ties are disposed in new landfills permitted for municipal solid waste. These standards will also be met for ties disposed in older landfills that will meet EPA closure requirements specified in 40CFR Part 258.60 for covering the landfill.

The report includes a helpful appendix with the location and costs of landfill, incinerator, and waste-to-energy facilities.

Suggested Distribution:

- ❑ Engineering Dept.
- ❑ Environmental Dept.
- ❑ Material Purchasing

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INTRODUCTION AND CONCLUSIONS

Disposal of used crossties and other treated wood is a continual and expensive problem. Each year, millions of pieces of treated wood are removed from service. Used railroad ties and wood poles are predominantly either reused or disposed in non-hazardous landfills. However, as landfill space becomes more limited, their operators may limit disposal of bulky material such as wood, and/or increase costs for disposal. Treated wood also is used as fuel in waste-to-energy plants or non-hazardous waste incinerators, and disposed in hazardous waste landfills. In the near future, the most likely options for management of used treated wood will continue to be disposal in landfills, reuse, and increasingly, use as a fuel. Other options have been investigated, but are not yet practical commercially.

There have been recent changes in the Environmental Protection Agency drinking water standards and in the performance standards for solid waste landfills. These changes prompted an evaluation of the disposal options for treated wood because of concern regarding continued use of landfills. Analyses of landfill conditions showed the drinking water and performance standards would be met in landfills that comply with the requirements specified by EPA for proper closure. These requirements include a cover with low permeability, and a minimum of 18 inches of soil, the top six inches of which must sustain plant life.

The report *"Management Practices for Used Treated Wood"* provides a helpful reference on landfill, incinerator, and waste-to-energy facility locations and the associated disposal costs (as of 1993) for these facilities. The appendices present useful information for the states including

- Disposal requirements for treated wood
- Telephone numbers for the appropriate agency
- Acceptance criteria and telephone numbers for treated wood burning facilities

Used Tie Generation

Railroads in the U.S. and Canada have an estimated 8 million poles and 750 million ties along their rights of way. Between 10 and 15 million ties are replaced annually, and the continual stream of used ties is a persistent disposal problem. In North America, nearly all ties are treated with creosote or creosote solutions. Creosote is a complex mixture of more than 100 compounds derived from coal tar. Consumption of creosote for new ties is approximately 64 million cubic feet (478 million gallons) per year, and railroad usage comprises 71 percent of annual creosote consumption.

Creosote

Creosote mixtures typically include polycyclic aromatic hydrocarbons (PAH) (85%), phenolic compounds (10%), and heterocyclics (5%). Of the phenolic compounds, creosols comprise 1 to 3 percent of the creoste, and pentachlorophenol was used in some formulations at 1 percent. These two compounds are of concern because leachate concentrations exceeding levels specified by EPA classify a waste as hazardous. Creosols have a high solubility and a low tendency to sorb onto organic matter and soils. The high solubility contributes to leaching of the creosols from the poles and ties by rainfall. Pentachlorophenol, however, is only moderately soluble and strongly sorbs to organic matter.

Earlier testing of old and new ties for comparison with hazardous waste classification standards found detectable concentrations of only a few metals and organic chemicals. All were below any hazardous waste criteria. The only hazardous metals detected were arsenic, barium, and zinc; the latter is not a regulated toxic metal. Of the hazardous organic chemicals, only creosols and phenols were detected. The highest concentrations came from a new tie with total creosols at 15.9 mg/L and phenols at 5.7 mg/L. The concentration from new ties is considerably higher than from 10 or 20 year old ties, indicating some loss of creosote over time.

Landfill Modeling

Modeling was conducted for a series of treated wood disposal scenarios simulating leaching of creosols, pentachlorophenol, and three polycyclic aromatic hydrocarbons. The modeling evaluated probable concentrations of these chemicals in groundwater at the criteria distance of 150 meters from the landfill. These concentrations were compared with the Maximum Contaminant Level (MCL) permitted by the EPA. Leachate data was used as the source concentration, except for the PAHs for which no leachate data could be found.

Modeled climatic and hydrogeological characteristics represented a range of typical landfill conditions. A 4x4 matrix of landfill conditions versus rainfall was used to determine 16 different infiltration rates. The simulations showed that the potential for leachate generation from landfills meeting the new regulations, which require liners, is at least two orders of magnitude less than for landfills without liners. From the range of the 16 infiltration rates, seven rates were selected for modeling landfill construction conditions. These ranged from no liner and cover, to the new landfill requirements that include both a liner and cover. The seven infiltration rates ranged from 0.004 inch to 15 inches per year. Each infiltration rate was modeled for both silty and sandy soil conditions using both the average and maximum leachate concentrations.

Since no leachate data on PAHs were found, three PAHs in creosol (naphthalene, fluorene, and benzo(a)pyrene) were modeled at their aqueous solubility limits. These compounds are strongly adsorbed onto the soil, and the modeling shows no groundwater problems are anticipated from ties for these compounds.

Most of the modeling effort was directed toward pentachlorophenol and creosols, as these were the chemicals of concern. A summary of the modeled characteristics for these chemicals is presented below:

	Penta	**p-Creosol**
Solubility	14 mg/L	24,000 mg/L
Partition Coefficient	20 mg/L	87 ml/g
Biodegradation Rate Constant	0.03/yr	2.28/yr
TCLP Leachate		
Maximum	7.8 mg/L	15.9 mg/L
Average	2 mg/L	1.6 mg/L

The specific modeling results for pentachlorophenol at the maximum leachate concentration show the revised groundwater MCL of 1 ug/L can be met at the required distance of 150 meters when biodegradation is included and infiltration is less than 8 inches per year. The results for creosol indicate that the MCL of 2 mg/L can be met at the 150 m. distance with a leachate concentration of 15.9 mg/L (the maximum concentration for railroad ties) and an infiltration rate as high as 15 in./yr. A landfill meeting the new standards, and any existing landfills that will be closed in conformance with the standards in 40CFR Part 258.60, would have infiltration rates less than these values.

Potential Disposal and Treatment Options

Tetra Tech evaluated the current and potential future methods for disposal of treated wood. Several options for using the wood as fuel are considered in some detail. Direct combustion of wood is being employed in several types of boilers. Since grate fired systems can tolerate high moisture content, they are more suitable for chipped ties that may absorb moisture during transport. There are three electrical generating units in the 30 to 50 MW range currently burning chipped ties on spreader-stoker traveling grates.

Fluidized-bed combustion of ties is used in at least one generating plant. The hot inert mass of sand or silica in the combustion bed contains sufficient energy to allow wet fuels to be burned. The bed particles abrade the wood chips, thereby constantly exposing fresh fuel for reaction.

Little data exist on air emissions from the combustion of treated wood, particularly data for the same combustion conditions using untreated and treated wood separately. Moreover, there are no nationally applicable standards that apply to many of the constituents that are found in emissions from units burning treated wood. Where comparisons can be made between emissions from treated and untreated wood, the emissions are not significantly different. The report contains several tables of emissions data from facilities burning either treated or untreated wood; however, there are limited data on emissions from the burning of only railroad ties.

Other potential methods for tie reuse are presented in the report along with possible implementation issues related to transfer of chemicals through the environment and to the public. These technologies have little or no immediate prospects for practical application to railroad ties, but may have some application in the future. Descriptions of processes and requirements are presented for removal of creosote from the ties and production of

- Charcoal
- Gas and liquid fuels
- Composting and mulching materials
- Particle board and other wood construction products

Note: Contact Roger Andes at (202) 639-2210 if you would like a copy of *Management Practices for Used Treated Wood*, or with questions or comments about this document.