CURRENT AND FUTURE OPTIONS FOR MANAGING USED PRESERVATIVE-TREATED WOOD

By

Rodney C. De Groot
Colin Felton

USDA Forest Service
Forest Products Laboratory
Madison, Wisconsin
U.S.A.

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IRG Secretariat
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S-114 Stockholm
Sweden
Abstract

The amount of preservative-treated wood available for disposal will continue to increase exponentially in the next several decades as landfill availability declines. At the same time, recent legal ruling on competitiveness among utilities and disposal of ash has clouded the economic outlook for combustion of treated wood for energy recovery. This report identifies current and future options for managing used preservative-treated wood, as well as technological and environmental/regulatory limitations to these options. Re-use, recycling (particularly through the manufacture of wood-based composites), and biodegradation are described as primary alternatives to land disposal and combustion. The report also describes supporting technologies (analytical methods and comminution) for managing used treated wood.

Introduction

In the context of materials being considered for recycling, material identified as treated or contaminated sometimes includes all wood that has been treated or chemically changed in some way, including surface coating (paint), manufacture with glues and binders, and impregnation with preservatives. For the purpose of this review and analysis, treated wood refers to only wood that has been treated with wood preservatives. This includes both surface applications of preservatives and in-depth treatments, i.e., impregnation with wood-preservative chemicals.

Common wood products containing nonwood materials that account for the majority of available wood waste are painted woods, wood panel products (containing glues and binders), pallets and shipping containers (having surface treatments and contaminants), and products treated with preservatives, such as poles, railroad ties, and decking. Used preservative-treated solid-wood products offer a sizable resource for recycling programs. However, as a resource, these products are encumbered with several environmental and public health concerns that do not encumber used untreated solid-wood products. Consequently, preservative-treated materials are not included in the recycling technologies being developed for untreated wood within the United States. This matter is of growing national concern because large volumes of treated wood are produced annually. Large-volume products such as utility poles and railroad ties, which have traditionally been treated with preservatives, are being continually removed from service. In addition, an increasing volume of construction lumber and timber is being treated. For example, over half of all Southern Pine lumber is treated with preservatives.

At present, the primary options for redeploying used treated wood products are reuse, disposal by landfill, and combustion with energy recovery. Options for reusing treated products in a manner consistent with their original purpose are somewhat restricted by product and locale. The availability of landfills is declining, and recent legal rulings on competitiveness among utilities and on ash disposal have clouded the economic outlook for combustion with energy recovery.

Additional options are definitely needed for managing used treated wood. Such options can be envisioned with the development or expansion of additional technologies, but no single-step solution will resolve all concerns.
Options for Managing Used Treated Wood

An overall view of approaches for recycling preservative-treated wood is shown in Figure 1.

Most wood in packaging, pallets, joinery, and truck beds that has been treated with preservative has been surface-treated with pentachlorophenol or copper naphthenate. Recently treated (after 1990) wood in these commodities may have been surface-treated with a metal-organic system, such as zinc naphthenate, copper-8-quinolinolate, or one of the more recently developed organic preservative systems. Some wood packaging may also have been pressure-treated with a waterborne system.

Virtually all railroad ties have been pressure-treated with creosote. Utility poles installed prior to 1985 have probably been treated with creosote, pentachlorophenol, or an ammoniacal waterborne preservative. Poles installed more recently may also have been treated with either chromated copper arsenate (CCA) or copper naphthenate.

Construction lumber may have been treated with creosote, pentachlorophenol, or any of several waterborne, inorganic wood preservatives. Most treated lumber acquired after 1980 would have been treated with inorganic arsenical compounds.
Reuse Versus Termination

Because of the unique environmental and processing concerns associated with individual treatments, recycling programs for used treated wood products must be designed not by commodity but for each specific type of chemical treatment.

For products within each treatment category, the critical programmatic determination will be whether to promote continued utilization of the wood fiber with attendant technical and administrative challenges or to revert the product to its component minerals and carbon dioxide (i.e., destroy or terminate the product). Because environmental perceptions and real conditions vary so much throughout the world and within the United States, either decision would be applauded in some locales and disputed in others.

Technologies probably can be developed to support either option. When the decision is made to reuse treated wood products, several intertwining management policies, criteria, and regulations contingent on the nation, State, or local region may come into play. Critical attention must be given to all pertinent administrative requirements in developing programs for managing used treated wood products.
Treatment-Specific Processing Options

Pentachlorophenol

Many types of products, from wood packaging to heavy structural timbers, have been treated with pentachlorophenol. Treatment processes have included nonpressure treatment of millwork and packaging; pressure treatment of lumber, timbers, and some poles; and hot- or cold-bath treatments of some poles, notably western species.

It is anticipated that any recycling program that utilizes Pentachlorophenol-treated wood as a furnish would be burdened with the responsibility to direct the use of the ultimate, recycled product in a manner consistent with Environmental Protection Agency (EPA) directives for use of the original product. These include prohibitions against use in frequent or prolonged contact with bare skin; in residential, industrial, or commercial interiors (with some exceptions); in containers for storing animal food; and in cutting boards or countertops.

<table>
<thead>
<tr>
<th>Decision point</th>
<th>Technical options</th>
<th>Technical options</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Reutilize used pentachlorophenol-treated wood; accept responsibility for directed product redeployment or product tracking.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- **Combustion**
  - technically feasible
  - economic outlook clouded
  - exacting combustion requirements

- **Extraction/ bioprocessing**
  - coupled technologies have technical base to build on

- **Catalytic decontamination**
  - technical principle established
  - residue goes to landfill

- **Landfill**
  - declining availability
  - costly

- **Reuse**
  - options restricted to certain uses
  - most economical option where possible

- **Recycling** composites
  -- have technical base to build on
  -- processing conditions are a concern
  -- thermolysis
  -- mobile hardware
  -- endproduct can be an absorbant
  -- extraction/bioprocess
  -- preliminary process; provides step to other processes
Creosote

Creosote has been used primarily in the pressure treatment of railroad ties, utility poles, construction timbers, and some dimension lumber used in older buildings. About 15% of used railroad ties in the United States are combusted with energy recovery. It is anticipated that the burden of directing the use of recycled products from creosote-treated furnish would be similar to that for pentachlorophenol-treated furnish.
CCA

The waterborne arsenical compounds, which include chromated copper arsenate (CCA) and the ammoniacal preservatives ammoniacal chromate arsenate (ACA) and ammoniacal chromate zinc arsenate (ACZA), may be used in building interiors and in frequent contact with humans. Consequently, the redirection of recycled products from arsenically treated wood will not be as precise as that of recycled products from furnish treated with pentachlorophenol or creosote. Most used CCA-treated wood furnish consists of treated Southern Pine lumber or poles.

![Diagram](image-url)

**Decision point**

- **No** → Reutilize used CCA-treated wood; accept responsibility for directed product redeployment or for product tracking.
- **Yes** →

**Technical options**

- **Combustion**
  - technically feasible
  - exacting combustion requirements
  - large permit costs anticipated

- **Extraction/bioprocessing**
  - new technologies need to be developed

- **Landfill**
  - declining availability
  - costly if available

- **Reuse**
  - options are product-dependent
  - most economical option
  - not feasible for demolition wood, short lengths

- **Recycle (composites)**
  - wood–cement
  - good technical potential
  - global market
  - wood–wood
    - historic problems with bonding of UF & PF resins
    - research with new bonding technology in progress
    - new extraction methods seem technically possible
    - big U.S. market if technology can be developed
    - wood–plastic
      - technology being developed

- **Other**
  - new methods being developed
ACA and ACZA

The ammoniacal preservatives ACA and ACZA have been used principally in the pressure treatment of refractory species such as Douglas Fir. For this reason, it is anticipated that most used ACA- or ACZA-treated wood will be Douglas Fir dimension material and utility poles.

Other Treatments

Other types of wood treatments are represented in less volume compared to pentachlorophenol, CCA, ACA, and ACZA. Volumes of wood treated with other preservatives probably do not warrant investment into development costs for new technology. Thus, terminating the product is considered to be a viable option until actual needs are further defined. However, identifying these treatments is critical to avoid the introduction of mixtures of preservatives into processing streams that are tailored for one specific treatment. For example, a recycling operation involving adhesives or bioprocessing may not be able to handle borate-treated wood from utility poles.
Supporting Technologies

Technologies for managing used treated wood include analytical methods and comminution. Programs must take into account Federal regulations for reusing treated wood.

Analytical Methods

Additional analytical chemical methodology needs to be developed for rapidly and accurately identifying materials in the field that cannot be identified visually. Such an identification protocol can be developed to identify all possible treatments with assurance or to distinguish only pentachlorophenol and creosote from the mix.

Comminution

Comminution, the process of reducing wood to smaller units, is a component step in all processes, except landfill. Specific activities range from sawing large members into sections for an industrial combuster to converting solid wood to fibers. The mechanics of comminution are well understood, but other processing concerns block exploration of recycling options for used treated wood products. All comminution procedures are accompanied by site-related environmental concerns (air, soil, and water) and health concerns (worker exposure). Resolution of these concerns to the extent required by pertinent regulations will be a necessary step in advancing conceptual technologies for recycling treated wood products to the level of industrial acceptance.
Regulations

The reutilization and disposal of treated wood products may be regulated by many levels of government. Therefore, management programs for used treated wood products must address regulations at various governmental levels.

Used treated wood products that are reused in somewhat the same form as the original products and in a manner compatible with their original intended purpose are usually not considered waste. Treated wood removed from service or generated as construction waste with no other useful application as a product is considered a solid waste. Comminuted treated wood, such as that produced by chipping, grinding, or shredding, is generally regulated as a form of solid waste.

Treated wood waste is not considered hazardous waste at the Federal level, but it may be classified as such at lower echelons of government. Hazardous waste is classified by the Federal government on the basis of its toxicity, flammability, or corrosivity characteristics. The toxic characteristic leaching procedure (TCLP), which evaluates a waste’s potential for leaching of hazardous compounds, is used to determine if a waste is toxic enough to be classified as hazardous.

Pentachlorophenol- and creosote-treated wood generally passes the TCLP test (EPRI 1991, Goodrich-Mahoney 1994). The test exclusions for chromium and arsenic prevent CCA-treated wood from being classified as hazardous waste. If waste wood is classified as hazardous and landfilled, it must be disposed of in hazardous waste (class I) landfills, which are significantly more expensive than other types of landfills. The wood must also be transported as hazardous waste by haulers approved to handle such waste.

The following Federal identification criteria and exemptions apply to inorganically treated wood that contains chromium and arsenic.

40 CFR Part 261 - Identification and Listing of Hazardous Waste

Subpart C - Characteristics of Hazardous Waste

261.20 A solid waste, which is not excluded from regulation as a hazardous waste under 261.4(b), is a hazardous waste if it exhibits any of the characteristics identified in this subpart.

261.22 Characteristic of Toxicity
(a) A solid waste exhibits the characteristic of toxicity if, using the test methods described in appendix II (TCLP) or equivalent methods approved by the Administrator under the procedures set forth in 260.20 and 260.21, the extract from a representative sample of the waste contains any of the contaminants listed in Table 1 at the concentration equal to or greater than the respective value given in that table.

261.4 Exclusions
(a) Materials which are not solid wastes:
   (9)(i) Spent wood preserving solutions that have been reclaimed and are reused for their original intended purpose; and
   (ii) waste water from the wood preserving process that has been reclaimed and reused to treat wood.
(b) Solid wastes which are not hazardous wastes:

(4) Fly ash waste, bottom ash waste, slag waste and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels, except as provided by 266.112 of this chapter for facilities that burn or process hazardous waste.

(6)(i) Wastes which fail the test for the Toxicity Characteristic because chromium is present or are listed in subpart D due to the presence of chromium, which do not fail the test for the Toxicity Characteristic for any other constituent or are not listed due to the presence of any other constituent, and which do not fail the test for any other characteristic, if it is shown by a waste generator or by the waste generators that: (A) The chromium in the waste is exclusively (or near exclusively) trivalent chromium; and; (B) The waste is generated from an industrial process which uses trivalent chromium exclusively (or near exclusively) and the process does not generate hexavalent chromium; and (C) The waste is typically and frequently managed in non-oxidizing environments

(9) Solid waste which consists of discarded wood or wood products which fails the test for the Toxicity Characteristic solely for arsenic and which is not a hazardous waste for any other reason or reasons, if the waste is generated by persons who utilize the arsenical-treated wood and wood products for these materials’ intended end use.

Although most states have regulations that mirror Federal regulations on hazardous waste and classification, in some states the regulations are significantly more stringent and restrictive. For example, California uses total threshold limit concentration (TTLC) and soluble threshold limit concentration (STLC) tests to determine the toxicity characteristic of the waste. In addition, California does not exempt arsenically treated wood from hazardous waste regulations [22 CCR 66261.4(b) (3)]. Also, California’s health and safety code (H&SC) 25143.2(b) indicates that treated wood that is managed for reuse is excluded from classification as hazardous waste. The exemption [H&SC 25143.2(e)] excludes treated wood waste that is burned for energy recovery, speculatively accumulated, or reused or recycled in a manner that constitutes disposal or in a manner that is inconsistent with the use of the preservative.
References


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