Incidence of treated wood in a wood recycling stream in western Oregon

J.J. Morrell*

Abstract

The incidence of treated wood in a recycling stream was assessed at a recycling center in western Oregon. Chromated copper arsenate (CCA) was the predominant treatment present in the material, ranging from 0 to 2 percent of the material present at any given time. Treated wood was present at 38 of the 41 sampling times, and the average amount of treated wood in the waste stream was 0.98 percent (volume basis). The material from this site is typically used for hog fuel; calculations of total CCA components in the resulting ash suggested that As, Cu, and Cr levels in the ash (assuming all metal in the wood wound up in the ash) would be approximately 9,900, 6,600, and 11,000 ppm, respectively. These values exceed the current State of Oregon limits for the land application of ash; however, this waste stream represents a relatively small fraction of the overall material being burned. As a result, it is likely that there is considerable dilution in the resulting ash, although these contaminants would pose a disposal issue if treated wood residues increase in the recycling stream.

Wood preservation has had a tremendous influence on extending our forest resources. At the turn of the 19th century, total wood consumption was rising at a rate that would have completely depleted our forest resources (Olsen 1971). The development of a wood preservation industry, primarily centered around the railroads, markedly extended railroad tie service life and sharply curtailed wood consumption. The treating industry continued to largely serve an industrial market consisting of ties, poles, and pilings until the early 1960s, when the emergence of chromated copper arsenate (CCA) as a preservative fueled a nearly three-decade growth in the use of treated wood for residential applications (Micklewright 1990). This process placed treated wood in the hands of millions of consumers, and created new disposal pathways as well.

As with any product, treated wood has a limited life span and, although it will last many times longer than untreated wood, it must eventually be replaced. For decades, the disposal of treated wood was of little concern to the general public. Most treated wood was used by large industrial concerns who either gave away or resold piles, poles, or timbers. The growth of residential markets for treated wood over the past 30 years, however, has been accompanied by increasing levels of treated wood entering the waste stream. In many cases, homeowners may even dispose of preservative-treated wood that is still free of decay because it has weathered or split or is otherwise disfigured. Yet homeowners lack the clear recycling pathways available to industrial users and instead must rely on the municipal waste (MSW) disposal system.

Although treated wood can be safely disposed in MSW facilities, the capacity of landfills in some regions of the United States is limited. One approach that communities have taken to extend landfill capacity is to institute recycling programs to recover paper, plastics, metals, glass, and wood from the waste stream (Falk 1997). The evolution of wood recycling programs carries with it the potential for introducing treated wood into the recycling stream. The risks associated with treated wood in the recycling stream depend on the chemical used to treat the wood and how the material is recycled. For example, the combustion of creosoted waste wood for energy generation poses little risk, provided the temperatures are adequate, but this disposal technology is not suitable for wood treated with inorganic salt preservatives such as CCA because of concerns over the metal levels in the residual ash. Even these risks depend on the levels of treated wood entering a given waste stream, however. Unfortunately, there is little information on the levels of treated wood entering the waste stream in many regions of the United States.

The potential impacts of large volumes of treated wood entering the waste

The author is a Professor, Dept. of Wood Science and Engineering, Oregon State Univ., Corvallis, OR 97331. This is paper 3559 of the Forest Res. Lab., OSU. This paper was received for publication in September 2002. Article No. 9544.
*Forest Products Society Member.

Forest Prod. J. 54(2):

stream can best be viewed in Florida, where severe climate conditions result in the extensive use of treated wood. Surveys indicated that treated wood represented 5.9 percent of the volume of materials entering construction and demolition landfills (Solo-Gabriele et al. 1999). Landfilled material is sometimes burned to generate electricity and there are currently few economical strategies for sorting and recycling treated wood that enters this stream. A related survey in Virginia found that 2.5 percent of the wood entering the waste stream was treated (Alderman and Smith 2000). Although these levels remain low, they represent the beginning of an increasing volume of treated wood. The steady increase in the use of treated wood over the last three decades will eventually be accompanied by a steady increase in the disposal of treated wood. As a result, quantifying the potential volume of treated wood entering waste streams, and developing methods for effectively dealing with these materials, will be essential for the continued use of any treated wood product.

Although the situation in Florida is cause for concern, and although this issue, coupled with concerns over the leaching of arsenic from CCA-treated wood used in playgrounds, has led to a voluntary removal of CCA-treated wood from the residential market, there is little information on the magnitude of treated wood disposal in other regions of the country. Anecdotal information suggests that the level of treated wood use in the western United States is far lower than in the Southeast, ranging from 5 to 10 percent of the total wood production. Naturally durable species such as western redcedar (*Thuja plicata*) and redwood (*Sequoia sempervirens*) remain among the dominant materials for decks in the West. In addition, the species in this region tend to be more difficult to treat than southern pine (*Pinus* spp.). As a result, preservative treatment tends to be shallow, further reducing the impacts of treated wood in the recycling stream. Finally, the risk of biological degradation aboveground is less than half that found in many parts of Florida (Scheffer 1971). Thus, treated wood should last longer in the western United States, resulting in slower rates of treated wood disposal in the MSW system.

Yet despite these potential mitigating factors, the impacts of treated wood entering our waste streams have not been fully determined. The absence of information on the volumes of treated wood entering the waste stream makes it difficult to assess the risks posed by these materials. In this report, we describe the results of a survey to quantify the levels of treated wood entering the recycling stream in western Oregon.

Materials and methods

Facility description

The Processing and Recovery Center (PRC) is located in rural Benton County, Oregon, approximately 1.6 km from a regional MSW facility. The PRC and the MSW facility are owned by the same company. The PRC processes both yard debris and wood waste. The yard debris is shredded and composted, while the wood is chipped and sold to local markets, where it is primarily burned for power or steam generation.

In 1999, the PRC received over 76,460 m^3 of yard debris and 57,345 m^3 of wood waste (Anonymous 2000). Materials can come from a five-county area that includes a number of large wood remanufacturing operations.

Materials delivered to the PRC are dumped in a staging area where they are sorted as either compost or wood waste. A large percentage of the limbs and other woody debris from the yard debris program is shunted to the wood waste stream. The waste is piled each day and chipped in the morning. All of the handling is accomplished with front-end loaders, with little opportunity for inspection during processing.

Survey method

Since it was not possible to observe the drop-off site continuously, we opted to survey the facility at the end of 41 workdays over a 2.5-year period. At each inspection, the total volume of material present was measured and the predominant materials present in the pile were noted. The pile was then examined for the presence of treated wood. The open nature of the pile generally allowed for the examination of materials 1.2 to 1.8 m from the surface, and a back retaining wall allowed us to look downward on the pile.

Treated wood was detected on the basis of the presence of oil deposits (for penta- or creosote-treated wood), greenish color, brownish color, or the presence of incisions. Unlike in most of the United States, wood treated with CCA in this region generally receives a supplemental brown stain to make it appear more like cedar. In addition, the American Wood Preservers' Association requires that wood of most western species be incised prior to treatment (AWPA 1999a). These characteristics greatly simplified detection of treated wood in the piles.

Results and discussion

The PRC receives a diverse array of materials, but the dominant materials were wood debris, pallets, and trim ends from panel manufacturers. Although initial discussions with PRC personnel implied that no treated wood was allowed in the facility, our surveys revealed that some treated wood was nearly always present (**Table 1**).

The volume of wood present in the facility at any given inspection ranged from 21.2 to 1672.2 m^3, with a mean of 402.3 m^3 (SD = 351.0 m^3). In most cases, large woody debris constituted a high percentage of the material present. We later learned that this material was intentionally removed from the yard debris because it tended to slow composting and because its presence in the wood sold for fuel was acceptable to the intended customers.

The incidence of treated wood in the piles ranged from a low of 0 to up to 2.00 percent by volume, with an average of 0.98 percent (SD = 1.931%). There appeared to be no consistent trend with regard to the incidence of treated wood, but some always appeared to be present. The exception was around the Christmas season (12/2/01 to 1/13/02), when discarded Christmas trees were the dominant material. Treated wood was absent in three samples and was present at <0.01 percent in the other samples examined during this period. The low levels of treated wood at these times may reflect a seasonal decline in construction activity coinciding with holidays and vacations.

Most of the treated wood detected was treated with CCA and consisted of cut-off scraps from construction projects, although treated wood was also present in demolition debris. At no time was there evidence of wholesale removal of CCA-treated projects, such as large wood decks. This could reflect vigilance by PRC personnel to exclude this material, knowledge on the part of the PRC customers that this material cannot be disposed of at this site, or the fact that

Table 1. — Characteristics and volumes of treated wood in as a component in a wood waste recycling facility.

Date	Wood volume	Composition	Treated wood present	Treated wood volume
	(m^3)			(%)
3/20/99	557.4	Demolition debris	CCA treated posts	0.25
3/30/99	557.4	Construction scraps	CCA treated timbers	1.00
4/17/99	557.4	Demolition lumber	CCA treated posts	0.25
4/20/99	836.1	Pallets	Penta pole section	0.25
4/22/99	46.5	Construction scraps	Ties, CCA lumber	0.50
4/24/99	1672.2	Pallets, construction scraps	CCA timber cutoffs	0.10
4/28/99	557.4	Plywood, construction scraps	CCA posts	2.00
5/1/99	557.4	Plywood, demolition debris	CCA decking	0.35
5/3/99	139.4	Particleboard, demolition debris	Ties, CCA posts	0.20
5/16/99	185.8	Demolition debris		0
6/2/99	185.8	Pallets, kiln stickers	CCA posts/decking	0.34
6/3/99	223.0	Decking, fencing, plywood, contruction scraps	CCA posts, decking, fencing	0.16
6/7/99	344.4	OSB, pallets	Ties, CCA posts	0.24
6/11/99	1114.8	Plywood, shingles, pallets	CCA decking	0.08
6/17/99	344.4	Cedar decking, OSB	CCA posts/decking, penta posts	0.66
6/20/99	706.0	Siding, fencing, particleboard	CCA posts/decking	0.06
6/21/99	371.6	Cabinets, framing, pallets	Creosote tie, CCA posts/decking	0.02
6/22/99	557.4	Pallets, shingles, siding, particleboard	CCA lumber	0.42
6/24/99	566.7	OSB, plywood, kiln stickers	CCA posts/decking	0.37
6/27/99	445.9	Plywood/fencing/panels/siding	CCA posts/decking	0.07
6/3/01	452.8	Yard debris/construction debris/decking	CCA lumber	0.02
6/18/01	424.5	Pallets/veneer/fencing/yard debris	CCA lumber/timber/creosote tie	0.12
7/8/01	509.4	Pallets/yard debris/siding	CCA lumber/timber	0.08
7/15/01	169.8	Pallets/yard debris/decking	CCA post/penta pole	0.05
8/1/01	21.2	OSB/yard debris/fencing	CCA post/lumber	0.58
9/3/01	1358.4	Pallets/siding/yard debris	CCA posts/timbers/lumber	0.03
9/30/01	254.7	Pallets/siding/fencing/decking/yard debris	CCA posts/decking/lumber	0.11
11/4/01	90.6	Pallets/yard debris/siding	CCA decking, timber	0.02
11/11/01	113.2	Yard debris/OSB/pallets/decking	CCA decking, lumber, posts	0.23
11/18/01	42.5	Yard debris/pallets/framing	CCA decking/posts	0.02
12/2/01	169.8	Pallets/shingles/siding/yard debris	CCA lumber	<0.01
12/16/01	339.6	Pallets/siding/particleboard/yard debris	CCA lumber	<0.01
12/25/01	56.6	Pallets/siding	CCA lumber	<0.01
12/26/01	382.1	Pallets	CCA lumber/decking/posts	<0.01
1/1/02	566.0	Christmas trees	--	0
1/13/02	254.7	Yard debris/pallets	--	0
1/20/02	113.2	Pallets/trim ends/demolition debris/ yard debris	CCA lumber/decking/timbers/ creosote tie	0.23
2/24/02	283.0	Pallets/yard debris	CCA lumber/decking/timber	0.03
3/4/02	169.8	Yard debris/OSB/decking/firewood	CCA lumber/decking/timber	0.07
3/10/02	113.2	Particleboard/yard debris/landscape timbers/siding	CCA lumber, decking/timbers	0.06
3/17/02	81.5	Pallets/yard debris/demolition debris	CCA lumber/decking/timbers	0.79

most treated wood in this region is performing well and has not reached the point where removal is required. Further surveys of the PRC users would be required to better answer this question. Regular examination of the discard bin at the PRC, where materials deemed to be unsuitable for the system such as household trash and large metal objects are discarded, failed to reveal the presence of any treated wood. This suggests that personnel at the PRC are not actively removing small amounts of treated wood from the waste stream, although they may be redirecting customers carting large volumes of treated wood to the nearby MSW facility.

Implications of treated wood in the recycling stream

Although it is clear that treated wood is entering the recycling stream in western Oregon, the levels present fall far below those found in other parts of the country. The total amount of chemical in the treated products is difficult to assess; however, if we use an assumed average density of 448 kg/m^3 (AWPA 1999b) for all of the woody material, and assume that any treated wood detected contains at least 6.4 kg/m^3 of CCA (oxide basis) and that the entire cross section has been treated to this level, then of the 7,389,446 kg of wood material examined in our survey, 72,416.6 kg contained CCA treatment. Using the ground-contact retention value, this translates to nearly 1034.5 kg of CCA. This value should be considered extremely conservative, since the percentage of wood actually treated would be much lower (< 60% of the wood cross section, depending on the dimensions) and much of this material would have been treated to the lower aboveground retention level.

The ash content of Douglas-fir and western hemlock are reported to be between 0.2 and 0.3 percent, respectively (Panshin and DeZeeuw 1980). As a result, all of the material examined in this survey would produce 22,168 kg of wood ash, plus 1034.5 kg of metals (oxide basis). If none of the CCA components are lost during combustion, the ash would contain 4.46 percent CCA (oxide basis), consisting of 1.10 percent Cr, 0.66 percent Cu, and 0.99 percent As (metal basis). The State of Oregon currently uses the federal limits for ash disposal and specifies that ash that is land-applied have no more than 75, 4,300, and 3,000 ppm of As, Cu, and Cr, respectively (Pour 1993). The potential As, Cu, and Cr levels in the ash resulting from the combustion of recycled materials from the PRC clearly exceed these limits. The primary concern would be for arsenic, since levels in the ash were over 100 times higher than the permissible land application limits.

It is important to remember that this wood represents only a small component of the total hog fuel used. Additional ash from the other wood would dilute these contaminants. In addiction, our calculations assumed that the entire cross section of the wood was treated. Typical treatments for dimension lumber of western species rarely exceed 40 percent of the total cross section, which would further reduce actual metal levels.

Conclusions

Current disposal practices in western Oregon appear to result in some treated wood entering the recycling stream; however, these levels remain far lower than have been reported in other parts of the United States. Continued surveys of the site are planned to ensure that treated wood levels in the stream do not appreciably increase.

Literature cited

Alderman, D.R., Jr. and R.L. Smith. 2000. Solid wood received and marketed by Virginia landfill facilities. Forest Prod. J. 50(6):39-44.

Anonymous. 2000. Coffin Butte Landfill/ Processing and Recovery Center Report. Solid Waste Advisory Committee, Benton County, OR.

American Wood-Preservers' Association (AWPA). 1999a. Lumber, timber, bridge ties, and mine ties-pressure treatment. Standard C2-99. *In*: Book of Standards. AWPA, Granbury, TX.

__________. 1999b. Wood densities for preservative retention calculations by standards. Standard A12-96. *In*: Book of Standards. AWPA, Granbury, TX.

Falk, B. 1997. Wood recycling: Opportunities for the woodwaste resource. Forest Prod. J. 47(6):17-22.

Micklewright, J.T. 1990. Wood preservation statistics, 1988. *In*: Proc. 86th Annual Meeting of the American Wood-Preservers' Association. AWPA, Granbury, TX. pp. 258-272.

Olsen, S.H. 1971. The Depletion Myth: A History of Railroad Use of Timber. Harvard University Press, Cambridge, MA.

Panshin, A.J. and C. de Zeeuw. 1980. Textbook of Wood Technology: Structure, Identification, Properties, and Uses of the Commercial Woods of the United States and Canada. Vol. 1. 4th ed. McGraw-Hill Inc., New York. 705 pp.

Pour, B.N. 1993. Guidelines for land application for industrial solid waste. Oregon Dept. of Environmental Quality, Portland, OR.

Scheffer, T.C. 1971. A climate index for estimating potential for decay in wood structures above ground. Forest Prod. J. 21(10):25-31.

Solo-Gabriele, H., T. Townsend, J. Penmha, T. Tolayman, and V. Calitu. 1999. Disposal-end management of CCA-treated wood. *In*: Proc. 95th Annual Meeting of the American Wood-Preservers' Association. AWPA, Granbury, TX. pp. 65-74.

9544 P & P: The presence of preservative-treated wood in a wood recycling facility was surveyed. Levels of treated wood were generally low, but the ash resulting from combustion would not be suitable for land application unless this material represented a small fraction of the total material burned.