Occurrence of Preservative-Treated Wood in a Wood Recovery Center in Western Oregon

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Abstract

The amounts of treated wood present at a wood recycling center in western Oregon were surveyed over a 10-year period. Treated wood was found at 106 of 112 inspections, but the levels never exceeded 2 percent of the volume present. The amount of treated wood averaged 0.15 percent of the total volume over the 10 years. These values were considerably lower than those found in surveys in Virginia and Florida, reflecting a lower overall use of treated wood and, with respect to Florida, a lower risk of decay in Oregon. The results indicate that treated wood is a minor component in the recycling stream studied and does not pose a risk to those using the material.

Over the past 2 decades, there has been tremendous growth in community recycling programs. Many of these programs have developed to meet state or region recycling goals, but they are also designed to extend the useful life of landfills. One area of more recent growth has been wood recycling because this material is often bulky and can consume a disproportionate volume of landfill space (Falk 1997). A number of communities have developed yard debris collection programs, construction and demolition (C&D) landfills, and other approaches to prevent these materials from entering municipal solid waste facilities. Yard debris is readily composted and this compost is often sold at a premium to area nurseries. The woody components are low in nitrogen and are therefore less easily degraded. Many facilities instead chip and sell this material as fuel. The use of recycled wood chips for fuel generally poses little problem. However, this wood stream can contain preservative-treated wood. The Environmental Protection Agency labeling for treated wood specifically states that this material should not be burned except in licensed facilities. Relatively few facilities in the United States are licensed for this purpose.

This issue was highlighted in Florida where researchers discovered that ash from a cogeneration plant that burned combinations of wood and bagasse contained high levels of heavy metals (Solo-Gabriele et al. 1999). The metals were attributed to the presence of high levels of treated wood from C&D facilities. This discovery led to an examination of disposal practices in these facilities, but few have examined the potential for similar occurrences in yard debris programs.

In 1999, we began assessing the presence of treated wood in a recycling center located near Corvallis, Oregon (Morrell 2004). The facility receives both yard debris (foliage, branches) and industrial wood (lumber, pallets). The yard debris is generally mulched and composted, while the wood is chipped and sold to local mills for hog fuel. Detecting treated wood was easily accomplished in this facility because most treated wood sold in the region is incised and stained with a brown pigment that makes it readily identifiable. In addition, the materials at the site are routinely spread on a concrete pad where they accumulate until there is a sufficient volume to make chipping economical. This created ample opportunity to observe reasonable quantities of woody debris at a given time. The results of the initial survey indicated that treated wood was almost always present in the piles, but the levels were low (Morrell 2004). We have continued to survey the site over the ensuing 7 years in order to determine whether the amounts of treated wood in the system were increasing to the point where action would be required. In this report, we describe the results of those additional surveys.

Material and Methods

The Processing and Recovery Center (PRC) processed approximately 7,040 tons of wood in 2007 and 5,474 tons of wood in 2008 (Anonymous 2008). The decline in volume reflects the start of an economic recession. This material is collected at the site for several days to weeks, depending on

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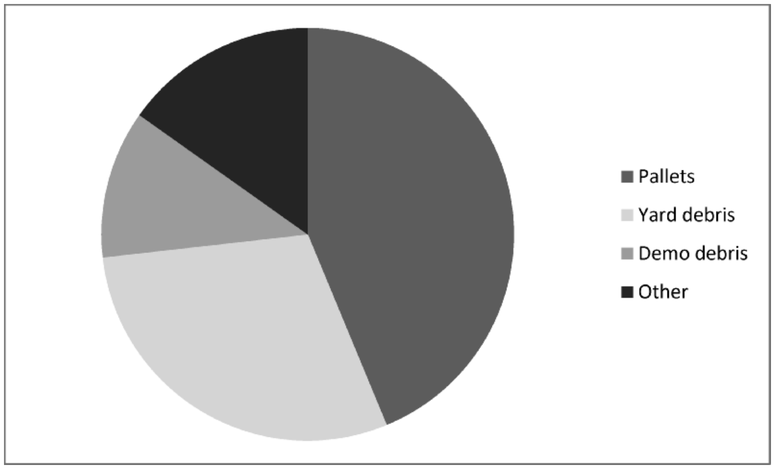

Figure 1.—Proportions of pallets, yard debris, demolition debris, and other materials in a recycling stream surveyed over a 10-year period. Values are based upon 112 surveys.

the rate of fill. The resulting material is then sold to local lumber and paper mills for use in their wood-fired boilers. The PRC-derived wood is generally a supplemental source of wood for these facilities.

The amount of treated wood was visually assessed 112 times over the 10-year period. At each time, the size of the entire pile was estimated. The presence of treated wood of a given dimension in the pile was then visually determined (e.g., 4 by 4 or 2 by 4 in.). As mentioned, treated wood is readily detected because of the distinctive brown stain and/or the presence of incisions. Depending on pile size, this allowed for visual detection 1 to 3 m inward from the outside of the pile. In addition, we estimated the relative proportions of various woody materials in the piles. The most common categories were yard debris, pallets, panels, and demolition debris.

The lineal footage of each piece of dimension material detected was then used to determine overall volume of wood using actual dimensions. Lumber for residential applications was primarily treated with chromate copper arsenate (CCA) until 2003, when it was withdrawn from the market. Lumber is now treated with either alkaline copper quaternary (ACQ) compound or copper azole (CA; American Wood Protection Association [AWPA] 2008a). It is not possible to visually distinguish wood treated with these three chemicals because of the brown pigments. For the purpose of determining chemical loading, we assumed that all of the wood had been treated to the AWPA Standards ground contact retention for treatment of lumber with any of the waterborne materials (6.4 kg/m^3 for ACQ or CCA or 3.3 kg/m^3 for CA) and that the entire cross section had been treated to that level. These represented extremely conservative approaches because not all wood is treated to the ground contact retention and preservative penetration is often shallow in the species used in this region. However, since we could not visually assess treatment depth or retention, we elected to use this conservative approach. As a result, the estimates of total chemical in the wood were intentionally extremely conservative.

In order to determine the potential effects of preservative metals on the ability to land apply the resulting ash, the amount of ash generated by the material surveyed was calculated based upon an estimated 0.2 percent (wt/wt) ash content for western hemlock (Panshin and deZeeuw 1980). These data originate from laboratory studies, which tend to produce more thorough combustion than wood-fired boilers. The ash value is additionally conservative because some of the material was Douglas-fir, which has a slightly higher ash content (0.3%, wt/wt). The use of this number would have resulted in a higher mass of ash, which would have diluted any metals to a greater extent than the western hemlock. The amount of copper, chromium, or arsenic in the ash was calculated based upon the average level of treated wood present. While some arsenic can be volatilized during combustion, it would be difficult to accurately estimate this percentage. Therefore all arsenic was assumed to be retained in the ash. The total mass of the wood present in the survey was determined by multiplying the volume by 446 kg/m^3 (the assumed mass for Douglas-fir—the most commonly used material for framing in this region) and then multiplying this number by 0.003 to estimate the total amount of ash that would be produced by burning this material (AWPA 2008b). This value (34,544 kg) was then multiplied by the weighted percentage of treated wood found in the materials (1.528%) to estimate the total amount of metals in the system on an oxide basis. This value was then used to determine the amount of each metal that would be present for scenarios where all of the wood was CCA, ACQ Type B, or CA Type B. Copper is the only heavy metal present in both ACQ and CA; however, these systems contain proportionally more copper than does CCA (AWPA 2008b). The resulting levels of heavy metals in the ash were then compared with Oregon guidelines for land application of industrial solid wastes under the US Environmental Protection Agency 40 CFR 503 Federal regulations, which have a ceiling for arsenic, chromium, and copper content in land-applied biosolids of 75, 3,000, and 4,300 ppm, respectively (Pour 1993).

Results and Discussion

The most abundant materials present at the site were pallets, yard debris, and demolition debris. The average volume of material present at any given inspection was 338.8 m^3. Pallets were the most abundant material at the site (49/112 times), while yard debris was the most common 33 times followed by demolition debris at 14 times (Fig. 1). A

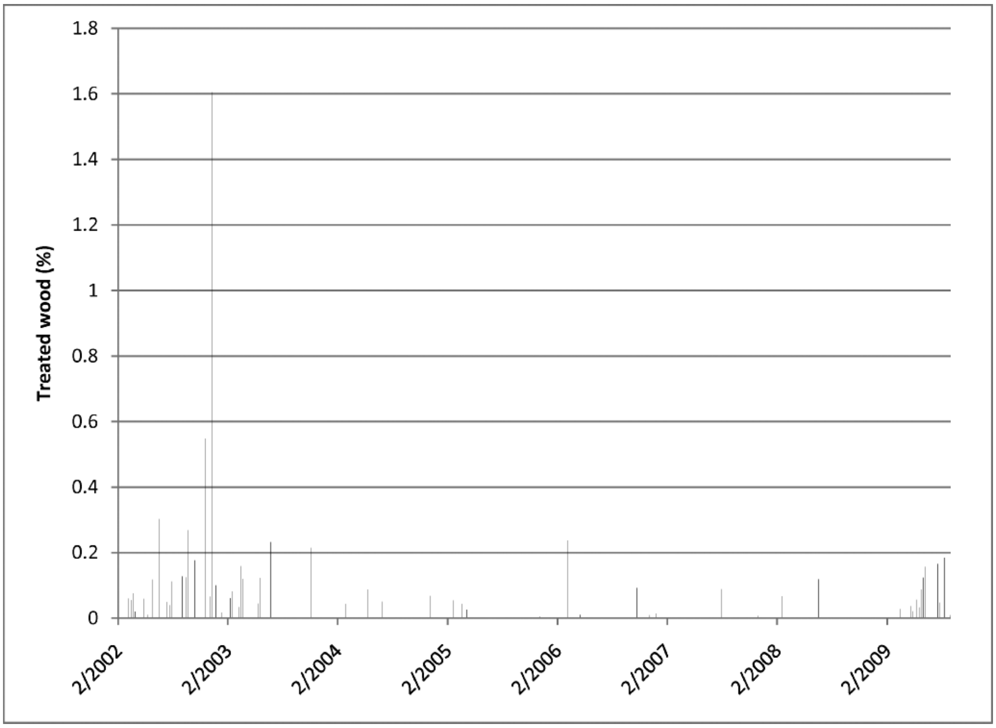

Figure 2.—Percentages of treated wood in a wood recycling center at 112 sampling times over a 10-year period.

variety of other materials were also present including panel trim scraps and shingles, but these represented minor volumes compared with the three most common materials.

Treated wood was detected in 106 of 112 inspections or 94.6 percent of the samples. The percentages of treated wood were generally low in the samples, ranging from <0.01 to 2.0 percent of the estimated volume (Fig. 2). Levels at or above 1 percent were only detected three times over the 10-year period. The average volume of treated wood present was 0.15 percent over the 10 years. Treated wood levels were >0.2 percent of the volume in 20.5 percent of the inspections, while they were between 0.1 and 0.2 percent of the volumes in another 16.1 percent of the inspections (Fig. 3). Treated wood represented <0.1 percent of the volume in most of the inspections (63.4%), indicating that this material was a relatively small proportion of the recycling stream.

In previous studies of wood recycling facilities, 5.9 percent of the volume at a C&D facility in Florida was treated wood (Solo-Gabriele et al. 1999), while 2.5 percent of the wood entering the waste stream in Virginia was treated (Alderman and Smith 2000). The volumes of treated wood entering the facility we surveyed were far lower than those levels. Furthermore, the levels have actually declined slightly over the past decade.

While the consistent presence of treated wood at the recycling center makes it clear that many waste haulers and consumers do not understand the need to separate treated

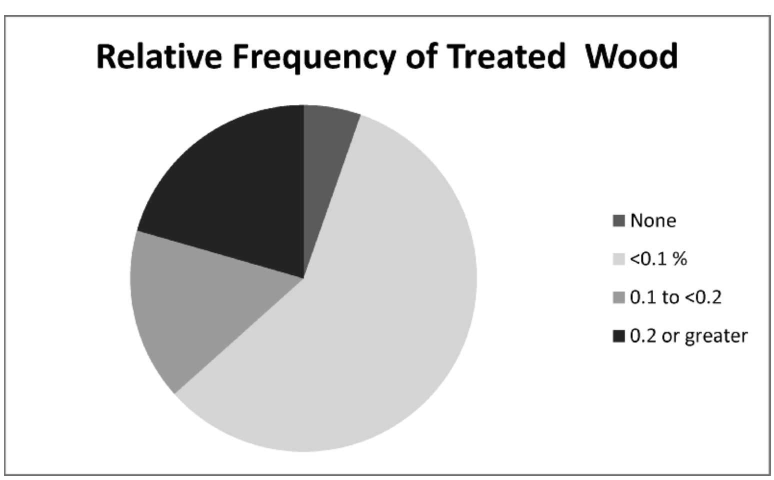

Figure 3.—Frequency of different levels of treated wood in a wood recycling center in western Oregon assessed over a 10-year period. Values are based upon 112 surveys.

from untreated wood in the waste stream, the volumes of treated wood entering the recycling stream in western Oregon remain low. This likely reflects the lower overall use of treated wood products in this region. Oregon has a moderate decay risk and many homeowners continue to use heartwoods of naturally durable species such as western red cedar and redwood for decking. Western red cedar decking was commonly observed in the recycling facility, although no attempt was made to quantify the volume. It was also observed that most treated wood decking was not biologically degraded, although many treated posts used to support fences were internally decayed. This damage is a function of the relatively shallow depth of preservative treatment on western wood species. The presence of sound treated wood in the recycling stream would support the common premise that most treated wood decking is removed from service for visual degradation not biological attack.

Arsenic levels in the ash resulting from combustion of the wood from this recycling facility were estimated to be nearly 32 times the limit for land application, while chromium and copper levels would be below the limits if the contaminating wood is assumed to be treated with CCA (Table 1). Copper levels would still fall below the limit if the wood was assumed to be composed entirely of ACQ-B or CA, although the levels would approach the limits because of the much higher levels of copper used with these systems.

In practice, the facilities purchasing this biomass source use it to supplement their internal supplies of untreated wood. As a result, there is a considerable dilution factor that sharply reduces the risk of exceeding disposal limits. Nevertheless, the findings highlight the need for some customer education at the recycling facility to encourage more careful waste sorting. There may also be a need to create some incentives for sorting. At present, disposal at the recycling center is less costly than similar disposal at the nearby municipal solid waste facility. There is clearly a disincentive to sort materials because this will incur a second charge to dispose of the treated wood. The facilities are both owned and operated by the same company and there might be a need to create some process whereby sorted treated materials could be moved to the municipal solid waste facility without an added cost.

Table 1.—Potential concentrations of arsenic, chromium, or copper in ash from combustion of wood from a recycling facility that contains approximately 0.15 percent treated wood.

		Potential ash concentration (ppm)[a]		
Metal	Upper limit (ppm)	CCA-C	ACQ-B	CA-B
As	75	2,380	—	—
Cr	3,000	2,640	—	—
Cu	4,300	1,580	3,720	2,950

[a] Values assume all of the treated wood is composed of that preservative at a loading of 6.4 kg/m^3 (oxide basis) for CCA or ACQ and 3.3 kg/m^3 for CA. ACQ-B and CA-B do not contain arsenic or chromium.

Conclusions

The results suggest that levels of treated wood in the recycling stream sampled remain extremely low. These levels should not pose a problem for those using these materials for cogeneration; however, it might be prudent for the facility to institute some type of educational program to alert customers about the need to segregate these materials for proper disposal.

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