ECONOMIC ANALYSIS OF REGULATING TREATED WOOD WASTE AS HAZARDOUS WASTE IN CALIFORNIA

prepared for

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optimizing environmental resources - water; air; earth

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EXECUTIVE SUMMARY

Legislation and/or regulatory changes are being considered in California that would require preservative treated wood waste to be managed and disposed as a non-RCRA hazardous waste. The purpose of the paper is to estimate the increased cost of such changes to the people of California.

This paper develops a method to estimate sales of treated wood in California based on population and wood preservation industry statistics. This estimate is supported by an independent estimate based on reporting of preservative chemical use in the Pacific Region to the Western Wood Preservers Institute. The estimate is projected back to a start date of 1950 and ahead through to 2002. Historic and current disposal rates of treated wood are estimated based on an assumed typical life expectancy for the treated wood products.

California represents approximately seven percent of the U.S. market for preservative treated wood. Sales of treated wood in California currently amounts to nearly 40 million cubic feet each year. Projecting sales of new and disposal of used treated wood since 1950, it is estimated that there is now nearly one billion (1,000,000,000) cubic feet or 15 billion board feet of preservative treated wood in use in California. As this wood is removed or replaced, it will be disposed over the next several decades. The rate of disposal is estimated to be nearly 30 million cubic feet or 400 million board feet per year. If disposed as hazardous waste, this volume would double the volume of hazardous waste disposed in the state.

Current costs of disposal of non-hazardous and non-RCRA hazardous waste are estimated and compared. The higher hazardous disposal costs are applied to the estimated annual disposal and total inventory of preservative treated wood for state-wide economic impact.

If the regulations are changed so that treated wood must be disposed as a non-RCRA hazardous waste (i.e., hazardous only in California), then the cost of disposing of treated wood will increase from about $61 per ton to about $291 per ton, or about 500 percent. The total cost to the people of California will increase by about $85 million per year. The total disposal cost of treated wood currently in use would increase by about $3 billion over the next several decades.

1. INTRODUCTION

Preservative treated wood is used widely throughout California and the world. Creosote has been used to preserve wood since the late 19th century and was critical to the successful development of the railroad transportation system that benefits all today. Other preservatives entered the marketplace in the 1950s with numerous improvements over the years. Treated wood products are now common in uses such as utility poles, railroad ties, pilings, sign and guard rail posts, fencing, outdoor decks, public boardwalks, foundation sill plates, and agricultural supports. These uses have become common because wood is a strong, flexible, economic building material that, when treated, will last a long time in moist and/or outdoor environments. In fact, depending on the severity of the use and environment, treated wood lasts for more than 20 years and often as long as 100 years.

Several wood preservatives are now in use. Creosote, a product derived from distillation of coal, is the oldest wood preservative. Creosote treated wood typically is black or dark brown. It is used for industrial applications such as railroad ties, marine and construction pilings, and utility poles. These products often are recycled for commercial or farm use as retaining walls or fence posts when removed from the initial service or use..

Water borne preservatives describe a preservative process that impregnates wood with chemicals that are carried by water. Chromated copper arsenate (CCA) is the most common and results in a treated product that is green in color. Most outdoor decks are constructed of CCA lumber. Ammonical copper zinc arsenate (ACZA) is more of a black-green. ACZA is normally used for utility poles, commercial construction lumber, and pilings. New alternative water borne preservatives are now coming to market primarily for non-industrial or residential use. Copper is typically an active ingredient in these systems.

Oil borne preservatives use petroleum oil or solvent as carriers to impregnate the preservative chemicals into the wood. The preservatives may be organic, such as pentachlorophenol, or a metal organic mixture such as copper naphthenate. These preservatives also are normally used for industrial or heavy-duty construction applications.

Treated wood must be disposed at the end of its useful life. That may occur because the wood is deteriorated or worn out from weathering or to make way for new construction or remodeling. Wherever possible, recycling of used treated wood to other uses for which it is suited is encouraged, but this is not always practical. Eventually, treated wood products must be disposed.

Disposal of waste materials is governed by solid and hazardous waste regulations of California. Currently, waste treated wood is disposed in approved solid waste landfills as non-hazardous waste according to exemptions granted by the California Department of Toxic Substances (DTSC).

Regulatory changes are now being considered that would nullify these exemptions and require treated wood to be disposed as a hazardous waste in California. The purpose of this paper is to evaluate the economic impacts to the various stakeholders of California resulting from imposition of hazardous waste requirements for waste treated wood.

2. CALIFORNIA WASTE REGULATION

The United States Environmental Protection Agency (USEPA) promulgates and enforces regulations that deal with the disposal of waste materials in the United States. States may either adopt the USEPA regulations or promulgate their own. State regulations may be more, but may not be less, stringent than the USEPA regulations. The California Environmental Protection Agency (CalEPA) regulations are more stringent.

CalEPA regulations of hazardous waste are contained in Title 22, Division 4.5. Hazardous wastes equivalent to the USEPA and are designated as RCRA hazardous wastes. (RCRA refers to the U.S. Resource Conservation and Recovery Act that authorized the USEPA hazardous waste program.) Wastes that do not meet the USEPA RCRA designations of hazardous waste but do meet other hazardous waste criteria of California are designated as non-RCRA hazardous wastes. Such wastes are not considered hazardous by USEPA and are only regulated as such in California.

Disposal of hazardous wastes must be in accordance with strict regulations and is also subject to significant taxation. Thus, the cost of disposing of material as hazardous waste is significantly more expensive than if disposed as non-hazardous.

One of the hazardous waste criteria is the "characteristic of toxicity." There are both RCRA toxicity characteristics and California non-RCRA characteristics. Most treated wood waste does not exhibit the RCRA toxicity characteristic. CCA and ACZA treated wood may exhibit this characteristic if finely ground. Recognizing that treated wood is normally disposed as large or bulk pieces that would present insignificant environmental risks in normal landfills, the USEPA regulations exempt waste treated wood disposed by end users from this criterion.

The California "characteristic of toxicity" expands considerably in its scope. Beyond the USEPA toxicity definition, California includes seven more criteria. Most, if not all, waste treated wood would exhibit at least one of these criteria. In fact, most untreated wood would be considered "hazardous" by one or more criteria. The DTSC recognized that in the form it is disposed, treated wood does not present unacceptable risks when disposed in properly constructed municipal waste landfills. Thus, specific exemptions were provided to treated wood suppliers and users. Currently, most treated wood is legally and appropriately disposed as non-hazardous waste in California.

Currently, these exemptions are being questioned and legislation is being considered that would revoke the exemptions and require treated wood to be disposed as non-RCRA hazardous waste.

3. ESTIMATING THE QUANTITY OF TREATED WOOD IN CALIFORNIA

The first step in the economic analysis is to determine how much treated wood exists in California and at what rate that will likely be disposed. Since no specific data could be found specifically reporting how much treated wood has been sold or put into use in California, other less specific reports were used. These required a number of assumptions to make a reasonable estimate. The process, information sources, and assumptions used are described further in this section.

3.1. Population Basis Assumption

Statistics available for either sales or production of treated wood are either for the whole U.S. or for regions, such as the Pacific Region. Lacking other data, the assumption was made that sales of treated wood within a region would be proportional to state populations. 1990 U. S. census data for states (Rand McNally 1999) was used. The data and calculation results are shown in Table 3-1. For example, with a population of 32.7 million, California accounts for approximately 75% of the Pacific Region states' population that includes California, Oregon, Washington, Alaska, and Hawaii.

3.2. Constants and Conversion Factors

Constants and conversion factors used in the calculations are listed in Table 3-8 for the convenience of the reader. The weight of used treated wood is assumed to be 26 pounds per cubic foot in accordance with American Wood-Preservers' Association standards.

The wood preservation statistics report the volume in actual cubic feet of treated wood. Lumber and timber volumes are also often reported on a nominal basis. For example, a 2 by 4-inch piece of lumber has actual dimensions of 1-5/8 by 3-1/2 inches. The nominal and actual cross sectional areas are 8.00 and 5.69 square inches, respectively. The nominal volume is 1.4 times (8/5.69) the actual wood volume. One cubic foot (cf) is equal to 12 board feet (bf). Allowing for the increase to nominal dimensions, one actual cubic foot of treated wood will equal about 17 nominal board feet of lumber. (1.4 x 12 = 16.8). For water borne preserved wood, which is mostly lumber, this factor is used. For creosote and oil borne preserved wood, which are mostly poles and ties that are typically reported in actual size, an actual to actual factor of 12 board feet per cubic foot is used. The derivation of these factors is included in Table 3-8. Volumes for annual and total treated wood disposal are converted from cubic feet to tons and board feet in Table 4-1 using these factors.

3.3. Wood Preservation Industry Statistics

The American wood preserving industry has conducted production and sales surveys. These are based on survey forms that are sent to all known wood preserving facilities in the U.S. Since not all respond, the surveyors have extrapolated the data to estimate U.S. and regional statistics. Three survey reports were used. Wood Preservation Statistics 1997 (Micklewright 1998) provided historical U.S. production data covering most years from 1984 to 1997. The

1995 Wood Preserving Industry Production Statistical Report (AWPI 1996) was used for missing years 1993 through 1995. AWPI 1997 was used for 1996 data. 1992 was not covered by these reports, so the average of one previous and one following year was used.

The statistical reports summarize production by preservative type; creosote, oil borne, and water borne. The primary preservative in the oil borne category is pentachlorophenol. Copper naphthenate is also an oil borne preservative. CCA is the primary water borne preservative, although ACZA is also available in the West. The production data for each preservative type is carried through all estimates because the type of preservative is indicative of the products produced and end uses of the treated wood.

Regional sales data (AWPI 1996) were used to proportion national statistics to regions. Sales data was used instead of production because products often are sold outside the regions where they were produced. Sales to the Pacific and Mountain regions accounted for 8.4% and 4.7%, respectively, of U.S. treated wood sales. Applying the California population percentages, California would account for approximately 6.3% of U.S. sales based on of Pacific Region sales or 7.2% based on the combined Pacific and Mountain Regions treated wood sales. A value between these is reasonable. Recognizing that there are significant imports to California from states outside the Pacific Region, a factor larger than the Pacific only region is justified. A California Sales Factor of 7% is reasonable. This 7% factor is used in the estimates of sales to California as a percentage of total U.S. production.

The national production for the given years multiplied by the California Sales Factor of 7% resulted in the estimated treated wood sales volumes in California. The data and calculation results of this step are shown in Table 3-2.

3.4. WWPI Preservative Chemicals Basis

Beginning in 1993, the Western Wood Preservers Institute (WWPI) began collecting dues from wood preservative chemical suppliers to support their programs. The dues were based on pounds or gallons of preservative used with the basis depending on the preservative. Chemical sales for the Pacific Region were subject to the dues. WWPI provided confidential summary data to this author to support a verification of the California treated wood sales estimate. The preservative quantities were converted to treated wood volume according to industry data for retention. For example, 100 pounds of preservative at a retention of 0.4 pounds per cubic foot will result in 250 cubic feet of treated wood.

The California Sales Factor for the Pacific Region only is 75%. The total wood volume by year times the California Sales Factor yields the estimate for California sales. These results are shown in Table 3-3.

Note that the WWPI estimates cover four preservative types; creosote, pentachlorophenol, copper naphthenate, and water borne. For comparison to the Industry Statistics, the production of pentachlorophenol and oil borne are added for comparison as oil borne.

3.5. Comparison of Estimates

Estimates based on the industry statistics and the WWPI dues are presented in Table 3-4. Only estimates for the years 1993 to 1997 are available by both methods. While there are some significant variations within preservative groups, the overall volume estimate by the WWPI dues basis is within 79% of the Industry Statistics basis. Since not all wood preservers in the Pacific and Mountain regions pay dues, an estimate this close provides confirmation of the reasonableness of the Industry Statistics basis estimate. All estimates and calculations described below are based on the Industry Statistics estimate.

3.6. Projecting Sales

Creosote preservation of railroad ties and utility poles has been common since the turn of the century. Use of other preservatives, such as CCA and pentachlorophenol began in the 1950s and later. Further, use of treated wood in California expanded rapidly with the post World War II boom in population and the migration of the population to the suburbs. Use of treated wood continued to expand well into the 1990s where it generally leveled off. Based on this scenario, sales of treated wood were projected on a straight line basis back to 1950. For creosote treated wood, approximately 20% of current sales was assumed for 1950. Other preservatives were assumed to be zero in 1950.

Since the production statistics are not available after 1997, the years 1998 through 2002 were estimated to be constant and at the average of the previous 5 years. Sales estimates of treated wood are shown in Table 3-5 for each year from 1950 to 2002.

3.7. Estimating Disposal

The economic life of treated wood is typically estimated to be between 20 and 40 years. Some products typically remain in place for significantly less time. Often, treated wood could last significantly longer, but is removed due to demolition or renovation work. Some products last significantly longer. For example, properly managed treated wood utility poles have a service life of 70 years or more with some in service for more than a century (Stewart 1996). In this estimate, the simplifying assumption is used that all treated wood will last 25 years and then be disposed. Thus, for this model, the rate of disposal is equal to the rate of production 25 years earlier. The estimated annual disposal rate is shown in Table 3-6. Based on these assumptions, the current rate of disposal of treated wood in California is estimated to be over 28,000,000 cubic feet or approximately 370,000 tons per year.

Other assumptions about current volume and disposal rates of treated wood waste were made to simplify the estimating process. 10,000 cubic feet of creosote treated wood was assumed to exist prior to 1950 so that with the 2,000 cubic feet solid in 1950, 12,000 cubic feet existed by the end of 1950. No disposal of creosote treated wood is included in the calculations until 1975. The small volume existing prior to 1950 grossly underestimates the volume since it would provide ties for only about 1400 miles of railroad. Disposal between 1950 and 1975 is also grossly underestimated since it is clear some disposal would have been ongoing. However, the underestimate of sales is considered to balance the underestimate of disposal so that the volume estimate is reasonable.

The annual rate of disposal will probably continue to increase over the next 10 to 20 years due to continued increases in treated wood sales volume over the last 20 years. However, annual disposal rates cited above, in the following text, and in the tables are based on the 2002 estimated disposal rate.

3.8. Current Inventory of Treated Wood

The amount of treated wood present in California is estimated in Table 3-7 for each year by adding new production to and subtracting disposal from the previous year's inventory value. Thus, it is estimated that the total amount of treated wood now in California is approximately 980,000,000 cubic feet. At 26 pounds per cubic foot, this equates to about 12 million tons of treated wood. The quantity is also shown in Table 4-1 and converted to other units of tons, cubic yards, and board feet.

Additional treated wood sold and installed in California after year 2002 is not included in the estimate. It is reasonable to assume that treated wood will continue to be used into the future and that the amount eventually requiring disposal will also continue to increase.

3.9. Treated Wood Waste Volume in Relation to Total Waste Volume

The total amounts of solid waste disposed in California for recent years (CIWMB 2002) are compared to the estimated treated wood waste disposal estimates from Table 3-6 (converted to tons) below. These figures indicate that treated wood waste amounts to approximately one percent (1%) of the total solid waste stream in California.

YEAR	SOLID WASTE QUANTITY	TREATED WOOD WASTE QUANTITY	UNITS
2001	38,120,084	356,824	Tons
2000	36,954,946	344,110	Tons
1999	35,508,313	331,383	Tons

In a study of California solid waste characteristics (CIWMB 1999), it was estimated that lumber accounted for 4.9% of the total and that construction and demolition waste (including lumber waste) accounted for 11.6% of the total. The estimate of treated wood waste accounting for 1% of total waste and about 20% of lumber waste seems reasonable compared to these figures.

3.10. Impact on Hazardous Waste Landfill Capacity

Review of the Toxic Release Inventory Data (USEPA 2001) for the three hazardous waste landfills indicates that in 2000 about 13,500 tons of hazardous waste was disposed. This data represents the amount of chemicals in disposed waste, rather than the total weight of the waste. Assuming the waste averaged one percent chemicals, then the total weight would be 1,350,000 tons. Hazardous waste is usually relatively dense, similar to soil. Assuming a density of 1.4 tons per cubic yard, this represents about 964,000 cubic yards. The estimated treated wood disposal is 28,000,000 cubic feet or about 1,000,000 cubic yards per year. If all treated wood had to be managed as hazardous waste, then the volume of hazardous waste disposal would double. This could have a significant impact on the expected useful life of existing hazardous waste landfills and require siting and development of new hazardous waste landfills.

4. ESTIMATING DISPOSAL COSTS

Costs associated with disposal of used treated wood under the current regulatory conditions are estimated to provide a basis for comparison. Costs associated with disposal of used treated wood are estimated assuming it is regulated as a non-RCRA hazardous waste. Increased costs are then calculated on a unit basis, and for annual statewide total and total current liability.

Treated wood is now disposed in municipal waste landfills with liners. The CalEPA Integrated Waste Management Board (CalEPA 2002) bases estimated unit costs of disposal on a tipping fee survey. The weighted average per cubic yard fee for landfills based on compact (not loose) waste is used and adjusted for wood density of 26 pounds per cubic foot. The current disposal tipping fee is estimated to be $41.42 per ton. Adding an estimated typical charge of $20.00 per ton for collection and local transportation, the total cost for non-hazardous waste disposal is about $61 per ton.

There are only three hazardous waste landfills in California, Chemical Waste Management at Kettleman City and Clean Harbors at Buttonwillow and Westmoreland. Cost estimates are based on telephone contacts by this author with the facilities contacts, published information, and professional judgement. Hazardous waste disposal costs include the facility fee, state tax, local tax, generator fees, transportation, and handling costs to separate the treated wood from other non-hazardous waste or debris. These costs would be approximately as follows:

- Facility Disposal Fee—The fee charged by the disposal company to accept the waste. For lower density materials, the charge is $50 per cubic yard. For wood waste at 26 pounds per cubic foot, this equates to $142.45 per ton.

- Taxes—California charges a tax of $16.51 per ton for non-RCRA hazardous waste disposal in the state. Additionally, the county in which the disposal facility operates charges a 10% tax on the disposal fee amount, or $14.25 per ton.

- Generator Fees—Each person or company that generates hazardous waste in quantities of 5 or more tons per year must pay a generator fee to the State. The fee varies depending on the annual total waste generated. For example, in the 5 to 25 ton range, about one truck load, the fee is $163. If this were a single 14-ton load, the fee adds $11.64 per ton. Other ranges and costs include 50 to 250 tons for $3,262, 500 to 1000 tons for $32,620, and over 2000 tons for $65,240. A representative cost of $40/ton is used in this paper.

- Transportation—Hazardous waste must be transported using a hazardous waste manifest and by permitted vehicles. Assuming a typical rate of $3.75 per loaded mile, 200 mile average haul distance, and 40 cubic yards per load at 26 pounds per cubic foot for wood waste, the rate is $53.42 per ton.

- Separation and Handling—Regulations on generators of hazardous waste are onerous, resulting in added costs to the people and organizations that generate the waste. For

treated wood, procedures and equipment would need to be put into place to separate the treated wood from other wastes, store it separately, and arrange for permitted transport to hazardous waste disposal facilities. $25 per ton is estimated as the average cost. This equates to $8.75 per cubic yard. The actual cost would likely be higher.

- Total Cost—Totaling the above costs results in a total cost of over $291 per ton of treated wood non-RCRA hazardous waste disposed.

The added cost per ton for regulating treated wood waste as hazardous waste is approximately $230 per ton.

Applying these cost increases to the estimated annual and total treated wood disposal need in California results in estimated increased costs of about $85 million per year with a total current liability increase of about $3 billion for wood currently in place in California. Cost data and calculation results are shown in Table 4-1.

5. WHO WOULD PAY?

Most sectors of the economy and many families would have to pay these added costs. The industry statistics (AWPA 1996) provide a basis for estimating the volume of different treated wood products. For water borne preservatives, about 75% is lumber, timber, and plywood indicating that most of this is used in buildings or structures, mostly residential. Nearly all, 94%, oil borne preservative production is for poles. Additionally, 10% of creosote and 6% of water borne production is poles. 83% of creosote production is for railroad cross ties, switch ties, and bridge ties. Some examples of how some sectors may be affected are highlighted below and in Table 5-1.

Homeowners—A typical treated wood backyard deck that is removed would have to be disposed as hazardous waste. Assume it is 15 by 20 feet. The volume of treated wood for the decking alone would be (15' x 20' x 1.5" / 12) 37.5 cubic feet. Hazardous waste disposal requirements would add about $100 according to the above rates. However, the true added cost would be probably be much higher because the contractor would need to bring in a dedicated hazardous waste roll-off bin and then arrange for separate transport of the bin to the disposal facility. A large proportion of the water borne treatment is for outdoor home use. Assuming 60% is installed at private homes, this represents additional disposal costs of about $31 million per year or $1.3 billion dollars total to California homeowners.

Utility Companies—Nearly all of the pentachlorophenol (oil borne) plus a portion of the other treatments are used for utility poles. Thus, the utility companies would likely be faced with added costs of seven to ten million dollars per year and a current liability of over $225 million.

Highway and Transportation Departments—Highway use of treated wood can be estimated from the 1997 Statistics (Micklewright 1998). Uses including highway posts and guardrails and crossing planks and panels account for about 0.28 percent of treated wood sold. State and local transportation agencies would have their disposal costs increased by at least $235,000 per year and total disposal liability increase by about $8 million. (See Table 5-1.) Additional costs would also be incurred to set up and operate hazardous waste collection, storage, and transport systems.

Local Governments—Cities and counties own a lot of treated wood in the form of decks and outdoor structures, guard rails, timber bridges, sign and fence posts, and wheel stops in parking lots. Each unit would have to set up new hazardous waste collection, storage and management equipment and procedures. Many local governments also operate household hazardous waste collection operations. Accepting used treated wood as household hazardous waste would likely overwhelm these programs. Programs will be cut and/or taxes increased as a result.

New construction costs would increase as contractors either opt for more expensive alternative products or must include the costs of collecting scraps as hazardous waste. Costs for disposal of all hazardous wastes would likely increase due to the large volume of treated wood that would fill existing landfill volume and require construction of new hazardous waste landfill cells. As people find the cost and difficulty of disposing used treated wood, illicit disposal along the states roads would likely become more of a problem.

6. CONCLUSION

California represents approximately seven percent of the U.S. market for preservative treated wood. Sales of treated wood in California currently amounts to nearly 40 million cubic feet each year. Projecting sales of new and disposal of used treated wood since 1950, it is estimated that there is now nearly one billion (1,000,000,000) cubic feet or 15 billion board feet of preservative treated wood in use in California. As this wood is removed or replaced, it will be disposed over the next several decades. The rate of disposal is estimated to be nearly 30 million cubic feet or 400 million board feet per year. If disposed as hazardous waste, the volume of hazardous waste disposal in the state would double.

If the regulations are changed so that treated wood must be disposed as a non-RCRA hazardous waste (i.e., hazardous only in California), then the cost of disposing of treated wood will increase from about $61 per ton to about $291 per ton, or about 500 percent. The total cost to the people of California will increase by about $85 million per year. The total disposal cost of treated wood currently in use would increase by about $3 billion over the next several decades.

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TABLE 3-1
POPULATION STATISTICS

(from Rand McNally Road Atlas, 1999
based on 1990 Census)

Pacific Region		Mountain Region	
CA	32.7	MT	0.9
OR	3.2	ID	1.2
WA	5.6	WY	0.5
AK	0.6	NV	1.7
HI	1.2	UT	2.0
		CO	3.8
		AZ	4.5
		NM	1.7
Total	43.3	Total	16.3

California population as percent of Pacific Region:	75.5%
California population as percent of Pacific + Mtn Regions:	54.9%

TABLE 3-2
ESTIMATE BASED ON 1995 AWPI TREATED WOOD STATISTICAL REPORT

Percent of U.S. Treated Wood Sales in Regions	
Pacific Region	8.40%
Mountain Region	4.70%
(per AWPI 1996)	

EST. SALES IN CA AS PERCENT OF US SALES	
(Region % times population %)	
CA sales as % of Pac. Reg.	6.3%
CA sales as % of Pac + Mtn Reg	7.2%
Best est. of CA % of US sales:	**7.0%**

PRODUCTION OF TREATED WOOD - 1995 (1000cf)

	US		PACIFIC		MTN	
Creosote	91,751	16%	5,068	12%	1,331	8%
Oil Borne	32,764	6%	5,415	12%	2,604	15%
Water Borne	450,596	78%	33,100	76%	13,040	77%
Total	575,111	100%	43,583	100%	16,975	100%

ESTIMATE BASED ON TREND DATA FROM 1997 AWPA STATISTICAL REPORT (1000 cf/yr)

Except 1993-1996 from 1996 report & 1992 estimated as ave. for previous and following years.

Year	TOTAL	Creosote	Oil Borne	Water B.
1984	492,904	137,597	53,610	301,697
1985	509,962	128,750	52,535	328,677
1986	543,691	118,749	49,484	375,458
1987	565,363	97,822	48,557	418,984
1988	588,915	90,481	47,869	450,565
1989	546,197	89,870	49,386	406,941
1990	577,460	93,193	46,592	437,675
1991	555,470	87,610	43,490	424,370
1992	577,131	89,871	39,823	447,437
1993	598,791	92,132	36,155	470,504
1994	632,727	94,547	41,297	496,883
1995	575,111	91,751	32,764	450,596
1996	587,861	86,512	33,494	467,855
1997	714,614	97,389	35,843	581,382

TABLE 3-2
ESTIMATES FOR CALIFORNIA TREATED WOOD VOLUME FROM AWPI STATISTICS (1000 cf/yr)

Year	TOTAL	Creosote	Oil Borne	Water B.
1984	34,503	9,632	3,753	21,119
1985	35,697	9,013	3,677	23,007
1986	38,058	8,312	3,464	26,282
1987	39,575	6,848	3,399	29,329
1988	41,224	6,334	3,351	31,540
1989	38,234	6,291	3,457	28,486
1990	40,422	6,524	3,261	30,637
1991	38,883	6,133	3,044	29,706
1992	40,399	6,291	2,788	31,321
1993	41,915	6,449	2,531	32,935
1994	44,291	6,618	2,891	34,782
1995	40,258	6,423	2,293	31,542
1996	41,150	6,056	2,345	32,750
1997	50,023	6,817	2,509	40,697

TABLE 3-3

ESTIMATED CALIFORNIA TREATED WOOD SALES BASED ON WWPI PRESERVATIVE USE (1000 cf/yr)

Year	Penta-chlorophenol	CCA/ACZA/ACQ/DOT	Copper Napthenate	Creosote	Total
1992	819	0	0	0	819
1993	4,196	17,306	244	0	21,746
1994	4,891	20,886	477	1,253	27,507
1995	3,739	18,968	335	1,366	24,408
1996	8,191	25,917	212	2,758	37,078
1997	4,118	44,621	0	941	49,680
1998	2,504	28,902	0	633	32,038
1999	3,191	28,370	83	284	31,928
2000	3,397	28,686	0	371	32,453
2001	2,482	26,059	0	367	28,908
2002	2,402	15,359	0	222	17,983
	Califronia market as % of WWPI Production				
	Based on of CA population as % of Pacific Region				
		75%			

TABLE 3-4
COMPARISON OF AWPI/AWPA STATISTICAL BASIS TO WWPI PRESERVATIVE BASIS FOR CALIFORNIA TREATED WOOD VOLUME ESTIMATES

	ESTIMATES FOR CALIFORNIA TREATED WOOD VOLUME FROM AWPI STATISTICS (1000 cf/yr)				ESTIMATED CALIFORNIA TREATED WOOD SALES BASED ON WWPI PRESERVATIVE USE (1000 cf/yr)			
Year	TOTAL	Creosote	Oil Borne	Water B.	Total	Creosote	Oil (Penta + CuNap)	Water Borne
1984	34,503	9,632	3,753	21,119				
1985	35,697	9,013	3,677	23,007				
1986	38,058	8,312	3,464	26,282				
1987	39,575	6,848	3,399	29,329				
1988	41,224	6,334	3,351	31,540				
1989	38,234	6,291	3,457	28,486				
1990	40,422	6,524	3,261	30,637				
1991	38,883	6,133	3,044	29,706				
1992	40,399	6,291	2,788	31,321				
1993	41,915	6,449	2,531	32,935	21,746	0	4,440	17,306
1994	44,291	6,618	2,891	34,782	27,507	1,253	5,368	20,886
1995	40,258	6,423	2,293	31,542	24,408	1,366	4,074	18,968
1996	41,150	6,056	2,345	32,750	37,078	2,758	8,403	25,917
1997	50,023	6,817	2,509	40,697	49,680	941	4,118	44,621
1998					32,038	633	2,504	28,902
1999					31,928	284	3,274	28,370
2000					32,453	371	3,397	28,686
2001					28,908	367	2,482	26,059
2002					17,983	222	2,402	15,359
TOTALS:	564,634	97,739	42,763	424,132	303,729	8,193	40,461	255,074
% by Preservative:		17%	8%	75%		3%	13%	84%
1994-1997 Comparisons								
Totals:	175,722	25,914	10,038	139,770	138,673	6,318	21,963	110,393
% by Preservative:		15%	6%	80%		5%	16%	80%
WWPI % variation from AWPI (94-97):					79%	24%	219%	79%

EVALUATION AND CONCLUSIONS:

1. Overall, at 79% agreement, total wood volume from two estimates is acceptable.
2. Low correlation at 24% is consistent with market since most creosote treaters are not WWPI members and/or are outside of pacific region.
3. High oil borne numbers for WWPI (219% of AWPI) not yet explained.
4. Recommend use AWPI basis for estimate. Reasonable based on independent confirmation of scale related to WWPI figures.

TABLE 3-5
ESTIMATES FOR CALIFORNIA TREATED WOOD VOLUME FROM AWPI STATISTICS (1000cf/yr)

Year	TOTAL	Creosote	Oil Borne	Water Borne
1950	2,000	2,000	0	0
1951	2,979	2,227	112	639
1952	3,958	2,455	224	1,279
1953	4,936	2,682	336	1,918
1954	5,915	2,909	448	2,558
1955	6,894	3,136	561	3,197
1956	7,873	3,364	673	3,836
1957	8,852	3,591	785	4,476
1958	9,830	3,818	897	5,115
1959	10,809	4,045	1,009	5,755
1960	11,788	4,273	1,121	6,394
1961	12,767	4,500	1,233	7,033
1962	13,745	4,727	1,345	7,673
1963	14,724	4,955	1,458	8,312
1964	15,703	5,182	1,570	8,952
1965	16,682	5,409	1,682	9,591
1966	17,661	5,636	1,794	10,230
1967	18,639	5,864	1,906	10,870
1968	19,618	6,091	2,018	11,509
1969	20,597	6,318	2,130	12,148
1970	21,576	6,545	2,242	12,788
1971	22,555	6,773	2,355	13,427
1972	23,533	7,000	2,467	14,067
1973	24,512	7,227	2,579	14,706
1974	25,491	7,455	2,691	15,345
1975	26,470	7,682	2,803	15,985
1976	27,448	7,909	2,915	16,624
1977	28,427	8,136	3,027	17,264
1978	29,406	8,364	3,139	17,903
1979	30,385	8,591	3,252	18,542
1980	31,364	8,818	3,364	19,182
1981	32,342	9,045	3,476	19,821
1982	33,321	9,273	3,588	20,461
1983	34,300	9,500	3,700	21,100
1984	34,503	9,632	3,753	21,119
1985	35,697	9,013	3,677	23,007
1986	38,058	8,312	3,464	26,282
1987	39,575	6,848	3,399	29,329
1988	41,224	6,334	3,351	31,540
1989	38,234	6,291	3,457	28,486
1990	40,422	6,524	3,261	30,637
1991	38,883	6,133	3,044	29,706
1992	40,399	6,291	2,788	31,321
1993	41,915	6,449	2,531	32,935
1994	44,291	6,618	2,891	34,782
1995	40,258	6,423	2,293	31,542
1996	41,150	6,056	2,345	32,750
1997	50,023	6,817	2,509	40,697
1998	43,527	6,473	2,514	34,541
1999	43,527	6,473	2,514	34,541
2000	43,527	6,473	2,514	34,541
2001	43,527	6,473	2,514	34,541
2002	43,527	6,473	2,514	34,541

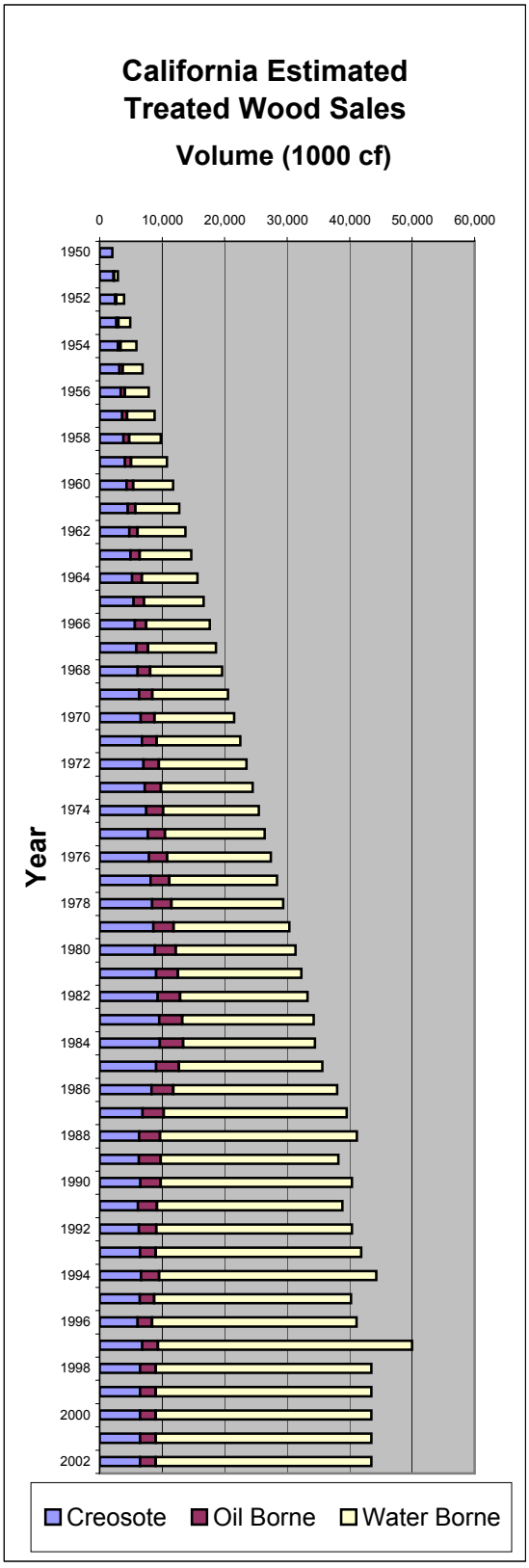

TABLE 3-6
ESTIMATED DISPOSAL (Assume disposal after 25 years) (1000 cf/yr)

Year	TOTAL	Creosote	Oil Borne	Water Borne
1950				
1951				
1952				
1953				
1954				
1955				
1956				
1957				
1958				
1959				
1960				
1961				
1962				
1963				
1964				
1965				
1966				
1967				
1968				
1969				
1970				
1971				
1972				
1973				
1974				
1975	2,000	2,000	0	0
1976	2,979	2,227	112	639
1977	3,958	2,455	224	1,279
1978	4,936	2,682	336	1,918
1979	5,915	2,909	448	2,558
1980	6,894	3,136	561	3,197
1981	7,873	3,364	673	3,836
1982	8,852	3,591	785	4,476
1983	9,830	3,818	897	5,115
1984	10,809	4,045	1,009	5,755
1985	11,788	4,273	1,121	6,394
1986	12,767	4,500	1,233	7,033
1987	13,745	4,727	1,345	7,673
1988	14,724	4,955	1,458	8,312
1989	15,703	5,182	1,570	8,952
1990	16,682	5,409	1,682	9,591
1991	17,661	5,636	1,794	10,230
1992	18,639	5,864	1,906	10,870
1993	19,618	6,091	2,018	11,509
1994	20,597	6,318	2,130	12,148
1995	21,576	6,545	2,242	12,788
1996	22,555	6,773	2,355	13,427
1997	23,533	7,000	2,467	14,067
1998	24,512	7,227	2,579	14,706
1999	25,491	7,455	2,691	15,345
2000	26,470	7,682	2,803	15,985
2001	27,448	7,909	2,915	16,624
2002	28,427	8,136	3,027	17,264

TABLE 3-7
ESTIMATED NET TREATED WOOD INVENTORY AFTER DISPOSAL (1000 cf/yr)

Year	TOTAL	Creosote	Oil Borne	Water Borne
1950	12,000	12,000		
1951	14,979	14,227	112	639
1952	18,936	16,682	336	1,918
1953	23,873	19,364	673	3,836
1954	29,788	22,273	1,121	6,394
1955	36,682	25,409	1,682	9,591
1956	44,555	28,773	2,355	13,427
1957	53,406	32,364	3,139	17,903
1958	63,236	36,182	4,036	23,018
1959	74,045	40,227	5,045	28,773
1960	85,833	44,500	6,167	35,167
1961	98,600	49,000	7,400	42,200
1962	112,345	53,727	8,745	49,873
1963	127,070	58,682	10,203	58,185
1964	142,773	63,864	11,773	67,136
1965	159,455	69,273	13,455	76,727
1966	177,115	74,909	15,248	86,958
1967	195,755	80,773	17,155	97,827
1968	215,373	86,864	19,173	109,336
1969	235,970	93,182	21,303	121,485
1970	257,545	99,727	23,545	134,273
1971	280,100	106,500	25,900	147,700
1972	303,633	113,500	28,367	161,767
1973	328,145	120,727	30,945	176,473
1974	353,636	128,182	33,636	191,818
1975	378,106	133,864	36,439	207,803
1976	402,576	139,545	39,242	223,788
1977	427,045	145,227	42,045	239,773
1978	451,515	150,909	44,848	255,758
1979	475,985	156,591	47,652	271,742
1980	500,455	162,273	50,455	287,727
1981	524,924	167,955	53,258	303,712
1982	549,394	173,636	56,061	319,697
1983	573,864	179,318	58,864	335,682
1984	597,558	184,905	61,607	351,046
1985	621,467	189,644	64,163	367,660
1986	646,759	193,457	66,394	386,908
1987	672,589	195,577	68,448	408,564
1988	699,089	196,956	70,341	431,792
1989	721,620	198,065	72,228	451,326
1990	745,360	199,180	73,808	472,373
1991	766,582	199,676	75,058	491,848
1992	788,342	200,103	75,940	512,299
1993	810,639	200,462	76,452	533,725
1994	834,333	200,762	77,213	556,359
1995	853,015	200,639	77,264	575,112
1996	871,611	199,922	77,254	594,435
1997	898,100	199,739	77,296	621,065
1998	917,116	198,985	77,231	640,900
1999	935,152	198,003	77,054	660,096
2000	952,210	196,793	76,765	678,652
2001	968,289	195,357	76,363	696,569
2002	983,389	193,693	75,850	713,846

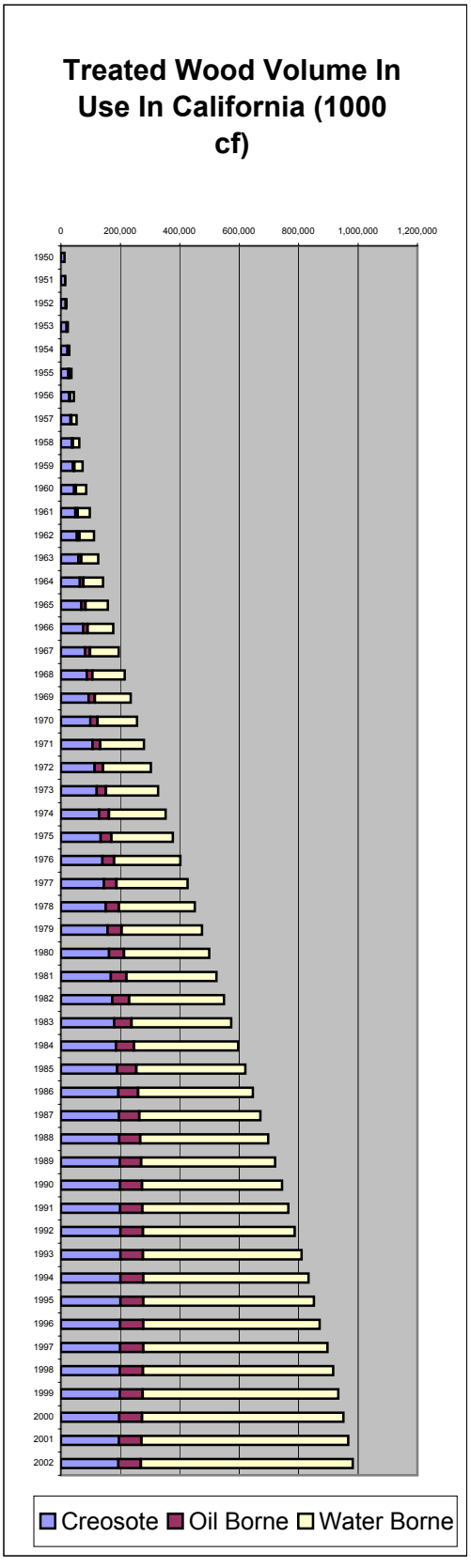

TABLE 3-8
CONSTANTS AND CONVERSION FACTORS

Wood Density	26	lb/cf	26	lb/cf
	0.351	ton/cy	26000	lb/1000cf
Truckload of waste wood	40	cy/load	13	ton/1000cf
	14.04	ton/load		
Transport to HW landfill	125	miles LA to Buttonwillow		
	175	miles LA to Kettleman		
	270	miles SF to Buttonwillow		
	220	miles SF to Kettleman		
	197.5	miles average		
	200	miles assumed typical		
	14.25	loaded mile/ton typical		

Conversions between nominal measure and net (actual) measure
Production statistics for lumber are based on actual lumber measure.
Volume reported as cubic feet (cf) (12"x12"x12") or board feet (bf) (12"x12"x1")

1.0 cf (nominal)	=	12 bf (nom)	
1.0 cf (actual)	=	17 bf (nom)	Use for water borne
1.0 cf (actual)	=	12 bf (actual)	Use for creosote and oil borne

Conversion to board feet	Nominal/Actual		Area	Fraction	Fraction	Factor
Typical lumber dimensions	Width (inch)	Thickness (Inch)	(square inch)	(actual to nominal)	nominal to actual	bf per actual cf
1 x 6 board (actual)	5.50	0.63	3.44	57.29%		
1 x 6 board (nominal)	6.00	1.00	6.00		174.55%	20.94545
2 x 4 board (actual)	3.50	1.63	5.69	71.09%		
2 x 4 board (nominal)	4.00	2.00	8.00		140.66%	16.87912
2 x 8 board (actual)	7.50	1.63	12.19	76.17%		
2 x 8 board (nominal)	8.00	2.00	16.00		131.28%	15.75385
Average Ratio (bf as % of cf)				68.19%	148.83%	17.86
Conversion factor to use (nominal board foot per actual cubic foot)						**17**

TABLE 4-1
ESTIMATED ANNUAL AND TOTAL DISPOSAL COST FOR USED TREATED WOOD IN CALIFORNIA AS NON-HAZAZARDOUS AND NON-RCRA HAZARDOUS

TREATED WOOD WASTE QUANTITY SUMMARY

	Units	TOTAL	Creosote	Oil Borne	Water Borne
Ave. Annual Disposal Quantity (based on year 2002 rate)	1000 cf	28,427	8,136	3,027	17,264
	tons	369,555	105,773	39,355	224,427
	1000 cy	1,053	301	112	639
	1000 bd-ft	427,445	97,636	36,327	293,482
2003 Treated Wood Inventory	1000 cf	983,389	193,693	75,850	713,846
	tons	12,784,060	2,518,012	986,047	9,280,000
	1000 cy	36,422	7,174	2,809	26,439
	1000 bd-ft	15,369,901	2,324,319	910,197	12,135,385
Note: Disposal of wood treated in the future is not estimated or included in cost estimates.					

NON HAZARDOUS WASTE DISPOSAL COST

			$35.14 /ton -or-		Choose the
Tipping Fee (CA weighted ave for landfills, 2000 survey) per ton	$41.42		$14.54 /c.y.		higher value
Collection & Transportation	$20.00				
Total Unit Cost per ton	$61.42	TOTAL	Creosote	Oil Borne	Water Borne
Annual Disposal Cost Total		$22,699,704	$6,497,037	$2,417,333	$13,785,333
Total Current Disposal Cost Liability		$785,254,501	$154,667,654	$60,567,459	$570,019,387

NON-RCRA HAZARDOUS WASTE DISPOSAL COST

Facility Tipping Fee	$142.45	/ton	$50.00 /cy or			Choose the
CA Disposal Tax	$16.51		$50.00 /ton			higher value
County Disposal Tax (10%)	$14.25					
Generator Fees (Taxes)	$40.00					
Added Transportation Cost	$53.42		$3.75	/loaded mile		
Separation/Handling	$25.00					
Total Unit Cost	$291.62	TOTAL	Creosote	Oil Borne	Water Borne	
Annual Disposal Cost Total		$107,770,960	$30,845,862	$11,476,728	$65,448,370	
Total Current Disposal Cost Liability		$3,728,138,151	$734,312,738	$287,554,998	$2,706,270,415	

ADDED COST DUE TO NON-RCRA HAZARDOUS WASTE REGULATION

Unit cost increase ($/ton)	$230.20	TOTAL	Creosote	Oil Borne	Water Borne
Annual Disposal Cost Total		$85,071,256	$24,348,825	$9,059,395	$51,663,037
Total Current Disposal Cost Liability		$2,942,883,650	$579,645,084	$226,987,538	$2,136,251,028

TABLE 5-1
CALIFORNIA TREATED WOOD USER COST INCREASES

Highway Products (1997 data)	Preservative	Fraction of Other Category	Other Volume	Estimated Volume
			(1000 cf)	(1000 cf)
Highway crossing planks and panels	Creosote	61.00%	1,308	798
Highway posts and guardrails	Oil Borne	16.80%	398	67
Highway posts and guardrails	Water Borne	19.20%	5,782	1,110
Total				1,975
1997 U.S. Production	All	714,614	(1000 cf)	
Highway Use Fraction	All	0.28%		

California Highway Departments Cost Increases

California Highway Estimate	All-Annual	1,021	tons/year	$235,101	/year
	All-Total	35,330	tons	$8,132,874	total

Homeowner Cost Increases

Water borne treatment used for outdoor homeowner uses	60.00%	$30,997,822	per year	$1,281,750,617	total

Utility Companies' Cost Increases

Assume all oil borne treated wood		$9,059,395	per year	$226,987,538	total