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ABSTRACT

SPENT CREOSOTE TREATED RAILROAD CROSSTIES -- ALTERNATIVES AND THEIR REUSE

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This paper will present the current methods and practices for the reuse of creosote treated crossties. In addition there will be data discussed concerning the Environmental Protection Agency (EPA) rule regarding the test procedure known as Toxicity Characteristic Leaching Procedure (TCLP). This test procedure determines the classification of waste materials that may be disposed of in a landfill.

Creosote treated wood crossties represent a potential source of fuel. This process of burning the crossties for fuel will be explored along with several other proposed alternative methods for using spent railroad crossties.

INTRODUCTION

In 1985 the Environmental Protection Agency (EPA) completed an eight-year study program focused on the reregistration of the major three wood preservatives that are used by the pressure treating industry -- creosote, pentachlorophenol and the waterborne arsenicals. This process was known as RPAR -- Rebuttable Presumption Against Reregistration. This is a rather ominous term for the EPA review process which focused on the major three wood preservatives with the result being label modifications as described in the January 10, 1986, Federal Register Notice.

The general conclusion which was reached by EPA was that the three preservative chemicals had benefits for preserving wood and with the appropriate label language changes would not pose a significant risk to man or the environment.

It also must be considered that with all three of these major preservatives, the registration process is a part of an ongoing review of each registered chemical as regulated by EPA under the jurisdiction of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The information given on a label applies to any pesticide (in this instance wood preservatives) as well as any other type of "broadcast" food crop pesticide.

For purposes of discussion it is important to make the distinction between the registered wood preservative chemicals -- creosote, penta and the waterborne arsenicals -- as compared to the actual treated wood products. The labels for each preservative are affixed to the preservative container. There are, however, no labels for treated wood. EPA regulates the pesticide chemical (this instance a wood preservative) and does not currently have jurisdiction over the treated wood product.

As a brief review of the regulatory history of the wood treating industry by EPA, the following information is presented. This federal regulatory agency is charged with the responsibility of specifically reviewing the wood preserving industry and its environmental impact. As indicated above, the EPA administers FIFRA. With the conclusion of the RPAR and the changes in the label language, the wood treating industry is now required to have certified licensed applicators. This is because each of the major three wood preservatives is now classified as a restricted-use pesticide and, thus, can only be sold to a licensed applicator. A licensed applicator is an individual who has completed a two- to three-day state (i.e., New York, Pennsylvania, etc.) training program. This program is an extensive review of the proper methods used to apply wood preservatives in both pressure and non-pressure applications.

It is not necessary to be a licensed applicator to install treated wood. Treated wood is not a "pesticide;" and, thus, installation, use and handling of treated wood are not regulated under the EPA. However, as a part of the RPAR settlement agreement, the wood preserving industry agreed to develop a voluntary Consumer Awareness Program (CAP). This voluntary program has been successfully implemented with the distribution of Consumer Information Sheets (CIS) used to convey the proper use, handling and disposal of treated wood products (Attached in Appendix A).

It is also important to point out that the American Wood Preservers Institute (AWPI), working on behalf of the industry, has not been content to continue to rely solely on the dissemination of the CIS as a means for conveying information to the consumer of treated wood products. The AWPI is currently developing a communication program to better inform the consumers of treated wood products with respect to the use and handling of these materials.

Even though treated wood products are exempt from OSHA regulations, the wood treating industry has recognized the need to provide this relevant information to its customers. There is a difference between the wood preservative chemicals and the treated wood. The appropriate information for each of these two different products is provided in Material Safety Data Sheets (MSDS). MSDSs for creosote preservative and the treated wood can be found in Appendix B.

ALTERNATIVES AND REUSE OF TREATED WOOD CROSSTIES

As indicated previously, EPA does not currently regulate treated wood products. Creosote-treated wood crossties, whether new or ties being taken out of track, are exempt from EPA pesticide regulations (FIFRA). As a creosote-treated crosstie completes its useful service life in track, it may be designated as a spent waste material which thus can be regulated. The CIS provides general guidelines for disposal of spent crossties. These guidelines were developed as a cooperative effort between the wood treating industry and the EPA.

There are several alternatives and potential reuses for creosote-treated railroad crosstie materials. These fall into three categories and are listed as follows:

- The reuse of spent railroad crosstie material is the preferred alternative. The treated wood crosstie can be rehabilitated and once again put back into track, or it can be used as fence post and landscape timber. The reuse of the creosote-treated crosstie is the primary recommended procedure, and a CIS should be always given to the customer of the rehabilitated/spent crosstie treated material.
- A second potential reuse (recycle) of spent railroad crossties would be as a fuel (either in whole sections or chips). The use of creosote-treated wood as a fuel may be used to directly fire an industrial boiler unit or provide a fuel source for a cogeneration facility. With each of these facilities it must be properly permitted according to state and local regulations.
- A third means for reuse (recycle) for treated wood crossties would be as a wood fiber source. The Cedrite process for making wood crossties utilized wood fiber (flakes) from spent crossties. The wood flakes were glued together with a phenolic resin and pressed and molded into crossties. The Cedrite ties were evaluated by a number of Class I railroads. In addition there are several other proposed methods to remove through extraction and/or biodegradation the creosote preservative which would then allow the wood fiber to possibly be used for other specialty wood and paper products.
- The final and least likely disposal of spent creosote-treated crossties would be for them to be placed in a

landfill. This could occur as either a solid or a chipped material. This fourth alternative would not be a wise use of a potentially valuable resource material -- spent creosote-treated crossties.

Of the four choices listed above for alternatives, reuse and recycle of creosote-treated crosstie material, the first option is probably the easiest and most practical use of a spent crosstie material. The rehabilitation of crossties to be placed back in track is entirely feasible. However, a major portion of the crossties that are removed from track cannot be rehabilitated; and these crossties will be designated to be used as a fuel/fiber or be disposed of in a landfill. Probably one of the most practical solutions for the recycling of crossties would be for its use as a fuel which will be a positive approach to recycling an energy rich source of material.

In 1986 the Association of American Railroads (AAR) performed a series of tests using creosote-treated crossties. The test program was initiated to assess the results according to the then new TCLP protocol. The treated crossties used in the test were segregated, and three groups -- freshly treated, 10-year old crossties and finally a 20-year old tie. Each of the creosote-treated crossties was sampled and reduced to chips according to the TCLP methodology. The chips were then subjected to the extraction procedure and in all cases passed the EPA regulatory level of being less than 200 mg/l. Subsequently, in 1988 a new sampling procedure, "cage method," for the TCLP was proposed; and the AAR in a similar manner conducted TCLP tests on newly treated red oak crossties which were treated with creosote/petroleum meeting the AWPA P3 solution.

The second crosstie was treated with the AWPA P2 creosote solution. The results of this second test using the cage method of sampling and extraction once again indicated the creosote-treated crossties were below the regulatory level for cresols (200 mg/l) for the TCLP test.

Recently, in March 1990, the EPA published in the Federal Register a final rule concerning the characterization of waste materials. This rule is termed the Toxicity Characteristic Leaching Procedure (TCLP). The promulgation of this rule has raised concern of the railroad users of creosote-treated wood crosstie materials. The TCLP procedure essentially determines whether or not any material will be classified as a hazardous waste. Consideration needs to be given to the fact that the TCLP rule is for all materials which are designated to be disposed of and not specifically focus on treated wood products.

Prior to the development of the TCLP rule, EPA required a predecessor test procedure which was known as the Extraction Procedure (EP) toxicity characteristic test. In effect the new TCLP rule superseded the previous EP procedure and proposed that additional chemicals be considered in determining hazardous waste materials. The TCLP and its predecessor, the EP test, were developed by EPA with the intent of simulating the mobility of hazardous chemical compounds in a landfill environment.

The new TCLP rule established regulatory levels for 39 compounds. With respect to creosote-treated wood, these compounds include benzene, the cresols and pyridine for which waste materials must be tested. The various creosote compounds are analyzed from the treated wood after the wood particles have been leached using acidic acid. TCLP test data that have been developed from several sources indicate that both freshly treated creosote wood products and those that have had an extended service life will pass the TCLP regulatory levels. Thus, creosote-treated wood crossties would not be classified as hazardous waste.

It is now appropriate to elaborate further on the specific TCLP test results for creosote-treated wood products. The Electric Power Research Institute (EPRI) has recently completed a test using 17 creosote-treated utility poles as well as six crossarms. There were 15 utilities from various parts of the United States including Hawaii who participated in this test. The creosote poles ranged in age from between 10 and 57 years with the predominant species being Douglas-fir, southern pine and western red cedar. The TCLP samples were analyzed for the presence of the cresol isomers of ortho, meta and para which are, as indicated above, the extractable compounds regulated according to the TCLP test. The total cresol constituents ranged from 14.95 mg/l to below the detectible level (i.e., less than 0.11 mg/l).

In addition Koppers Industries has had conducted by Resource Consultants, 7121 Crossroads Boulevard, Brentwood, Tennessee 37024, a series of TCLP tests using the EPA protocol with samples of southern pine and Douglas-fir creosote-treated pole material as well as several different hardwood species that were treated with creosote. These data are provided in the Table attached showing the results of the TCLP analyses for creosote-treated wood products. The creosote-treated wood samples were essentially all material that had been recently treated from Koppers treating operations. The age of the material ranged from several weeks to a maximum of six months. None of the creosote-treated material would have been classified as "used" treated wood. Essentially, the TCLP data indicated a range of cresol organic extractable (mg/l) to be from a high of 38.1 mg/l to a low of being nondetectible with a limit of cresol at 0.05 mg/l. The regulatory level is 200 mg/l, and thus all creosote samples tested were within the EPA criteria. The result being the creosote-treated wood will not be classified as a hazardous waste. In a similar manner, analyses were performed for benzene and pyridine; and these data are also given in the Table with once again the results indicating levels significantly below the EPA TCLP regulatory limits.

Thus, it can be concluded that based on the available data both new and used creosote-treated crossties will not be classified as hazardous waste materials according to the current EPA federal regulation. The data provided in this paper can be used as reference information for a generator of spent crosstie material. It is, however, the responsibility of the generator to make his own determination concerning the specific material which is to be discarded/recycled. It may be necessary to have a specific "sample" of crossties tested for TCLP.

The sampling for TCLP to determine whether or not a material is hazardous waste is a criteria to be followed if the spent crossties are for disposal into a landfill. As previously cited in this paper, there are other potential choices for disposal -- reuse as fence post or landscape timber, etc., or reuse (recycle) for fuel and wood fiber.

The decision to use spent crossties as a fuel is one that can lead to using creosote-treated crossties in a cogeneration facility.

Several wood treating companies and power cogeneration facilities have recently been permitted by local and state authorities to burn treated wood in this manner.

In conclusion it can be stated that creosote-treated wood crossties will not be listed as a hazardous waste. Creosote-treated crossties can be used safely and without adverse effects on this environment. Although questions may arise concerning the disposal/reuse (recycle) of the treated crossties, there is no evidence to indicate that the disposal would have an adverse effect on the environment.

The harvesting of trees, the continual planting and utilization of timber products and the use of wood preservative chemicals to treat crossties are wise uses of this natural resource. The use of this structural material which comes from trees that are harvested and replanted is a direct contrast to other competitive products -- steel, aluminum, concrete, fiberglass -- which once removed from the earth cannot be replenished. Wood is a renewable resource.

TCLP ANALYSES OF CREOSOTE TREATED WOOD[1]

Wood Species	Creosote Retention (pcf)[2]	Benzene (mg/kg)	TCLP Extractable Organic (mg/l) o-cresol	m- and p-cresol	Total Cresol	Pyridine
Environmental Protection Agency (EPA) TCLP Regulatory Limits		0.5	200.0	200.0	200.0	5.0
Crosstie and Lumber Products[3]						
Red Maple	16.4	nd[4]	0.03	0.11	0.14	nd[5]
Hard Maple	16.8	nd[4]	0.58	2.70	3.28	nd[5]
Beech	17.4	nd[4]	0.11	0.25	0.36	nd[5]
Hickory	7.4	nd[4]	0.26	0.97	1.23	nd[5]
Red Oak	-	0.1	1.50	6.60	8.10	nd[5]
Southern Pine						
Pole A	7.4	nd[4]	2.3	7.1	9.4	0.29
Pole B	10.9	nd[4]	9.0	29.0	38.0	0.53
Douglas-Fir						
Pole Sample	7.4	nd[4]	nd[6]	0.35	0.35	nd[5]

(1) Sample for TCLP was of total cross-sectional area approximately one inch in thickness.
(2) Analyses based on AWPA C2 and C4 Standards for lumber and poles when sampling the creosote treated wood.
(3) Creosote assay zone was 0 to 1 inch.
(4) Not detected -- limit of detection for benzene was 0.1 mg/kg.
(5) Not detected -- limit for pyridine ranged between 0.01 and 0.5 mg/l.
(6) Not detected -- limit for cresol ranged from 0.05 to 0.10 mg/l.

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ASSOCIATION OF AMERICAN RAILROADS | RESEARCH AND TEST DEPARTMENT

REPORT BRIEF

A Review of Toxicity Characteristic Leaching Procedure Testing of Railroad Crossties

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Crosstie disposal has been an issue with the railroad industry because of concern that crossties might leach chemicals considered harmful to the environment, and thus be regulated as a hazardous waste. To address this concern, the Association of American Railroads (AAR) has reviewed the results of various crosstie testing programs to determine hazardous characteristics, and has determined that new and used crossties would not generally be classified as a hazardous waste.

This report describes six different testing programs involving Toxicity Characteristic Leaching Procedure (TCLP) testing of railroad crossties. Data from at least 28 individual TCLP tests, representing at least two dozen new and used crossties from all over the U.S., were examined.

The test results reviewed in this report were obtained from 1987 through 1992, with the first two series of tests conducted by the AAR. In 1987, the AAR tested chipped ties using the same TCLP physical extraction protocol as exists today. In 1988, the AAR tested crossties using an alternative "cage modification" method that was proposed (and subsequently abandoned) by the Environmental Protection Agency (EPA). After the final 1990 TCLP rules were promulgated, further testing programs were undertaken by several railroads and others, including: the Chicago and NorthWestern Railway Company, Consolidated Rail Corporation, the Atchison, Topeka, and Santa Fe Railway, and the New York State Energy Research and Development Authority.

The results of all of the TCLP testing programs were similar, including those utilizing modifications of the TCLP, such as the AAR's 1988 "cage modification" study and the 1992 AT&SF study involving both the TCLP and the California Waste Extraction Test (WET). Only a small group of the 39 TCLP parameters were detected: cresol, arsenic, barium, lead, mercury, and selenium; and in most cases, these were only present at low, near-detection-limit concentrations in the extracts. In no case did any crosstie sample approach failure of the TCLP for any of the test parameters.

Orders for AAR Report "A Review of Toxicity Characteristic Leaching Procedure Testing of Railroad Crossties" should be sent to: Association of American Railroads, Publication Order Processing, 50 F Street, NW - 5th Floor COG, Washington, DC 20001. The AAR Report number is R-861. The price is $10.00 for member railroads and $100.00 for nonmembers. Illinois residents add 6.25% (Chicago--8.75%) sales tax. Price includes domestic shipping and handling charges. There will be shipping charges for locations outside the United States. Checks should be made payable to the Association of American Railroads. Visa and Mastercard are accepted for payment. A complete listing of reports is available upon request.

Summary

Production and use of pressure-treated wood produce some waste. The waste's character depends in which part of the process it is produced. Waste from the pressure process is primarily sludge developed in the storage tanks. The easiest solution is to deposit the liquid sludge in concrete. Alternatively it can be sent for disposal to the United Kingdom. Investigations for methods to recycle the sludge are in process.

Wood waste will be produced in the form of cut after adjustment or by changing used treated wood. If the cutting can be reused, this is the best solution today even if it only postpones the final waste problem.

When the waste volume of pressure-treated wood increases, a central collection can be carried out, primarily from the professional users like the railroad-, tele- or electricity companies. The wood can be burned and the bio-energy can be used. Creosote treated wood is easy to burn, while wood treated with salt preservatives, especially CCA-treated wood, will require treatment of the ashes and cleaning of the smoke. In the long run also the Do-it-yourself should deliver waste from treated wood to the public rubbish heaps. In this way the wood can be burned and used as bio-energy. From the ashes of salt treated wood, the metals can be regained.

So far, biological and chemical treatment of the waste seems unprofitable compared with burning, where the bio-energy is gained in addition to a regaining of the metals.

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THE INTERNATIONAL RESEARCH GROUP ON WOOD PRESERVATION

Section 5 environmental aspects

POSSIBILITY AND PROBLEMS OF CHARACTERIZING TREATED WOOD AFTER SERVICE WITH REGARD TO DISPOSAL

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POSSIBILITIES AND PROBLEMS OF CHARACTERIZING TREATED WOOD AFTER SERVICE WITH REGARD TO DISPOSAL

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Abstract

For the disposal of wood waste under ecological conditions, information about its hazardous potential and the logistic aspects for its handling is needed.

The main criterion to evaluate the hazardous potential besides the determination of the type and quantity of active ingredients in the wood will be the degree of mixture with different treated or untreated timber. Assortments can be homogeneous (e.g. creosoted ties), partial homogeneous (e.g. poles with various chromium containing types) and mixed (e.g. wood from demolition of buildings).

To improve the possibilites of re-using, recycling or disposal, a comprehensive survey on the structure of ownership, the kind of accumulation and the quantities of waste wood will provide with basical information. The evaluation of these logistical aspects can help for example to avoid mixed assortments, to decide whether separation as well as concentration may be useful and possible and to choose a suitable disposal method.

As conclusions unsolved problems are identified.

Keywords: Waste wood, disposal, hazardous potential, classification of wood assortments

1. Introduction

The proper handling of treated timber after service is a major challenge of todays wood preservation. Consequently, in the Second Cannes-Symposium, 8-9 February 1993, "Wast" were one of the five topics of discussion. So far most of the timber is either disposed on landfill sites or on any other dumping place, or it is burned.

First of all it has to be noticed that wood as such is of no harm. Only the additives might lead to problems. This concerns mainly preservative treated wood and wood based materials, which contain hazardous substances. They are responsible that treated wood becomes waste after service.

Treated wood is only part of the tremendous amount of waste and rubbish which can hardly be handled in a proper way, mainly in highly industrialized countries. In fact the possibilities of a correct disposal as well as of incineration are limited due to lack of respective landfill sites and incineration plants. Burning in small fire places should be avoided due to a high risk for health and safety.

To overcome the problem of waste and rubbish the general principle ought to be

first to AVOID,
then to REDUCE,
then to RE-USE or to RECYCLE,

- To **avoid** waste of treated wood a long-term strategy is needed. Timber, which now comes out of service, has been impregnated long ago. There hardly is an influence on the amounts of waste and no influence at all on the types of preservatives used. Often the kind of treatment in the past is even unknown.

- To **reduce** the waste of treated wood needs a distinct separation between treated and untreated wood and further more within treated wood between different kinds of treatment. This becomes difficult in case of unknown treatment.

- Also for **re-using** and **recycling** as well as for a proper **disposal** information is needed on the material you have to deal with.

For a safe handling of treated wood as waste it is necessary to define this material. In this paper some principles of characterizing treated wood after service are outlined, based on a research project sponsored by the German Environmental Protection Agency. In this connection every kind of wood will be regarded as being treated, in case it might have been impregnated with wood preservatives, even if this was not necessary since no risk of deterioration exists in the respective field of timber utilization.

2. General problems regarding preservative treated wood as waste

Some basic problems have to be kept in mind if preservative treated wood after service is regarded as waste.

- Treated wood is not a homogenous, easily definable material:

  - There is no worldwide accepted definition of "wood preservatives" as well as of "hazardous waste".

  - Generally, treated wood is neither marked nor easily to be recognized. Even if wood is known as treated, the toxic ingredients are often unknown in detail.

- It is not possible to recognize hazardous substances in wood visually.

- Since now even no analytical method exists for an easy and rapid identification of any kind of active ingredient. If the respective methods are fast, they are not exact enough - if they are exact, their application is much time-consuming and it is too expensive to have them installed as standardized methods.

- Wood waste we now have to deal with has been treated decades ago:

  - Not the actual preservatives have to be considered for the disposal but former active ingredients. These are often unknown.

  - In many countries no statistical data are available on the quantities of waste wood and its degree of contamination. Under these circumstances any planning of disposal capacities or waste-management seems to be extremely difficult.

3. Possibilities of characterizing impregnated wood after service

3.1 How to approach a characterization

Due to the problems mentioned above, almost no immediate information is available on waste wood. Therefore there is only the possibility to approach to the real circumstances. Despite of different situations in each country, the structure of evaluation is a general one.

There are two different levels to be distinguished:

° At first the composition of the assortments[1] and the **hazardous potential** of the "wood material" in question. Criterion of characterization are

  - the hazardous potential caused by the wood preservatives involved (type of preservative; amount and distribution in the wood);
  - the homogeneity of the various timber components;
  - the degree of mixture of wood treated in a different way and/or of treated and untreated wood.

° Secondly to consider the **structural level** where the assortments are observed from their starting point of beeing waste up to their definite disposal. The main criterions are

  - the structure of the ownership of the wood which becomes waste;
  - the kind of accumulation of waste wood;
  - the quantity of waste wood in total.

These two levels are not independent of each other. Both are important for the evaluation of waste wood. The first level gives a survey how to evaluate the hazardous potential. The second level considers the logistical and more structural facts. This level gives a chance to improve the situation. In this paper only a rough guideline is possible and only the most important facts can be outlined.

3.2 First evaluation level: the hazardous potential

As mentioned above the chances for an immediate analysis of the contamination of wood after service are only limited. For that reason the evaluation of a hazardous potential depends on indirect information. Every country has its own tradition of wood preservation. This tradition is the key for the evaluation of the hazardous potential and thus for every country the following questions have to be answered:

° What kind of active ingredients were used for impregnation in the last 50 years?
° Which ones are of major importance?
° Are there any possibilities to define the application

  - for a limited period of utilization?
  - for several specific assortments?
  - for specific regions?

The knowledge of the use of preservatives and their active ingredients has to be connected with the information on wood assortments. Both together will allow an assessment of the hazardous potential.

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1 There are two kinds of assortments to be distinguished. The assortments of production or use and the assortments of disposal after service. In every country the composition of several wood assortments of each kind will differ somehow. Its only important, to find a possibility to gather those wood products or wood waste either (a) whith an identical treatment or (b) which occur together for example in municipal waste.

Three main assortments can be distinguished, depending upon the homogeneity as the major criterion.

- **homogeneous-assortments**, characterized by:

  - a homogeneous hazardous potential of the wood product
  - a high degree of uniformity of the wood products
  - no mixture with untreated wood or with wood treated with various active ingredients or with further contaminants.

  EXAMPLE: Creosoted ties

- **partial homogeneous-assortments**, characterized by

  - hazardous potential only partially homogeneous
  - a composition of different wood products and dimensions
  - a possible mixture with other kinds of differently treated wood

  EXAMPLE: For countries, where CCA is not the dominating wood preservative, the various chromium containing types cannot be distinguished.

- **Mixed-assortments**, characterized by

  - an inhomogeneous treatment. It is not possible to determine the different kinds of treatment in quality and quantity.
  - wood products coming from different in-service conditions (e.g. indoor- or outdoor-use).
  - a given mixture of treated and untreated wood.

  EXAMPLE: Wood from demolition of buildings and of building sites

The hazardous potential of any assortment depends not only on its homogeneity but on the kind of active ingredient and its amount. Nevertheless, for several reasons an assortment should be homogeneous:

- the identification and evaluation of the hazardous potential is easier than for an inhomogenous one;
- homogeneous materials are easier to dispose of, because there are only limited and defined contaminants to be considered;
- depending on the quantities, chances for a specific utilization of the waste may exist or will become possible;
- the hazardous potential is often obvious and waste with high or low risk may easily be separated.

In contrast to the more homogeneous assortments, the possibilities to define the hazardous potential of mixed-assortments are only rare. Any wood preservative used in the past may be present and as a consequence every hazardous substance has to be considered. Due to the mixture with untreated wood, the quantities of these assortments are much higher than they ought to be.

3.3 Second level of evaluation: The logistical structure

Waste management needs some decisive requirements

- to register the quantities of wood which are to be disposed;
- to avoid mixed assortments;
- to divide mixed wood into various homogeneous assortments if useful and as far as possible;
- to concentrate wood waste, if it improves the logistic and economic conditions;

° to select non-polluting disposal-methods.

Even in countries with high waste management standards these requirements are not fulfilled. However, consideration of the structural situation for

- ° the structure of ownership
- ° the kind of accumulation
- ° the quantity of waste wood

involves possibilities to improve the waste management under safety and ecological conditions. The importance of management besides technology for a good environmental performance has been outlined by J.A. de Larderel, United Nations Environment Programm, at the Second Cannes-Symposium (de Larderel 1993).

The **structures of ownership** shall be analysed with regard to their organisation level and the quantities of consumption. For example the owners of ties and posts out of service are big industrial organisations, such as Postal Administrations and Railway Companys or power plants. They may provide rather homogeneous assortments for disposal whereas in municipal waste inhomogeneity is usual.

The **kind of accumulation** means the local concentration or dispersion of wood assortments. It characterizes also differences in regional distributions or peculiarities.

The **quantity of waste wood** for different assortments is important for logistical aspects of transportation, storage and disposal capacities. On one hand, a minimum quantity is necessary to install e.g. an incineration plant. On the other hand too large a concentration causes difficulties in transportation and storage logistic. An estimation of the todays and tomorrows quantities is besides the evaluation of hazardous potential one of the most important challenges for the development of conceptions for disposal.

A special problem of evaluation and assessment of the structural situation is the changing of wood assortments from the moment of beeing waste to the definit disposal. For this reason, the **moment of classification** is very important and influences the result markedly. An assortment being partial-homogeneous in its first stage might become part of a mixed assortment by transportation or collection. As a consequence the classification has to take place as early as possible.

For each region or country a comprehensive survey on these structures will be a basis for discussion with both the relevant legislative authorities and the waste disposers or waste utilization companies. Collecting this data provides with important information. They will help to realize the possibilities of improvement. Which kind of improvement finally takes place and in which direction the first step forward will be made depends on the kind of disposal planned.

4. Unsolved problems and outlook

° In each country the priority of problems of disposal might be different. Even if the disposal of waste wood causes no problems at the moment, it would be wrong not to care about the difficulties, which must be expected. The development of conceptions should start before enactments have been legislated. It is often difficult to change a misleading wording which came about due to a lack of expert knowledge.

° The im- and exportation of impregnated wood products as well as of wood waste into other countries point out, that the problem of disposal overlaps national borders. Therefore the experiences in different countries ought to be exchanged.

° Up to now wood preservatives are regarded mainly with concern to their formulation (e.g. PCP as an organic solvent formulation or as water-borne sodium pentachlorphenolate). For the disposal, however, only the contaminating substances and their hazardous potential are of importance.

- The active ingredients in preservative formulations have to be declared.

- The admission of (new) formulations or (new) active ingredients should also consider to the problems of disposal.

- Fast and exact methods to identify harmful substances should be developed. They should easy to be handled.

- The separation of different assortments with regard to the contamination only makes sense, if there are specific possibilities for the disposal. The expenses for sorting are only justified, if the separated waste wood with less contamination can be disposed under more suitable and less expensive conditions.

- It is of great importance to get timely a basis of planning. The authorities and waste disposers need information about the hazardous potential of the waste wood; the Impregnation Industry needs to know what type of disposal is suitable and what costs are to be expected.

Table 1: Survey on treated wood assortments after service with regard to their homogeneity

Criterion	**hazardous potential by wood preservatives**	**homogeneity of the various timber components**	**degree of mixture**
homogeneous assortments	homogeneous: - only one type of preservative - quantities and distribution of preservatives are easy to assess	considerable homogeneous	no mixture (at all)
partial homogeneous assortments	partial homogeneous: - limited amount of types of preservatives - generally, the quantities and distribution of preservatives can be assessed	limited: different wood products and dimensions	mixture is possible, but seldom
mixed assortments	inhomogeneous, no determination of: - types of preservatives - quantity and quality of treatment	none: products come from different fields of application	mixture is usual