

PROJECT SUMMARY SHEET

TITLE: Extent of CCA-Treated Wood Used for Commercial Mulch

COMPLETION DATE: October 31, 2003

PRINCIPAL INVESTIGATOR: Helena Solo-Gabriele, Assistant Professor

AFFILIATION: University of Miami, Dept. of Civil, Arch., & Environ. Engineering

ASSOCIATE INVESTIGATOR: Timothy Townsend, Assistant Professor

AFFILIATION: University of Florida, Dept. of Environ. Engrg. Sci., Solid & Haz Waste Prog.

STUDENTS: Upon initiation of the study, both Drs. Solo-Gabriele and Townsend will recruit students for this project. It is likely that students working on current and past CCA projects (e.g. Bernine Khan, Gary Jacobi, Ken Brown from U.Miami and Jenna Jambeck, Dubey Kumar, Thabet Tolaymat from U.Florida) will be involved in the proposed project described herein.

OBJECTIVES: The objectives of this study are to conduct a preliminary study to determine the extent to which mulch purchased by the Florida consumer is contaminated with CCA and to preliminarily assess the adequacy of visual methods in establishing whether or not a mulch contains CCA-treated wood. Specifically, this study will document the leaching characteristics and fraction of CCA-treated wood found in commercially-available mulches. Visual methods will focus on inspection of samples for remnants of engineered wood (e.g. plywood and particle-board) and the adequacy of chemical stains for detecting the presence of CCA.

METHODOLOGY: Mulches will be purchased from both retail establishments located in South Florida and from mulch currently in use, such as that found in playgrounds. Analysis of these samples will include quantifying the fraction of CCA-treated wood within these mulches and the amount of leachable As, Cr, and Cu. Relevant information concerning each sample will be carefully documented including brand of mulch, store name, color, price, etc.. All of the mulches will be visually inspected prior to analysis. Visual inspection will focus on documenting the presence of remnants of engineered wood. The mulch will be also stained using the CCA stains developed through prior studies in order to establish their utility in identifying contaminated mulch samples.

RATIONALE: Concern has been voiced by consumers about the potential contamination of mulch existing within their homes. This study will preliminarily document the extent to which CCA contaminated mulch is sold within south Florida. The data can be used by regulatory agencies to determine whether policy should be adopted which prevents mulch contamination. The visual inspection methods preliminarily evaluated through this study can be used to determine whether CCA-contaminated mulches are easily identified at the point of purchase or use.

ACCOMPLISHMENTS: Drs. Solo-Gabriele and Townsend have worked on CCA-treated wood projects for the Center for the past five years. They have presented their research results at many conferences and meetings, have produced five technical reports on the subject for the Center, and have published their work in peer-reviewed journals. They have collectively graduated 6 masters students on Center sponsored CCA projects and have 2 masters and 2 Ph.D. students currently working on the existing Center projects.

EXTENT OF CCA-TREATED WOOD USED FOR COMMERCIAL MULCH (2002 – 2003)

A Research Proposal Submitted to
The Florida Center for Solid and Hazardous Waste Management (FCSHWM)
June 3, 2002

Abstract

The contamination of commercially-available mulch with CCA-treated wood is of concern due to potential impacts on human health and the environment. Mulch is of special concern due to its small particle size which promotes leaching of CCA and which enhances its ability to become airborne. The primary objectives of this study are to preliminarily assess the extent to which commercially-available mulch is contaminated within the State of Florida. Samples will be collected from retail establishments and from sources of mulch currently in use, such as playgrounds. Samples will be analyzed for: a) the amount of arsenic, chromium, and copper leached and b) the fraction of CCA-treated wood within the entire mulch sample. Furthermore, data will be collected concerning the brand of mulch and visual characteristics that can potentially be used to identify the presence of CCA. Results of this study can be used by regulatory agencies and retail establishments to establish policy concerning quality of mulch sold to consumers. It will also be helpful in providing consumers with some piece-of-mind concerning the quality of mulch sold within south Florida.

Introduction and Objectives

The primary disposal pathway for CCA-treated wood in Florida is through construction and demolition (C&D) facilities. Once within these facilities the treated wood is ultimately disposed through one of three methods: in C&D landfills which are generally unlined in Florida, recycled as fuel, or used for the production of mulch. Among these three practices the recycling of C&D wood, which may contain some CCA-treated wood, is the most troubling because of: 1) the direct contact by Florida residents with the ground-up material and 2) due to the increase in surface area of the wood which would promote leaching of CCA chemicals if the wood is contaminated.

The potential for C&D wood to contain CCA-treated wood has been well documented. Samples collected from 12 facilities in Florida during 1996 contained 6% CCA-treated wood on average. Wood waste was again characterized during 1999 at 3 C&D facilities, two of which practiced visual sorting of CCA-treated wood. The C&D wood waste during the 1999 study was characterized by 9 to 30% CCA-treated wood. During 2001, an extensive wood waste characterization study conducted at one facility located in Florida found that 22% of the incoming wood waste stream was CCA-treated (Solo-Gabriele and Townsend 1999; Tolaymat et

al. 2000; Blassino et al. 2001; Solo-Gabriele et al., 2001). These results indicate that there is a high likelihood that recycled C&D wood contains considerable amounts of CCA, so care must be taken concerning how C&D wood is recycled.

A major market for recycled C&D wood includes residential and commercial landscaping. Typically, C&D wood used for mulch is dyed to mask the typical grayish color associated with recycled C&D wood. In particular, the use of the red-colored mulch and to a lesser extent green-gold-, and black- colored mulch, has become very popular in Florida. The red mulch has become so popular that even wood made from pure vegetative wood, from non-C&D sources, is now available in distinctive dye-enhanced colors.

A preliminary study was conducted to evaluate the leaching characteristics of mulch material in Florida (Townsend et al. 2000). The samples evaluated included mulch samples from 20 C&D facilities, 3 yard waste facilities, 3 retail stores (colored mulch), and 3 retail stores (vegetative mulch). Results indicated that of the 20 C&D mulch samples, 18 exceeded Florida's Groundwater Clean-up Target Level (GWCTL) for arsenic and 5 exceeded for chromium. Two of the three colored mulches purchased from retail establishments exceeded the GWCTL for arsenic. One of the yard waste samples exceeded the arsenic GWCTL and one exceeded the chromium GWCTL. None of the vegetative mulch samples (e.g. cypress mulch / pine bark mulch) exceeded the GWCTL's. The results from this preliminary study are troubling given that it documents that contaminated mulch is being sold at retail establishments to unsuspecting consumers.

A considerable amount of media attention has been given to the observation that mulch purchased at retail establishments may be contaminated with CCA. (A newspaper article and copy of video were provided to Mr. Schert during the pre-proposal stage for those reviewers interested.) Given this coverage, home owners, gardeners, child care centers, and schools have contacted members of the research team asking for additional guidance concerning how to recognize mulch that may be contaminated. Samples from these concerned citizens were mailed by these citizens to members of the research team and analyzed on a case-by-case basis using a few different methods including chemical stains and some leaching tests. It was found that some of these mulches from concerned citizens did contain CCA-treated wood whereas others did not.

The tests on mulch from retail establishments and homeowners to date are limited and somewhat disjointed. The more "organized" evaluation included only 3 samples of commercial red mulch and only evaluated the leaching characteristics of these samples. The remaining samples obtained from concerned citizens were evaluated in a different manner depending upon the researcher contacted and communications with the citizen. In this earlier work, if there was an attempt to determine the quantity of CCA-treated wood in the mulch mix, it was based upon the use of chemical stains which is useful for establishing the presence of CCA but imprecise for establishing the fraction of CCA within the wood mix. Furthermore, the stains did not work well when the mulch was colored. These preliminary studies are sufficient, nevertheless, to indicate that there is a problem associated with contaminated mulch, but it is not sufficient to establish the extent of this problem.

The overall goals of this study are to preliminarily assess the extent to which mulch purchased by the south Florida consumer is contaminated with CCA and to preliminarily evaluate the adequacy of visual methods in establishing whether or not a mulch sample contains CCA-treated wood. Specifically, during this project, mulches will be purchased from both retail establishments located throughout Florida and from mulch currently in use, such as that found in playgrounds. Analysis of these samples will include quantifying the fraction of CCA-treated wood within these mulches and the amount of leachable As, Cr, and Cu. All of the mulches will be visually inspected prior to analysis. Visual inspection will include whether or not the mulch contains remnants of engineered wood, such as plywood or particleboard, and the mulch will be stained using the CCA stains developed through prior studies (Blassino et al. 2001). The visual inspection will be used to determine whether CCA-contaminated mulches are easily identified at the point of purchase or use.

Methods - Scientific Approach

Phase I: Sample Collection

Twenty samples will be collected from retail establishments or playgrounds located in south Florida. Relevant information concerning each sample will be carefully documented including the date and time of purchase, store name, street address of store, brand of mulch, color, and price.

Phase II: Sample Pre-Processing

Pre-processing of the samples will consist of two parts. The first part is visual inspection which will include closely observing the mulch for evidence that it came from C&D wood. This includes looking for the presence of engineered wood such as remnants of plywood, particleboard, painted wood and in some cases plastics. The visual evidence of C&D wood, if found in the samples, will be carefully documented. Furthermore, mulch samples will be stained using the CCA stains developed in this study to establish the reliability of this quick analysis method. For mulch samples that are very soiled and/or colored, efforts will be made to “wash” the samples in an attempt to remove enough debris to enable the stains to function properly. This “washing” practice was found to work very well with heavily soiled mulch samples. It is yet to be shown the extent to which dyed-mulch can be “washed.”

The second part of pre-processing the samples is to ash a sub-sample of the mulch. The ashing is a necessary step in the analytical method used to determine the fraction of CCA-treated wood within the mulch sample. The wood samples will be ashed under controlled conditions in the laboratory.

Phase III: Sample Analysis

For every mulch sample collected, there will be a set of paired processed sub-samples. This will include a sub-sample of the unburned mulch as purchased at the store and a separate ash sample. The unburned mulch sample will be subjected to standard SPLP (Synthetic Precipitation Leaching Procedure) (USEPA 1996) to determine the amount of leachable arsenic, chromium, and copper. The SPLP test is used by regulatory agencies to evaluate recycled wastes that may come into contact with rainwater. The results of the tests are compared to groundwater clean-up target levels to determine whether or not it is in the best interest of the population and

environment to dispose of the waste in areas where contact with rainwater is likely. This set of analyses will be useful for regulators in establishing policy concerning whether or not CCA-contaminated mulch should be recycled. The second set of tests focus on the analyses of the ashed samples. The ashed samples will be analyzed as per protocol developed by Tolaymat et al. 2000. The protocol requires that the ash be digested and filtered. The filtrate is then analyzed for chromium, copper, and arsenic using either an atomic absorption spectrophotometer or an inductively coupled plasma. The purpose of the ash analysis is to determine the fraction of CCA-treated wood within each mulch sample. Such data can be used in conjunction with the SPLP results to establish the CCA fraction which causes excessive leaching of metals.

All analyses will follow standard quality control/quality assurance protocols. Blanks and replicates will be included to assure high data quality.

Timeline

Project Duration: 1.3 years

Project Start Date: July 1, 2002 Project End Date: October 31, 2003

Description	2002						2003										
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	
Phase I: Sample Collection	°	°	°	°	X												
Phase II: Sample Pre-processing	°	°	°	°	°	°	X										
Phase III: Sample Analysis				°	°	°	°	°	°	°	°	°	X				
Progress Reports			X			X			X			X					
TAG Meetings							X						X				
Draft Report												°	°	X			
Final Report														°	°	X	

A draft of the final report will be available in August 2003. The report will be finalized by October 2003, after comments are received from the Center and from the TAG.

Deliverables

Due to limited funds within the project, no additional technical awareness group (TAG) meetings will be held in conjunction with this project. Rather, results from this project will be reported during the TAG meetings for the existing projects. A final report will be prepared which documents the methods and results from both phases of the research. The current web site, www.ccaresearch.org, will continue to be maintained and updated throughout the duration of the project. Quarterly progress reports, minutes of the technical advisory group meetings, technology transfer plan, etc.. will be submitted to the Center as required.

Expected Technical Results

This study will preliminarily characterize mulch sold at commercial establishments within south Florida. Characteristics documented for each mulch sample will include: leachability of arsenic, chromium, and copper using SPLP tests, the fraction of CCA-treated wood within the sample, visual characteristics including remnants of engineered / recycled wood, and their staining characteristics. All of this information will be linked to the brand of mulch, the retail establishment that sold the mulch, and the particular use of the mulch if it was collected directly from the field. This later information will be made available to the Florida Department of Environmental Protection.

Anticipated Benefits

The results of this study will preliminarily quantify the extent to which CCA-treated wood is found in commercially-available mulch in south Florida. These results can be used by the State regulatory agencies to determine whether a more extensive study is needed.

If the visual inspection of the mulch (e.g. presence of plywood and particle-board) is found to be helpful in establishing the potential presence of CCA, then an additional study can be initiated to determine whether such a practice can be invoked through-out the state to screen mulch for the presence of CCA. Such a screening method, due to its simplicity, can be used by the regulatory agencies, retail stores, and consumers.

Related Work

The research team has conducted a considerable amount of research work evaluating disposal pathways for CCA-treated wood. This research has shown that CCA-treated wood does contaminate C&D wood used for recycling purposes and has provided *preliminary* evidence indicating that contaminated mulch is being sold at commercial establishments. (Please refer to the introduction of this proposal for details concerning the preliminary evidence.) The current proposed study will provide thorough documentation of the extent to which CCA is contaminating commercially-available mulch and will evaluate methods by which to visually recognize CCA contamination. The only other mulch study that the research team is aware of is one conducted by a local television station in Miami that evaluated two mulch samples purchased from a retail establishment. These samples were visually-inspected by Dr. Solo-Gabriele and analyzed in Dr. Townsend's lab at U.Florida. The one that contained remnants of engineered wood was found to leach arsenic; the sample that did not contain remnants of engineered wood did not leach arsenic. A videotape copy of this mini-study conducted by the local television station was provided to Mr. John Schert during the submission of the pre-proposal for this proposed project. Other than the preliminary work conducted by the research team and the two samples evaluated by a local Miami television network, there are no other studies, to the knowledge of the research team, which have systematically evaluated CCA contamination of mulch.

Studies that are relevant to the proposed study described herein include the work by Dr. Lena Ma evaluating background concentrations of metals (chromium, copper, and arsenic) in natural and urban areas and the proposed study titled, "Soil-based Retention Indices of Copper, Chromium, and Arsenic for Soils Exposed to CCA-Treated Wood Products." These studies would be of interest if the project were expanded to evaluate soil contamination due to CCA contaminated mulch.

Separation of Work Among the Universities

Helena Solo-Gabriele will be responsible for all administrative activities required by the Center, and for all deliverables. She will also be responsible for directly supervising Phases I and II of the project. Tim Townsend will be responsible for supervising Phase III. Although both PIs have separate work phases, they plan to coordinate their research efforts in the most effective manner possible. The budget for Dr. Townsend's portion of the work (an equivalent to \$3000) will come from the RCRA sub-contract.

Pertinent Literature and References

- Blassino, M., Solo-Gabriele, H., and Townsend, T., 2001. "Sorting Technologies for CCA-Treated Wood Waste." *Waste Management Research*, (in press).
- Solo-Gabriele, H.M., and Townsend, T., 1999. "Disposal Practices and Management Alternatives for CCA-Treated Wood Waste." *Waste Management Research*, 17: 378-389.
- Solo-Gabriele, H., Townsend, T., Kormienko, M., Stook, K., Gary, K., and Tolaymat, T., 2000. *Alternative Chemicals and Improved Disposal-End Management Practices for CCA-treated Wood*. Final Technical Report #00-03. Florida Center for Solid and Hazardous Waste, Gainesville, FL.
- Solo-Gabriele, H.M., Townsend, T., Hahn, D, Hosein, N., Jacobi, G., Jambeck, J., Moskal, T., Iida, K., 2001. *On-Line Sorting Technologies for CCA-Treated Wood*. Florida Department of Environmental Protection, Innovative Recycling Grants Program, Tallahassee, Fl.
- Tolaymat, T.M., Townsend, T.G., and Solo-Gabriele, H., 2000. Chromated copper arsenate Treated wood in recovered construction and demolition waste recycling facilities. *Environmental Engineering Science*, 17(1): 19-28.
- Townsend, T., Solo-Gabriele, H., Stook, K., Hosein, N., Tolaymat, T., Khan, B., Song, J.K., 2000. New Lines of CCA-Treated Wood Research: In-Service and Disposal Issues, Report #00-12. Florida Center for Solid and Hazardous Waste Management, Gainesville, Florida.
- U.S. Environmental Protection Agency, 1996. Test Methods for Evaluating Solid Waste, SW846, 3rd Edition. Office of Solid Waste and Emergency Response, Washington D.C.