Agenda for TAG Meeting
Monday, May 6, 2002, 11 am to 3 pm
New Engineering Building, Room 100
University of Florida Campus, Gainesville, Florida

<u>Introduction</u>

1. Welcome
2. History of Florida CCA Research — Solo-G/Townsend

<u>Florida Center for Solid and Hazardous Waste Sponsored Research (FCSHWM)</u> with Florida Power and Light, matching funds

4. Background Information Concerning FCSHWM — Schert

5. Review of "Year 4" Report Titled, "Leaching and Toxicity of CCA-Treated and Alternative-Treated Wood Products"
   - Leaching of Alt. Chemical Treated Wood — Townsend
   - Toxicity of Alt. Chemical Treated Wood — Townsend

6. Progress to Date on "Year 5" Study
   - Arsenic Speciation of CCA-Treated Wood Samples — Khan
   - Complimentary Study on Cr Speciation — Townsend/Song

7. Research Plan and Progress to Date on "Year 6" Study
   - Lysimeter Study — Jambeck
   - Arsenic Mass Balance — Sakura-L/Jambeck

<u>Research Funded by the National Institutes of Environmental Health Sciences</u>

8. Research Plan for Project Titled, "Impacts of Arsenic from CCA-Treated Wood in Marine and Terrestrial Environments." — Solo-G
   - Arsenic Speciation in Soils — Cai/Georgiadis

9. Regulatory Implications — Kastury/Hinkley

Refreshments Will Be Available.

Minutes of the May 6, 2002 Meeting Held at
the University of Florida
Gainesville, Florida

<u>Attendees</u>:
Kevin Archer, Chemical Specialties Inc., Charlotte, NC
Bill Baldwin, Arch Wood Treatment Inc., Smyrna, GA
Parker Brugge, American Wood Preservers' Association, Fairfax, VA
Yong Cai, Florida International University, Miami, FL
David Dee, Landers & Parsons, Tallahassee, FL
Brajesh Dubey, University of Florida, Gainesville, FL
Bill Gay, Langdale Forest Products, Valdosta, GA
Sam Levin, S2L Incorporated, Maitland, FL
Myron Georgiadis, Florida International University, Miami, FL
Belinda Gruthpietz, University of Florida, Gainesville, FL
Julie Hauserman, St. Petersburg Times, Tallahassee, FL
Sheree Henninger, Orange County Environmental Protection Division, Orlando, FL
Jim Hickman, Langdale Forest Products, Valdosta, GA
Bill Hinkley, Florida Dept. of Environ. Protection, Tallahassee, FL
David Hodge, Kuykendall and Associates, Birmingham, AL
John Horton, Osmose Inc., Griffin, GA
Jenna Jambeck, University of Florida, Gainesville, FL
Bernine Khan, University of Miami, Coral Gables, FL
Anne Kimball, Wildman, Harrold, Allen & Dixon, Chicago, IL
Sam Levin, S2L Incorporated, Maitland, FL
Marcia Lewis, Florida Center for Solid and Haz. Waste Mgt., Gainesville, FL
Alisa Marchionno, University of Florida, Gainesville, FL
Lee Martin, Florida Dept. of Environ. Protection, Tallahassee, FL
Ron Matus, Gainesville Sun, Gainesville, FL
Carolyn McCreedy, Waste Management Inc. of Florida, Okeechobee, FL
Hugh McNeely, Simien & Simien, Baton Rouge, LA
Mel H. Pine, American Wood Preservers' Institute, Fairfax, VA
Ray Moreau, Southern Waste Information Exchange Inc., Tallahassee, FL
Gus Olmos, Alachua County Environmental Protection Dept., Gainesville, FL
Mel Pine, American Wood Preservers' Association, Fairfax, VA
Joe Prager, Publisher – bancca.org, Gainesville, FL
Jay Robbins, Robbins Manufacturing, Tampa, FL
Rhonda Rogers, Florida Center for Solid and Haz. Waste Mgt., Gainesville, FL
John Schert, Florida Center for Solid and Haz. Waste Mgt., Gainesville, FL
Jim Seufert, Universal Forest Products, Grand Rapids, MI
Jimmy Simien, Simien & Simien, Baton Rouge, LA
Helena Solo-Gabriele, University of Miami, Coral Gables, FL
Jin-Kun Song, University of Florida, Gainesville, FL
Gus Staats, Osmose Wood Preserving Division, Griffin, GA
Kim Stenger, Florida Center for Solid and Haz. Waste Mgt., Gainesville, FL
Diana Stetter, Florida Center for Solid and Haz. Waste Mgt., Gainesville, FL

Don Surrency, Koppers Industries Inc., Gainesville, FL
John H. Taylor, Osmose Inc., Griffin, GA
Richard Tedder, Florida Dept. of Environ. Protection, Tallahassee, FL
Thabet Tolaymat, University of Florida, Gainesville, FL
Timothy Townsend, University of Florida, Gainesville, FL
Kevin Vann, University of Florida, Gainesville, FL
Lakmini Wadanambi, University of Florida, Gainesville, FL

The meeting began at 11:05 am and adjourned at 3:15 pm. The participants took a 45 minute break for lunch at approximately 12:30 pm.

1. Welcome

Helena Solo-Gabriele welcomed the meeting attendees. Each attendee introduced themselves by stating their name and affiliation. Helena Solo-Gabriele reviewed the agenda and mentioned that she will be working from home this summer due to the recent birth of her second daughter. The best way to contact her is through email.

2. History of Florida CCA Research

Helena Solo-Gabriele described the history of the CCA-treated wood research. She mentioned that primary funds for this research have been obtained from the Florida Center for Solid and Hazardous Waste Management. Funds have also been obtained from Florida Power and Light, Sarasota County/Florida Department of Environmental Protection, and Florida International University/National Institutes for Environmental Health Science. Active faculty researchers on the project include herself of the University of Miami, Dr. Timothy Townsend of the University of Florida, and Dr. Yong Cai of Florida International University. She also acknowledge the work of numerous students who have been supported on the project. Background information concerning CCA-treated wood was provided including a description of the original motivation for research. The original motivation was due to an ash contamination problem from cogeneration plants located in Florida that would burn recycled construction and demolition (C&D) wood. Due to this problem, research was initiated during year 1 (1996-1997) to develop a disposal forecast for CCA-treated wood and to determine the disposal routes for the waste. Research has shown that CCA-treated wood is disposed through C&D recycling facilities. Markets for C&D waste wood include wood for cogeneration and for use as mulch. Given the problems associated with the disposal of CCA-treated wood identified during year 1, the focus of year 2 (1997-1998) was to develop potential solutions to the disposal problems. The focus of research during year 2 was to conduct leaching studies of CCA-treated wood ash and to conduct sorting studies for identifying CCA-treated wood within the waste stream. During year 3 (1998-1999), research again focused on disposal-end management plus evaluating an option for waste minimization in the form of utilizing alternative-chemical treated wood. The 4 most promising alternatives to CCA identified in this study included ACQ, CBA, CC, and

CDDC. During the year 3 project, the research team was invited to the Minnesota Proceedings which focused on a potential ban on CCA-treated wood within that particular State. One of the observations from this meeting was the lack of scientific data. As a result, the research team applied for supplemental funds to evaluate: the impacts of CCA-treated wood during its in-service use, to quantify use sectors for CCA-treated wood, to evaluate leaching of CCA-treated wood and C&D wood mulch, and to conduct a literature review on laboratory analytical methods for evaluating arsenic/chromium species and for evaluating alternative chemicals in solution. The results of the "year 3 supplemental" were briefly reviewed. In addition to the Center funded research, a study focusing on sorting CCA-treated wood from untreated wood was funded through the Sarasota County/FDEP Innovative Recycling Grants Program. The sorting study focused on the use of laser and x-ray technologies for identifying CCA-treated wood within the waste stream. Results from this study indicate that both technologies are very promising. Research recently completed include the year 4 study focusing on leaching and toxicity of CCA-treated wood and alternative chemical treated wood. On-going research includes evaluation of arsenic and chromium species in CCA-treated wood and a new deck study funded by FIU/NIEHS.

<u>Questions</u>

Bill Hinkley: The disposal forecast shows a large future increase in disposal quantities. Has there been other studies showing that we may be higher on the disposal forecast curve than shown?

Helena Solo-Gabriele: Our model assumes a service life of 25 years for lumber and timbers and a service life of 40 years for utility poles. The 40 year service life for utility poles corresponds to a the value used by Florida Power and Light for their budgeting purposes. The 25 year service life for lumber and timbers is supported by the literature. However, there is one extensive study where carpenters were interviewed. This study indicates that the average service life for decks is approximately 13 years. With a 13 year service life for lumber and timbers the disposal forecast would shift forward but we would still be on the upward side of the disposal forecast.

3. <u>Review of "Year 4" Report Titled, "Leaching and Toxicity of CCA-Treated and Alternative-Treated Wood Products</u>"

Tim Townsend mentioned that the rationale for conducting this portion of the study was because the aquatic toxicity of chemical alternatives to CCA was of concern. The objectives of the study was to conduct side-by-side comparisons of CCA-treated wood and alternative-chemical treated wood with respect to chemical leaching and aquatic toxicity of the leachates. Experiments were conducted with untreated wood and with CCA-, ACQ-, CBA-, CC-, and CDDC-treated wood. Leaching tests included the SPLP, TCLP, and leaching tests with synthetic seawater and deionized water. Each component of each chemical preservative was measured. Leaching data indicate that the amount of arsenic leached was a function of the leaching solution used. For the CCA samples, more copper was leached using the TCLP and seawater extraction fluid than with de-ionized water and the SPLP fluid. Similar results were observed for the CBA-treated wood. General observations include that for copper, the TCLP solution and saltwater extract the most. The TCLP fluid extracts the most chromium. Arsenic leaching is approximately equal for TCLP, SPLP, and DI. Organic chemicals for the most part leach independent of leaching fluid. When considering the alternative chemical treated wood it was found that copper concentrations were greater in the leachates from the alternative-chemical treated wood samples than from the CCA-treated wood samples. The mass percentage of copper leached is higher for the alternatives.

Aquatic toxicity tests conducted in this study included the MetPLATE™ test, the Microtox test, an algal assay (*Selenastrum capricornutum*), and an invertebrate assay (*Ceriodaphnia dubia*). In general it was found that the invertebrate and algal assays were the most sensitive test methods. For the invertebrate assay it was found that CCA-treated wood was less toxic than the alternative-chemical treated wood. Similar results were observed for the algal assay with the exception that CBA-treated wood has a similar toxicity as CCA-treated wood. The toxicity of the wood samples is correlated with the copper concentration in the leaching solution. Overall results show that alternative-chemical treated wood products are expected to leach more copper. This observation raises concern since copper is a potent aquatic biocide. Additional factors including dilution, sedimentation, and complexation should be considered when evaluating the potential toxicity of treated wood. A risk approach, similar to that proposed by Brooks, is one method by which some of these additional factors can be considered. Data, not included in the draft of the report, indicates that copper leaching in the alternative-chemical treated wood is a function of time. Copper concentrations in CBA- and ACQ-treated wood were found to decrease in time. With respect to relative risk, CCA-treated wood is considered to pose a greater risk with respect to human toxicity and waste management. Results from this work indicate that risk from alternative-chemical treated wood is greater with respect to aquatic toxicity. Recommendations for future work include further evaluation of the organic co-biocides and evaluating the impacts of the alternative-chemical treated wood products under field conditions.

Questions

John Schert: The Wildwood study conducted by Ken Brooks indicated that there were no impacts from copper releases from treated wood. This study shows that saltwater leached more than de-ionized water. The greater amount of leaching is not due to pH differences but appears to be a function of chemistry.

Tim Townsend: The Wildwood study was a study that evaluated the impacts of a boardwalk within a wetland type environment. There were no impacts observed with respect to aquatic toxicity. There was no difference in the invertebrate population between the areas in the vicinity of the boardwalk and areas farther removed from the boardwalk. The lack of impact is probably due to flushing and dilution of the water within the wetland. Chemistry also likely played a large role since the copper could have been bound by humic material in the water column.

4. Background Information Concerning FCSHWM

John Schert indicated that the Florida Center for Solid and Hazardous Waste Management (FCSHWM) is a statewide research center whose mandate is to sponsor funded research. The CCA project is the longest project funded through the Center. John Schert thanked the students, faculty, and TAG members for their participation in the research process.

5. Progress to Date on "Year 5" Study, Arsenic Speciation of CCA-Treated Wood and Complimentary Study on Cr Speciation

Arsenic Speciation

Bernine Khan explained that the purpose of this portion of the study was to identify and quantify the arsenic species (As(III), As(V), MMAA, and DMAA) leached from CCA-treated wood. Speciation is of interest because the toxicity of the leachate depends upon the species of arsenic. Arsenic leaching from CCA-treated wood was evaluated through a set of three experiments. Laboratory batch experiments were utilized for the first set of experiments. These experiments included a pH stat test and a set of solvent extractions including TCLP, SPLP, de-ionized water, rainwater, and seawater. The second set of experiments consist of controlled field-scale experiments and the third set of experiments consisted of uncontrolled field-scale experiments. The controlled field tests included a lysimeter study and a deck study. The uncontrolled field-scale experiments consisted of testing groundwater and landfill leachate. Results from the pH stat experiment showed that arsenic leaching is enhanced at the extreme pH values. For new wood, As(V) was the only species detected. Both As(III) and As(V) were detected in weathered wood. More arsenic was leached from weathered wood in the near neutral pH ranges. The reason for increased leaching from weathered wood can be due to the higher retention of the weathered wood sample, the age of the wood, and the finding that the arsenic in the wood has been converted to the +3 valence which is more mobile than arsenic in the +5 valence. Results from the TCLP test for unburned CCA-treated wood indicates that the highest concentrations of As(III) were leached from the weathered wood sample. The highest concentrations of As(V) were leached from the 2.5 pcf sample. The 2.5 pcf sample leached the most As(III) and As(V) for the wood ash samples. Similar results were observed for the SPLP test. Data indicates that all samples exceeded TCLP limits for arsenic with the exception of untreated wood (unburned and ash) and the unburned 0.25 pcf sample and the unburned C&D samples. All samples exceeded SPLP limits for arsenic with the exception of untreated wood (unburned and ash) and one unburned C&D sample. Results from the de-ionized water leaching experiment using unburned wood were also similar to the results from the TCLP and SPLP test. Leachates created with de-ionized water indicates that As(III) is the predominant species in weathered wood and that the concentration of arsenic within the leachates was between 2.5 and 5 mg/L. The results from the group 2 set of experiments will be discussed in subsequent presentations. Jenna Jambeck will discuss the status of the lysimeter study and Helena Solo-Gabriele will discuss the status of the deck study. Plans for the group 3 set of experiments include re-collecting and re-analyzing groundwater and landfill leachate samples.

Questions

John Schert: Is there other literature indicating that weathered wood leaches more than new wood?

Bernine Khan: No. The literature does not show that leaching increases with the age of wood. This study indicates that not only more arsenic leaches but the toxicity of the arsenic species increases with the age of the wood. It is hypothesized that the conversion of arsenic from As(V) to As(III) is a result of microbial activity.

Bill Hinkley: I am puzzled about the first slide. The wood was rated at 0.4 pcf but when it was measured it was found to be actually 0.286 pcf. Could the sample have been mislabeled?

Response: The sample could have contained a lot of heartwood.

Richard Teddar: How was the weathered wood selected?

Helena Solo-Gabriele: There were two sets of weathered wood utilized. One corresponded to a utility pole that was provided by Florida Power and Light. Florida Power and Light maintains a pole recycling facility. The poles available at these facilities are stamped with the date when they were produced. The pole utilized for this study was 18 years old. The second set of weathered wood samples corresponded to a playground that was demolished.

Tim Townsend: The age of the playground was known. Once demolished the wood from the playground was stored under cover in a roll-off.

Chromium Speciation Presentation

Tim Townsend mentioned that the chromium speciation study was funded by the FDEP RCRA Program. He acknowledged Jin-Kun Song, the graduate student who performed the laboratory work for this project. Relevant background for the study was reviewed including the different chemical species of chromium. It was emphasized that Cr(VI) is much more toxic and mobile than Cr(III). RCRA regulations acknowledge this difference in toxicity in that a waste will not be considered hazardous based on chromium species if it can be shown that the chromium is in the +3 valence and if the waste is typically managed in a non-oxidizing environment. The soil screening level for Cr(III) is 78,000 mg/kg whereas for Cr(VI) is 390 mg/kg. Cr(VI) is typically found in alkaline and strongly oxidizing environments whereas Cr(III) exists in moderately oxidizing and reduced environments. The predominance of different species was reviewed in the context of an Eh-pH diagram. The fate of chromium during the treatment process was discussed. Chromium is present as Cr(VI) in the raw CCA treating solution. Once it is impregnated into the wood it is converted to Cr(III) as part of the fixation process. Data from Cooper and Ung, 1992, indicate that the chromium in the treating solution is converted to the +3 valence in a manner of hours.

The objective of the chromium speciation study was to examine the fate and behavior of hexavalent chromium in various environmental media impacted by CCA. Methods used for analyzing chromium species included an alkaline solvent extraction followed by total chromium analysis. The alkaline solvent extraction is designed to prevent a change in the distribution of chromium between its different species. Cr(VI) is measured in the extract using either a colorimetric method or ion chromatography (SW-846 Method 7199). The first set of experiments was designed to examine the fate of Cr(VI) in soils spiked with CCA solution. The soils were subjected to the alkaline solvent extraction procedure to measure total Cr(VI) and to an SPLP to measure leachable Cr(VI). Three soil types were evaluated: a clay soil, an organic soil, and a sandy soil. Results indicate that the total Cr(VI) concentration remained elevated in the sandy and clay soils whereas it decreased significantly in the organic soil. A similar trend was observed for the leachable Cr(VI) fraction. However, even for the organic soil, the leachable Cr(VI) concentration was above Florida's GWCTL of 0.1 mg/L for a considerable amount of time. Experiment number 2 focused on evaluating how much Cr(VI) is in CCA-treated wood. Results from the alkaline digestion of CCA-treated wood showed that Cr(VI) concentrations range from 7 to 250 mg/kg, which represents less than 3% of the total-total chromium. SPLP leachates showed no detectable Cr(VI) concentrations. The focus of experiment 3 was to evaluate the conditions during which Cr(VI) would form. Data indcates that Cr(VI) predominates under alkaline pH values. High alkaline leachates can be generated in C&D wastes that contain significant amounts of concrete, in particular if the waste is under saturated conditions. It is also recognized that some ash is characterized by a high pH. Experiment 4 focused on using an alkaline leachate to determine if Cr(VI) can be formed. It was found that Cr(VI) is leached from CCA-treated wood when subjected to a concrete leachate solution. Experiment 5 focused on evaluating whether Cr(VI) is formed during the combustion of CCA-treated wood. Ash formed from the combustion of CCA-treated wood and from recycled C&D wood indicate that Cr(VI) is the predominate chromium species leached for the 0.25 pcf sample, the weathered wood sample, and the C&D wood samples evaluated. Chromium leaching was not observed for the untreated wood sample and the 0.6 pcf and 2.5 pcf CCA-treated wood samples. It is hypothesized that the reason for the presence of Cr(VI) in some CCA ash samples is due to the presence of other chemicals within the samples. The experimentation is just about completed. Remaining tasks include the analysis of the data and preparation of the final report.

<u>Questions</u>

Bill Hinkley: These results are interesting given that Cooper's study showed that Cr(VI) was quickly reduced to Cr(III) in the real world.

Tim Townsend: The last set of data corresponded to the ash. More chromium leached from the 0.25 pcf sample and from the C&D samples. The best way to explain this observation is that there must be some specific chemical reactions that produce Cr(VI) during the combustion process. There is dirt and soil in C&D which can contribute to Cr(VI) production. It is also of interest to note that Dr. Wu of the University of Florida found that the addition of sodium carbonate to the wood prior to burning enhanced the leaching of chromium from the wood.

Bill Hinkley: How do these results fit-in with other work that focuses on the use of concrete to control H_2S leaching?

Tim Townsend: The H_2S is produced under landfill conditions due to the presence of drywall. The presence of concrete helps to remove H_2S. Therefore adding a layer of fine concrete may help in solving the H_2S problems at landfills. Now the presence of concrete will have a tendency to increase the pH of the landfill and thus encourage chromium to leach. The pH tends to be very high when the landfill is saturated. Under unsaturated conditions, the pH will generally be low enough to minimize leaching.

John Schert: What impact will oxidants have on chromium speciation?

Tim Townsend: Oxidants can potentially convert chromium from III to VI.

Helena Solo-Gabriele: Exactly what was the impact of adding sodium carbonate to the wood prior to burning?

Tim Townsend: There were two additives evaluated in Dr. Wu's study: lime and sodium carbonate. The lime addition resulted in an ash with reduced arsenic leaching but increased chromium leaching. The sodium carbonate addition resulted in an overall decrease in arsenic leaching but not as large of a reduction as observed for the lime. The sodium carbonate, however, resulted in a large increase in chromium leaching much more that what was observed for lime.

Bill Hinkley: Perhaps the press release focusing on these additives was pre-mature given the chromium results.

6. <u>Research Plan and Progress to Date on "Year 6" Study, Lysimeter and Arsenic Mass Balance Study</u>

<u>Lysimeter Study</u>

Jenna Jambeck reviewed the design of the 6 lysimeters to be used. The lysimeters are constructed of 22 ft high, 1 ft diameter, PVC columns. The leachate is produced from natural rainfall that is captured in the cap. The contents of the lysimeters are designed to simulated a CCA monofill, a C&D landfill, and a MSW landfill. The construction of the lysimeters was reviewed. The construction included a bottom concrete platform, splicing the PVC column to the appropriate length, the installation of the bottom leachate collection system, and the erection of the columns. The lysimeters are designed to capture gases that are released. The detailed contents of the lysimeters were described. Lysimeter 1 contains untreated wood; lysimeter 2 contains 50% weathered CCA-treated wood and 50% new (0.4 pcf) CCA-treated wood. The weathered CCA-treated wood came from the Kidspace demolition in Gainesville. Lysimeter 3 contains a typical C&D mix without CCA; lysimeter 4 contains a typical C&D mix with CCA-treated wood; lysimeter 5 contains MSW with untreated wood; and lysimeter 6 contains MSW with CCA-treated wood. The MSW was obtained through the Palm Beach Solid Waste Authority. Dog food was added to the MSW lysimeters to increase the organic content.

Lysimeters began operation during August and September 2002. Monitoring includes a local weather station and weekly temperature readings inside the lysimeters. Preliminary results show that the temperature fluctuates in relation to ambient temperature. Methane was recently detected in the MSW lysimeters and leachate has been generated from lysimeter number 2 only. Arsenic, chromium, and copper concentrations were provided for the leachate samples collected to date. Due to the limited amount of leachate generated, the addition of moisture above that from rainfall alone is being considered.

Questions

Bill Hinkley: Does the waste become saturated within the columns?

Jenna Jambeck: The water within the columns is designed to flow through. The columns are thus not saturated. Also the samples evaluated to date do not show the presence of Cr(VI).

Bill Hinkley: Concrete is not typically co-disposed with other wastes and so it may not be affecting the pH of the waste.

Tim Townsend: In some cases concrete blocks are co-disposed with bulk C&D waste.

Helena Solo-Gabriele: At what point will the decision be made to switch from natural rainfall to synthetic rainfall?

Jenna Jambeck: Currently it appears as though the columns are reaching their field capacity. Leachate should be generated soon. The issue of synthetic rainfall will be evaluated again at the end of this month.

Arsenic Mass Balance

Helena Solo-Gabriele mentioned that the purpose of the arsenic mass balance research was to evaluate the relative magnitude of arsenic from CCA-treated wood versus the amounts from other arsenic sources for the State of Florida. The amount of arsenic in various inputs, outputs, and reservoirs are being evaluated. Inputs evaluated included CCA-treated wood, MSMA (monosodium methylarsonate), coal, petroleum, biosolids, fish, shellfish, rainfall, and rivers. Outputs include fertilizer, air emissions from incinerator facilities, treated wastewater, and river outflow. Reservoirs evaluated include CCA-treated wood, groundwater, surface water, surface soil, and specific contaminated areas, such as golf courses impacted by MSMA. During her presentation she briefly described how each of these inputs, outputs, and reservoirs were computed. Preliminary results indicate that CCA-treated wood is the current primary arsenic input into the State of Florida. Only two of the outputs, fertilizer and river outflow, have been evaluated to date. Among the reservoirs evaluated, CCA-treated wood represents the primary reservoir of arsenic within Florida. It was emphasized that the numbers provided were preliminary and that additional work was needed before the values could be finalized. Furthermore, Helena Solo-Gabriele asked those present if there were any other inputs, outputs, or reservoirs that should be included within the mass balance computation.

<u>Questions</u>

Richard Teddar: You may wish to include limerock as an additional arsenic reservoir.

Bill Hinkley: Other arsenic sources to consider include ironite and gypsum stacks. Also, you need to consider that half of the biosolids are imported into Florida from outside the State. Not all of the fertilizer is exported.

Yong: You should also consider the arsenic that is volatilized through natural methylation processes.

Bill Hinkley: Data from the U.S. Bureau of Mines indicates that phospho-gypsum has an arsenic concentration of 42 mg/kg.

Carol McCreedy: There may be the potential for arsenic uptake by sugar cane from arsenic contaminated agricultural land. The concentration of arsenic in sugar should be measured.

David Bullock: How was the retention level of 0.45 pcf determined?

Helena Solo-Gabriele: In 1996, a questionnaire was sent to Florida wood treaters. In that questionnaire, there was a question asking about the amount of wood and retention level of that wood produced by each treater. The 0.45 pcf value is a weighted average of the data received from the responding facilities.

Jay Robbins: The retention levels prior to 1996 are likely to be much lower. Historically wood was treated at lower retention levels.

Tim Townsend: Perhaps a computation can be performed where the entire amount of CCA utilized in Florida is divided by the entire wood volume.

Helena Solo-Gabriele: We plan to check the 0.45 pcf assumption against additional industry statistics as suggested.

7. <u>Research Plan for Project Titled, "Impacts of Arsenic from CCA-Treated Wood in Marine and Terrestrial Environments</u>."

Helena Solo-Gabriele mentioned that this project was funded through Florida International University with ultimate funding through the National Institutes of Environmental Health Sciences. She reviewed the objectives of the project which included developing methods for arsenic speciation in the particulate phase and evaluating the impacts of arsenic from CCA-treated wood by measuring the species of arsenic that are leached from different einvironmental samples. The project is separated into two phases: phase I, laboratory evaluation and phase II, field evaluation. Phase I focuses on a series of leaching experiments which include the following solvents: de-ionized water, rain water, ocean water, simulated rain water (SPLP), and simulated landfill leachate (TCLP). To date all of the leaching experiments have been completed except for the rain water and ocean water tests. The field evaluation will include a deck sampling and a marine dock sampling exercise. The deck sampling study includes two decks: one CCA treated and one untreated Southern Yellow Pine. The decks will be fitted with a leachate collection system. The construction of the decks is roughly 80% complete. Helena Solo-Gabriele also mentioned that a second set of decks have been constructed at U.Florida. This second set of decks include two CCA treated decks, one ACQ treated, and one CBA treated. Marine dock sampling is yet to be initiated. The experimental design for this portion of the study will begin shortly.

Yong Cai described the goals of the laboratory-methods-development portion of the study. The goals include developing analytical techniques for arsenic speciation in leachate of CCA-treated wood and surrounding soils and to develop an analytical procedure for arsenic speciation based on the partitioning of arsenic compounds between different molecular-weight fractions in leachate. Soil speciation research focused on the use of a standard soil sample, PACS-2 which contains a total of 26 ug/g arsenic. Results of the soil speciation effort indicate that the phosphate solution extracted less than 10% of the total arsenic in the soil. It was found that the duration of the extraction did not increase the total amount of arsenic released. Results from spiking the PACS-2 standard with As(III) indicates that As(III) is converted to As(V) during the extraction process. The chemical EDTA was also tested along with the phosphate solution. It was found that EDTA does enhance the extraction of the arsenic from the soil. Speciation based upon the molecular size was completed using a series of dialysis bags which are capable of retaining a particular size molecule. The units used to describe molecular size are "Daltons." The smaller the molecular size the smaller the Dalton unit. Speciation based upon molecular size was based upon two types of dialysis bags, one that retains molecules smaller than 500 Daltons and another that retains molecules smaller than 12000 Daltons. Initial tests indicate that the percent recovery of As(III) and As(V) was very good using the dialysis bags. Results using leachate samples indicate that the majority of the arsenic is associated with molecules smaller than 500 Daltons. Overall, results to date are very promising. Work will continue to further expand the utility of this technique.

Questions

Helena Solo-Gabriele: In the last slide, for leachate number 2, when the arsenic is found outside of the bag does it mean that the arsenic is associated with the particulate fraction?

Yong: The arsenic is associated with the dissolved phase when it is outside of the dialysis bag.

8. Regulatory Implications

Helena Solo-Gabriele mentioned that she and Tim Townsend were to provide the background for the presentation. Helena Solo-Gabriele focused on the quantities of CCA-treated wood. She described the model that was used to forecast disposal and she reviewed the year by year disposal quantities as well as the cumulative quantities of CCA-treated wood purchased and disposed within Florida. The cumulative quantity of arsenic imported into the State associated with CCA-treated wood is estimated at 31,400 tons. Of this quantity, it is estimated that 29,150 tons are associated with "in-service" CCA-treated wood whereas 2,250 tons have been disposed. The 31,400 tons of arsenic is equivalent to raising a volume of water equivalent to the size of 590 Lake Okeechobees from 0 to 10 ug/L, which is the recently adopted drinking water standard. The cumulative volume of CCA-treated wood in Florida corresponds to 635 million cubic feet which is equivalent to 216,000 miles of 2" x 4"s.

Tim Townsend reviewed the data concerning the leaching of CCA-treated wood. He mentioned that the TCLP test is used to determine whether a waste is hazardous. The current TCLP limit for arsenic is 5 mg/L. CCA-treated wood is provided an exemption from being classified as a hazardous waste. TCLP data for new and weathered wood shows that CCA-treated wood usually fails the 5 mg/L arsenic limit. The 13 weathered wood samples evaluated were from Alachua County during their deconstruction of CCA treated structures. SPLP data is typically used to evaluate whether a waste will significantly impact groundwater. Again, the amount of arsenic leached from new CCA-treated wood using the SPLP leaching solution exceeds the 5 mg/L value. Arsenic concentrations in leachates from lysimeters containing C&D debris also leached measurable amounts of arsenic. The concentrations from the lysimeters exceeded drinking water standards. Leaching data for mulch also shows that mulch, in particular mulches made from recycled wood, will leach arsenic at concentrations greater than the State Groundwater Cleanup Target Level. Leaching data for ash indicate that arsenic concentrations are very high for CCA-treated wood leachates (on the order of 1000 mg/L). Leachate produced from recycled wood ash was found to exceed the 5 mg/L TCLP limit.

Bill Hinkley described the process of regulatory implementation. He emphasized that there were four areas of regulatory concern. First, is the issue of in-service use of CCA-treated wood. Sawdust is a major concern since it may not be exempted from being classified as a hazardous waste under current federal regulations. It is yet to be determined how the sawdust is to be regulated. Soil contamination is also a major issue associated with in-service uses. The Association for the Environmental Health of Soils (AEHS.com) conducted a study of State soil clean-up levels. This study shows that Florida's Soil Clean-up Target Levels are consistent with those of other states who participated in the study. The 29 mg/kg soil contamination value that was observed in the research team's deck study exceeds all of the States' soil target levels except that for Colorado. Florida's SCTLs are based upon a 10^{-6} incremental cancer risk. The risk is based upon the bioavailability of arsenic that can be ingested, inhaled, or absorbed through the skin. The model used for the risk computations is available at the FDEP web site under FDEP regulation number 62-777. The Florida leaching criteria is currently set at 29 mg/kg. This value will likely decrease to a value of 5.8 mg/kg due to the reduction of the drinking water standard from 50 ug/L to 10 ug/L. The leaching value corresponds to the amount of arsenic that is leached from a typical Florida soil that would cause an exceedence of the drinking water standard in the leachate. There is an allowance for a mixing zone below landfills. The drinking water standard must be met at the point where groundwater concentrations are measured. It is important to keep in mind that in Florida the groundwater table is a few feet below the ground surface. There are sites in Florida impacted from non-CCA sources (e.g. arsenic used for fruit ripeners and for railroad right-of-ways) that are not contaminated to the same extent as soils located below decks. Many of these sites were required to clean-up.

The second area of regulatory concern is the reuse of CCA-treated wood as mulch. Leachates from recycled wood mulch have been shown to fail the current drinking water standard of 50 ug/L. Exceedences would be more pronounced with the new 10 ug/L standard. It is emphasized that making mulch from CCA is illegal in Florida. The reason it happens is because it is difficult to identify CCA-treated wood within the wood waste stream. The manufacturers of CCA agree that CCA-treated wood should not be used for mulch. Conceptually the recycling of wood waste for mulch is excellent. It is regrettable that there is arsenic contamination in the wood.

The third area of regulatory concern focuses on the combustion of CCA-treated wood. Combustion of this waste requires further scrutiny. For facilities that have air pollution control devices, it is likely that the arsenic volatilizes in the combustion chamber and recondenses on the fly ash. What about facilities with no or limited air pollution control, for example air curtain incinerators? Communications have been made with Dr. Hahn of U.Florida to determine whether lasers can be used to detect arsenic through the plumes of air curtain incinerators. Dr. Parris of the AWPI has suggested in the past that all CCA-treated wood should be burned in incinerator facilities. If this were accomplished then the ash from all 13 incinerator facilities in Florida would fail TCLP. The TCLP limit of 5 mg/L for arsenic was derived from the drinking water standard. If the drinking water standard is lowered to 10 ug/L then the TCLP limit will likely decrease to 1 mg/L. There is the option to potentially treat the ash. There's a product called "Waste Fix" that is marketed through Wheelabrator. This product essentially modifies the pH of the ash. It is yet to be observed how long this product will be able to maintain the proper pH to minimize leaching. It would be worthwhile to revisit how ash should be treated if it is to be disposed through combustion facilities.

The fourth area of regulatory concern is land disposal. The law (403-707) describes the process for permitting C&D sites. C&D waste is defined as non-leaching and non-polluting. CCA-treated wood does not qualify as a C&D waste. Applicable Florida regulations are provided in 62-701. Bob Gruber had recommended that all CCA-treated wood be sent to a lined landfill. The repercussions from such a practice would require that CCA be banned from C&D landfills or that all C&D landfills have a liner. Prior to groundwater monitoring regulations there were 300 C&D landfills in Florida. There are now only 100, after the groundwater monitoring requirements were implemented. The C&D landfill in Alachua County does not accept CCA-treated wood. The New River Regional Landfill in Alachua also does not accept CCA-treated wood. The facilities accepting CCA-treated wood are becoming much more limited. Such a situation would promote illegal dumping, which is a major problem in Florida. The FDEP must be cautious in what policy it proposes. The options on the disposal side of the issue include requiring that C&D landfills have a liner. The burden can be placed on the generator but FDEP does not regulate the generator. C&D wood can be accepted at C&D facilities but CCA-treated wood must be sorted out. Many facilities may be able to sort.

At the arsenic conference last March data was presented that showed that some soil types in Florida, in particular those with high iron and aluminum content, can absorb arsenic. Such a finding may promote a new landfill design where such soils can be used to "pick-up" the arsenic. It is recognized that most C&D waste is non-polluting and inert so trapping the arsenic in the soil appears to be a very promising alternative. There are also more exotic approaches including pyrolysis processes such as the Chartherm process in France. Tom Marr of Osmose had discussed the potential for running a pyrolysis process to recover the metals. Permitting will be awkward for a pyrolysis system.

No regulations focusing of the CCA-treated wood disposal problem have been implemented to date. There are no new regulations yet.

Questions

David Dee: Is there a likelihood that CCA will be incinerated?

Bill Hinkley: The cost for incineration is $60 to $80 per ton. Due to the costs, incineration is not likely.

Bill Hinkley: Is Waste Management accepting poles?

Carol McCreedy: Yes, the poles are disposed without shredding. The poles that have been disposed are primarily creosote treated.

Bill Hinkley: Perhaps one option is a pole monofill. However, poles represent only 5% of CCA-treated wood.

Sheree Henninger: Utility poles are treated at a higher retention level so perhaps the fraction would be larger if the amount of arsenic were considered.

Helena Solo-Gabriele: The 5% value for utility poles was computed based on the arsenic content and not on the wood volume.