Agenda for TAG Meeting
Thursday, January 11, 2001, 10 am to 2 pm
Learning Center Room 180 (NOTE: ROOM CHANGE)
University of Miami Campus, Coral Gables (Miami), FL

Introduction

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

Sorting Study (Sarasota County, Innovative Recycling Grant)

3. On-Line Sorting Technologies for CCA-Treated Wood
    - Shelter — Carlsen/Townsend
    - Conveyor — Hosein/Solo-Gabriele
    - Detector — Hahn/Moskal/Solo-G

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

4. Background Information Concerning FCSHWM Schert

5. Year 3 Supplemental
   Summary of Final Results
    - Leaching Tests, Unburned Wood — Townsend/Tolaymat
    - Major Use Sectors of CCA — Hosein
    - Deck Study: Sampling — Hosein
      Results — Townsend
    - Comments on Draft of Final Report — Solo-Gabriele

6. Year 4
    - Leaching of Alt. Chemical Treated Wood — Stook/Khan
    - Arsenic Speciation — Khan
    - Complimentary Study on Cr Speciation — Townsend/Song

7. Proposed Research Plan for "Year 5" (Funding is Pending for this Proposal)

8. Future Innovative Recycling Grant Proposal – Focus on Ultimate Disposal
    - Pyrolysis
      (Description of Field Trip to Jean Hery's Facility in France)
      Townsend/Schert
    - Wood Cement Composites
      (Description of Field Trip to Bill Loftus's Facility in Florida)
      Solo-Gabriele/Townsend

Refreshments Will Be Available.

Minutes of the January 11, 2001 Meeting Held at the
University of Miami Campus, Room LC170
Coral Gables, Florida

<u>Attendees</u>
Kevin Archer, Product Development Manager, Chemical Specialties Inc, Charlotte, NC

Mark Bingham, Delta Recycling, Miami, FL

David Bullock, Wood Protection Products, Charlotte, NC

Jenna Carlson, University of Florida, Gainesville, FL

Lee Casey, Metro-Dade County Dept. of Solid Waste Mgt., Miami, FL

Robert Clinton, Demolition Industry, Florida

James Cooper, Florida Department of Agriculture and Consumer Services, Tallahassee, FL

Louis DiVita, Delta Recycling Corp., Pompano Beach, FL

Keith Drescher, Florida Power and Light, West Palm Beach, FL

Jeffrey Fehrs, Consultant, Williston, VT

Bob Gruber, Arch Wood Treatment, Smyrna, GA

David Hahn, University of Florida, Gainesville, FL

Jim Healey, Koppers Industries, Inc., Gainesville, FL

Jim Hickman, Langdale Forest Products Co, Valdosta, GA

William Hinkley, Florida Department of Environmental Protection, Tallahassee, FL

Naila Hosein, University of Miami, Coral Gables, FL

Gary Hurst, Robbins Manufacturing, Tampa, FL

Robert Johns, Miami-Dade County DERM, Miami, FL

Mitch Kessler, TIA Solid Waste Management Consultants, Inc., Tampa, FL

Russell Ketchem, Florida Power and Light, West Palm Beach, FL

Bernine Khan, University of Miami, Coral Gables, FL

Frank Klasnick, Osmose, Inc., Griffin, GA

Robert Klenk, Klenks C&C Landfill, Port Orange, FL

William Krumbholz, Department of Environmental Protection Solid Waste Division, Ft. Myers, FL

Dave Mason, Southern Forest Products Association, Kenner, LA

Eric McLaughlin, Flagler Construction & Demolition Site Inc., Bunnell, FL

Jerry McMullan, Florida Power and Light Company, West Palm Beach, FL

Rhonda Moll, U.S. Biosystems, Pembroke Pines, FL

Tom Moskcol, University of Florida, Gainesville, FL

George Parris, Ph.D., American Wood Preservers Institute, Fairfax, VA

Mike Petrovich, Hopping Green Sams & Smith, P.A., Tallahassee, FL

Mel Pine, American Wood Preservers Institute, Fairfax, VA

Jay Robbins, Robbins Manufacturing Corporation, Tampa, FL

John Schert, Florida Center for Solid and Hazardous Waste Management, Gainesville, FL

Jim Seufert, Universal Forest Products, Grand Rapids, MI

Helena Solo-Gabriele, University of Miami, Coral Gables, FL

Kristin Stook, University of Florida, Gainesville, FL

Yadly St. Fort, University of Miami, Coral Gables, FL

Donald Surrency, Koppers Industries, Inc., Gainesville, FL

Ram Tewari, Ph.D, Broward County Commission Solid Waste Operations Division, Ft. Lauderdale, FL

Timothy Townsend, Ph.D., University of Florida, Gainesville, FL

Sermin Unsal, Broward County Department of Planning & Environmental Protection, Ft. Lauderdale, FL

Brad Waller, Hydrologic Associates, Miami, FL

Richard Wilkins, Pollution Prevention & Remediation Division, Ft. Lauderdale, FL

The meeting began at 10:05 am and ended 2:10 pm. The meeting adjourned for lunch between 11:45 am and 12:20 pm.

1. Welcome and Introduction of Meeting Attendees

Helena Solo-Gabriele welcomed the meeting attendees and all participants introduced themselves by stating their name and affiliation.

2. History of Research Project on CCA-Treated Wood

Helena Solo-Gabriele indicated that funding for this research was obtained from three sources. Funds were received for the past four years from the Florida Center for Solid and Hazardous Waste Management (FCSHWM). Matching funds have obtained from Florida Power and Light Company. More recently funds have been received from Sarasota County. Faculty and students working on the project were listed. Background information for the project was presented, including an emphasis on the strict disposal guidelines for arsenic and a description of retention levels for various treated wood products. The motivation for the project was due to the elevated arsenic and chromium concentrations found in the ash from cogeneration facilities. The history of the project was presented on a year by year basis. During year 1 the purpose of the project was to develop a disposal forecast for CCA-treated wood and to identify the reservoirs for disposal. The primary disposal routes during 1996 were through construction and demolition (C&D) recycling facilities and through wood burning facilities. The use of C&D wood as mulch appears to be gaining a larger share of the market since 1996. The year 2 project focused on leaching studies on CCA-treated wood ash and on sorting methods (chemical stains and x-ray technology) for separating CCA-treated wood from other wood types. The year 3 project focused on chemical alternatives to CCA-treated wood (ACQ, CBA, CC, and CDDC) and on three sub-tasks focused on disposal-end management. These sub-tasks included testing the chemical stains in the field, an evaluation of pyrolysis technology through a literature review, and development of a resource book for the wood disposal sector. The year 3 supplemental study has been recently completed and will be described in more detail. On-going work that will also be described in more detail include the year 4, year 5, and Sarasota County projects.

<u>Questions</u>

Mark Bingham: What was the variability of the results of the Lena Ma study concerning background arsenic concentrations in soils?
Response: The geometric mean for arsenic was 0.4 mg/kg. Between 70 to 80% of the soils tested were below this value.

Lou DiVita: Is x-ray technology feasible for on-line sorting?
Response: The technology of choice for use in Sarasota County is based upon the use of lasers. The laser can hit the wood sample at a distance that varies between + or – 4 inches. We plan to evaluate the use of x-ray technology; however, the x-ray detector must be within 1 inch of the wood to analyze it.

Mike Petrovich: Has the Lena Ma study been peer reviewed, in particular has the statistical analysis been reviewed?
Response: The study has been published in a few peer reviewed journals. John Schert added that the study has undergone extensive review. Some adjustments were made in the statistical analysis prior to it's final posting.

3. <u>On-Line Sorting Technologies for CCA-Treated Wood</u>
(Sarasota County, Innovative Recycling Grant).

Helena Solo-Gabriele described the objective of the project which is to construct and operate an on-line sorting system for separating CCA-treated wood from untreated wood. The reason that sorting is important is because significant quantities of CCA-treated wood are co-mingled with untreated wood at C&D recycling facilities. This wood is then recycled as wood fuel or mulch. Studies conducted in 1996 showed that treated wood represented roughly 6% of recycled wood waste at C&D facilities. In 1999, wood piles at three facilities indicated that between 9 to 30% of the wood pile consisted of CCA-treated wood. These values are consistent with U.S. production statistics for southern pine as reported by the Southern Forest Products Association (SFPA). The five tasks of the project were reviewed and the overall timeline was presented.

The construction of the shelter was described by Jenna Carlson. The building is 30 feet by 40 feet by 15 feet high. It consists of an engineered concrete slab with a portal frame support for the roof. The metal shelter roof support was designed and fabricated by Trident. The concrete slab was designed by Sarasota County. The concrete formwork was provided by Meyer and Gabbert. The concrete pour, anchor bolts, and project management was coordinated by Anderson and Ellis. The electrical work was provided by Claxton Electric. The formwork for the concrete pour was completed on December 21, 2000. The main electrical conduit was installed on December 27th, 2000. The concrete was poured on December 29th, 2000. The shelter was assembled on January 6, 2001. Future work includes construction of the interior control room and additional electrical installation.

The conveyor design was presented by Helena Solo-Gabriele. The most recent conveyor design includes a mounting table, a roller conveyor, a flat belt conveyor, followed by a 24 foot inclined conveyor. The conveyor will be 5 feet wide. New accessories added to the conveyor design include a gravity driven spur arm for the treated wood that is sorted out and a shear arm that will be actuated by the LIBS detector system. The construction of the conveyor system is almost complete.

David Hahn described the laser induced breakdown spectroscopy (LIBS) detector. He mentioned that funds will be used for LIBS; research with x-ray fluorescence (XRF) will continue with borrowed equipment. David Hahn presented the theory of operation for the laser . The laser is focused on the wood sample to create a plasma on the surface of the wood, which vaporizes a small portion of the wood. This plasma then emits a spectrum which is read by a spectrometer. The LIBS spectrum for CCA-treated wood was presented. To date the laser and spectrometer have been purchased. The spectrometer was interfaced with the computer and the optics and detector system have been designed. Future work will focus on the construction of the detector system, synchronizing the spectrometer with firing of the laser, and achieving real-time LIBS spectra from wood.

<u>Questions</u>

Bob Gruber: Of the 3 facilities that were visited in 1999 as part of the stain field study, how many of them were included within the 1996 study which focused on quantifying the amount of CCA-treated wood in recycled C&D debris wood?
Response: Two of the three. The one not included in the 1996 study has recently come on line.

Rich Wilkins: Will there be an alarm that indicates when the wood is treated?
Response: Yes. The detector will also activate a shear arm.

Bob Gruber: Will the wood be placed on the conveyor one piece at a time by hand?
Response: Yes. The logistics of automating the loading process did not appear feasible.

Bob Gruber: Why not simply place all construction and demolition waste (C&D) into a municipal solid waste (MSW) landfill?
Bill Hinkley: Does this mean that you support House Bill number 125 which requires that CCA-treated wood be placed in a lined landfill?
Bob Gruber: It would be prudent to put discarded CCA-treated wood into a lined landfill.
George Parris: Most of the wood/waste is combusted and therefore minimizing the quantity that must be disposed in landfills.
Bill Hinkley: Only about 17% of the waste in Florida is combusted.

Mark Bingham: Can the detector sense all the metals in CCA?
Response: We have chosen to detect Cr because it provides the strongest signal. The equipment can detect arsenic as well but the chromium signal is better.

Jeff Fehrs: In full-scale operations throughput is very important. Analysis on a piece by piece basis appears to be cumbersome.
Response: The conveyor speed can be adjusted to sort at slower or faster rates; however, the wood samples will have to be aligned one after the other and therefore analyzed on a piece by piece basis.
Jeff Fehrs: Does the laser analyze at one point? Can the wood be placed side-by-side? Also from a full-scale operation point of view it would have to be shown that the sorting technology is capable of achieving standards in order for a biomass combustion system to obtain a permit to burn the wood.
Response: A system can be designed so that wood samples can be analyzed if placed side by side. However, the design for the pilot project will require that only one wood sample be analyzed at a time. A system can also be designed to analyze wood chips where the laser can take readings very quickly and get an estimate for the fraction of CCA within the chips.
Jeff Fehrs: Its too late, however, once the chips are on the conveyor to be burned.

Mike Petrovich: What is the cost for the LIBS system.
Response: The laser costs $11,000; the spectrometer costs $2,000; there’s a few thousand dollar cost for miscellaneous items including the optics. Overall the cost for the detector should be under $20,000.

Mitch Kessler: The conveyor cannot be stacked with wood?
Response: The wood cannot be stacked.

Lou DiVita: At what speed can the conveyor run and what is the tonnage that it can handle?

Response: We have conducted some "back of the envelope calculations" concerning the speed of the conveyor in order to design the conveyor used in the pilot study. One of the objectives of the pilot study is to better quantify those parameters.

Robert Clinton: Can the detector identify whether or not wood is treated if the wood is painted?
Response: The laser has the capacity to burn through a layer of paint.
Frank Klasnik: Does paint have chromium and if it does will it be able to distinguish chromium in paint versus chromium in CCA?
Response: The detector can be designed to detect more than one metal and therefore if necessary the system will have the capacity to get around such a problem.

John Schert: Will the laser damage the conveyor belt?
Response: The laser will discharge between two rollers and will therefore not come in contact with the belt.

Lou DiVita: It is important to note that painted wood should not be processed.

5. <u>Year 3 Supplemental</u>

Helena Solo-Gabriele mentioned that the purpose of the supplemental study was to accelerate new lines of research. These lines of research were developed as a result of hearings in Minnesota where a ban on CCA was being considered. Many of the deliberations focused on in-service issues and metal speciation. The five tasks included within the supplemental study are consistent with questions raised in Minnesota. These tasks include: depletion of Cr, Cu, and As during the service life of CCA-treated wood, quantifying CCA-treated wood used by major industries, leaching tests on unburned CCA-treated wood, a literature review on As and Cr speciation, and a literature review on laboratory methods for organics analysis associated with alternative chemicals.

Tim Townsend mentioned that two sets of leaching tests were conducted. One set focused on tests conducted on new CCA-treated wood and a second set focused on leaching of wood mulch produced by C&D debris recycling operations. Ten samples of CCA-treated wood (new) were purchased from home supply stores. One sample was subjected to a series of different standardized leaching tests including TCLP, SPLP, EP Tox, WET, and MEP. Regulatory guidelines were reviewed. These included the toxicity characteristic limit of 5 mg/l for arsenic and chromium and the groundwater cleanup target levels of 0.05 mg/l for arsenic, 0.1 mg/l for chromium, and 1 mg/l for copper. Results show that CCA-treated sawdust will fail TCLP for arsenic upon occasion. Chromium passes. Although copper also leaches, there is no federal regulatory limit established for copper. Particle size impacts the results from TCLP tests. In general the smaller the particle size the greater the amount of arsenic leached. Arsenic leachate concentrations were similar between the TCLP, SPLP, and EP Tox tests whereas concentrations were generally higher for the Waste Extraction Test (WET). The WET uses a citric acid leaching solution which differs from the other leaching solutions tested. A multiple TCLP extraction procedure (MEP), where TCLP tests were conducted on consecutive samples indicates that leachate concentrations continue to show leachable arsenic concentrations after 9 consecutive extractions. The implications of the leaching tests were that without the exclusion, CCA-treated wood would often be characterized as a hazardous waste. If SPLP results are compared to GWCTLs results show that CCA-treated wood should not be disposed in an unlined landfills if current policy used for other wastes is also applied to CCA-treated wood.

Land application of mulch produced from C&D operations was also evaluated using SPLP analysis. The mulching and bagging process were described. SPLP was performed on samples of processed wood from C&D debris recycling facilities. SPLP was also performed on several samples of other mulches, including colored mulch. Results showed that 18 of the 20 wood samples from C&D facilities exceeded the GWCTLs. One of the 3 yard waste samples exceeded the GWCTL. Two of the 3 colored mulch samples exceeded GWCTLs, whereas none of the horticultural mulch samples produced from pine bark or cypress exceeded the GWCTL. Implications of the mulch study suggest that CCA-treated wood must be present at less than 1% in wood mulch to meet current groundwater standards. Most C&D wood samples are greater than 1%.

<u>Questions</u>
Dave Hahn: Are there labeling requirements for mulch?
Response: The mulch may indicate that it is made from recycled materials for marketing purposes. However, we

are not aware of a requirement for stating that it is made from recycled materials.

Bob Johns: Was the total metal concentration evaluated within the mulch?
Response: No. It would require that the mulch be shredded and ashed. It my opinion, it would likely exceed the 0.8 and 3.7 mg/kg regulatory guidelines for arsenic.

Jeff Fehrs: Are there efforts on the construction side for source separation?
Response: There are a few efforts that have been completed in the past.
Mitch Kessler: There is currently one innovative recycling grant that looks at source separation at construction sites.

Lou DiVita: CCA-treated wood should be handled just like asbestos and it should be mandatory that it should be separated on site.
Jeff Fehrs: It definitely should be separated at construction sites.
Lou DiVita: A good portion, such as decks and porches, can be easily identified at demolition sites.
Bob Gruber: Source separation at the construction/demolition site has been mentioned before.
Tim Townsend: Separation at the construction/demolition site will be a tough challenge.
Lou DiVita: It is time that the material get banned from usage. We have alternatives. We should make strides for the future.

George Parris: Mulch is not a particularly good use of the product. Chipping will increase the likelihood for dispersion. We should consider other reuse options. We should consider using it for press boards.
Response: Is recycling into press boards feasible?
George Parris: There is a demand for termite resistant products. The feedstock for the pressboards can be treated. I do not think that the treated wood should be used for mulch.

Robert Clinton: The demolition industry can likely take off a significant portion of the treated wood from a facility (for example porches). However, once placed in an appropriate dumpster the demolition contractor has no ability to keep people from throwing away other materials into the dumpster. Once the dumpster is taken to the landfill, some additional separation will be required there. For mulching operations it should be feasible to pull out clean wood. Demolition debris should not be used.
George Parris: It will be difficult to remove 100% of the treated wood.
Robert Clinton: At least the majority can be removed.
Lou DiVita: It will be difficult to remove the treated wood contained within a building.

Ram Tewari: Broward County runs a waste to energy facility. The ash is disposed properly in a monofill. There needs to be an economic analysis of the optimum solution. There should be a cost comparison between sorting and combustion options.
Response: If the treated wood is combusted then the ash must be disposed.
Ram Tewari: If the wood is processed through a C&D facility, the wood is mulched and the metals contaminate the surrounding soil. If the wood is burned in a waste to energy facility, the ash is then disposed in a Class I landfill and there are benefits to the environment in doing so.
Response: Processing and disposal in one location and capturing the leachate, rather dispersal, is a better option for the environment.

Bill Hinkley: Tom Marr mentioned earlier that combustion is a good option. Leachate must go somewhere. A small wastewater treatment facility was accepting the leachate from the Polk County landfill. This landfill contains ash. The wastewater treatment facility then refused to accept the leachate because of the elevated levels of arsenic which would require pre-treatment of the leachate for arsenic removal.
John Schert: Now the leachate is trucked to a much larger wastewater treatment facility whose effluent is capable of providing sufficient dilution of the leachate so that pre-treatment is not necessary.
George Parris: Did the leachate fail pre-treatment criteria for arsenic only.
John Schert: It was because of the arsenic that the effluent was trucked to the larger wastewater treatment plant.
Bill Hinkley: There are two criteria that must be met by the wastewater treatment plant: criteria on maximum/instantaneous loadings and criteria on total loadings. Landfills need to meet these criteria for arsenic.

Dave Hahn: If treated wood is incinerated, arsenic is lost through the stack. Emission standards are strict. You will need expensive air pollution control equipment in such a case. There is essentially no data on arsenic emissions.

George Parris: There are other sources of arsenic. Seafood is likely the second largest source of arsenic.

Presentations (con'd)

Naila Hosein described the major use sectors for CCA-treated. Statistics were compiled for production and disposal by product type and for the total amount of arsenic associated with CCA-treated wood currently in service. A breakdown was provided for various use categories, in particular U.S. data were collected and an in depth evaluation was performed for the State of Florida for utility poles and docks. Production statistics indicate that the bulk of the treated wood produced is in the form of lumber and timbers. A large increase in the quantity of lumber and timbers produced was observed during the 1980s. Disposal of these products will reflect this increase but at a lag time. The production of utility poles illustrated a similar pattern as for lumber and timbers. Given the longer service life of utility poles, significant increases in the disposal of these products will be observed after the year 2010. Roughly 28,800 tons of arsenic have been imported into the State of Florida. Roughly 1,800 tons have been disposed leaving a net amount of arsenic currently in service of roughly 26,800 tons. This quantity was "scaled" against the quantity of water within Lake Okeechobe and the upper 1 inch of Florida soil. The soil scaling computation indicates that the cumulative amount of arsenic imported into the State has the capacity to increase background arsenic concentrations within the upper one inch of soil by 5 mg/kg. This quanitity is large compared to natural background arsenic concentrations which are generally less than 1 mg/kg. U.S. statistics on treated southern pine compiled by the Southern Forest Products Association (SFPA) indicate that 36% of the treated wood volume is used for outdoor decks, 15% for landscape timbers, 8% for fences, 18% for marine applications, and 10% for highway uses. The focus of the current study is to double-check the distributions of treated wood usage for Florida. Specifically the focus is on quantifying the amount associated with utility poles and the amount associated with docks. Results indicate that utility poles currently in service account for roughly 5 to 6% of the arsenic that has been imported associated with CCA-treated wood. Research on residential docks focused on evaluating data from three counties (Alachua, Dade, and Leon). The distribution of building materials for these docks in each county were described. Results indicate that marine and freshwater docks account for approximately 16% of the arsenic associated with CCA-treated wood sold within the state. Overall, results indicate that the disposal of utility poles has not yet been observed in significant quantities given that major lines have not yet come to the end of their service lives. It is likely that current pole recycling/reuse operations will not likely be able to handle the decommissioning of major lines due to the quantity and quality of the wood that will be removed at that time. Results also indicate that a management plan is needed to recover as much of the arsenic as feasible. If a management plan were to focus on recovering utility poles roughly 5% of the arsenic would be recovered, whereas if the focus were docks then roughly 16% would be recovered. It is important to note that there are alternative chemicals available for the bulk of the remaining use categories.

Questions

George Parris: The disposal projections make assumptions concerning assumed service lives of treated wood. If these assumed service lives were different then the disposal projection would be different. Also the disposal forecast does not account for catastrophic losses associated with Hurricanes or pre-mature obsolescence. Also, there is too much emphasis on the scaling computations for arsenic. Leaching of iron, for example, is a bigger issue.

Bill Hinkley: Stan Rhodes, a consultant for the wood treatment industry, started the debate about arsenic. He computed the total amount of arsenic imported into Minnesota and applied it to a specified soil volume and found that the concentration increases were small. In Florida we have very low background arsenic concentratrations in the soil and the potential impact to soil is significant.

George Parris: The scaling computations are simply an exercise in numbers. It ignores the geochemical cycles of the material.

Bill Hinkley: What do you mean by geochemical cycles?

George Parris: It ignores that arsenic is lost to surface waters and runs off to the oceans. It can volatilize and blows out of the state. It is artificial to think of Florida as a box. It can be tied geologically within phosphate deposits for example. Except for human beings and the cancer issue, arsenic is not a big issue to the environment.

Bill Hinkley: The human cancer issue is a big exception that cannot be ignored. There has been debate about the cancer slope. What is the best way to estimate it.

George Parris: It is not a linear extrapolation.

Bill Hinkley: The industry has criticized regulators for using the linear extrapolation and imply that the regulators are using bad science. The Environmental Protection Agency uses a linear extrapolation and the EPA's approach is

backed by the National Academy of Science.
George Parris: As a state regulator, the use of the EPA approach is justified.
Bill Hinkley: Also, it is important to note that iron is a secondary drinking water standard. It is regulated for aesthetic (color) reasons. To compare iron to arsenic is absurd. Concerning the phosphate issue, it is important to note that the phosphate deposits in Florida are 40 to 50 feet underground. From this point view, phosphate is not available at C&D landfills to bind up the arsenic.

Mike Petrovich: There are other sources of arsenic.
Response: We have not completed an in depth analysis of alternative sources of arsenic to the state.

Bob Gruber: If the entire depth of the first aquifer is considered there is more arsenic within the aquifer than the arsenic associated with CCA.
Response: CCA results in arsenic to be concentrated at the surface, which is different than low concentrations of arsenic at depth.

Lou DiVita: George Parris, in your opinion, should CCA-treated wood not be landfilled.
George Parris: Looking at Florida landfill leachate data, there are some landfills with arsenic hits. The most common is for non-detects to be measured.

Lou DiVita: How about disposal as mulch?
George Parris: Mulch is not the best option because it represents an uncontrollable exposure. The product is not designed to be chipped up and used as mulch.
Mitch Kessler: An analogy can be made with a television set.

Bob Gruber: The majority of the groundwater data from C&D facilities indicate no problem with respect to leachate. This is contrary to what the data show.

Bill Hinkley: The groundwater data is collected 100 feet away from the landfill. There is a large zone of mixing prior to collection of the sample. The fact that the groundwater monitoring wells are below detection does not mean that arsenic does not have the capacity to be released from CCA-treated wood.

<u>Presentation</u> (con'd)

The sampling program for evaluating the impact of CCA-treated decks on the environment was presented by Naila Hosein. Surface soil samples were collected in a grid-like fashion from nine decks. Three were located in Gainesville, three in Miami, and three in Tallahassee. One of three decks in Tallahassee was not CCA-treated. One soil core sample was collected from each site. All decks were stained with PAN indicator to determine whether they were CCA-treated. All were positive for CCA except for the one (Lake Talquin) located in Tallahassee. XRF results from the sawdust from each deck also confirmed the presence of CCA in samples that were analyzed to date. Grain size analysis indicates that the average grain size of all the soil samples was 0.3 mm which is typical of a sand. Results of % volatiles analysis indicates that between sites metal concentrations were not strongly correlated with % volatiles content. Within a site, correlations were observed.

Tim Townsend presented the results from analyzing metal concentrations in soil under the decks. The regulatory guidelines for arsenic are 0.8 mg/kg for residential areas and 3.7 mg/kg for industrial areas. The natural background concentration of arsenic in Florida soils is 0.42 mg/kg (geometric mean). Of the 65 soil samples collected, the average concentration of arsenic in the soil below the deck was 28.5 mg/kg whereas the average concentration of the controls was between 1.3 and 1.5 mg/kg. The graphs clearly indicate that the soils below the CCA-treated decks were significantly higher in arsenic concentrations than that of the control samples. Results for chromium were more variable due to the higher background concentrations. In most cases the copper concentrations in the soils located below the decks were higher than that of the control samples. The results from the cores samples indicate that the impacts of the decks are observed down to a depth of 8 inches. It was found that the mean concentration of arsenic under the 8 CCA-treated decks exceeded the industrial Florida SCTL of 3.7 mg/kg. 61 of the 73 individual soil samples also exceeded 3.7 mg/kg. It is estimated that approximately 25,000 acres of Florida land is covered by CCA-treated decks. The top 8 inches of this area corresponds to 60 million tons of soil. A plot showing the relationship between percent leaching versus soil arsenic concentrations showed that the soil metals concentrations measured in this study can be accounted for through the leaching of a fraction of the CCA originally present in the deck.

Questions/Comments

George Parris: Was there a correlation between retention level and concentration under the deck or age?
Response: There was no obvious correlation.

George Parris: The maps providing the sampling locations were useful. Was there any correlation between sample location and arsenic concentration in the soil?
Response: At Oleta Park the sampling grid was reconstructed after the data were available and it was noticed that the highest concentrations were found at the drip line, in particular at a "T" in the beams located above the deck.

Mel Pine: Was the deck retention level sampled?
Response: Yes, wood samples were taken from the deck and analyzed for retention level.

John Schert: Osmose was conducting a deck study of their own. Are the results of that study available?

7. "Year 4" and Future Plans for "Year 5"

Helena Solo-Gabriele described the project objectives for the year 4 study titled, "Fate of CCA-Treated Wood." The project is separated into two phases: Phase I, Evaluate CCA- and alternative-chemical- treated wood through TCLP and SPLP, and Phase II, Evaluate arsenic species in leachates collected from landfills. There is a complimentary study funded by the Florida Dept. of Environmental Protection that focuses on chromium speciation. Samples used for phase I of the project include: ACQ-, CBA-, CC-, and CDDC-treated wood. Two CCA-treated wood control samples and untreated wood are also be included. Untreated wood boards (2" x 4" x 16') were purchased by the research team and cut into 2 foot lengths. A 2 foot length was randomly chosen from each board for treatment by each company.

Kristin Stook described the leaching and toxicity tests to be conducted. Leaching tests include TCLP and SPLP, as well as leaching tests conducted with deionized-distilled water and synthetic seawater. Samples were size reduced. Analytical methods to be used to analyze for the various constituents in the leachates were described. The inorganic chemicals will be analyzed by ICP-AES, Flame AA, and Graphite Furnace AA. The analysis of tebuconazole will use a GC-MS, DDAC will be analyzed using a two-phase titration, CDDC will use a UV spectrometer, and citrate will use an ion chromatograph. The toxicity assays will include MetPLATE™, Microtox, an algal assay, a yeast assay, and an invertebrate test. MetPLATE ™ is a short term chronic toxicity assay that uses a 96 well microplate and is based upon the activity of the CPRG enzyme. Microtox is based upon the activity of a bacteria (*Vibrio fischeri*) which is capable of luminescence. Changes in the luminescence of this bacteria is a function of the toxicity of the leachate. The algal assay is based upon the reproduction rates of an algal organism (*Selanastrom Capricornutum*). The invertebrate test is based upon the ability of a neonatal invertebrate (*Ceridaphnia Dubia*) to survive in leachates from treated wood. The yeast assay is based upon the enzymatic changes of a yeast (*Saccharomyces cerevisiae*) due to the exposure to a leachate. All leaching and toxicity tests (except for the yeast assay) have been conducted on the untreated and two CCA-treated wood samples.

Bernine Khan presented the status of the arsenic speciation portion of the study. She described toxicity, mobility, and analytical methods for speciation. Different arsenic species include arsenic in different oxidation states (+3, +5, and -3). Inorganic arsenic species may be bound with sulfer. Organic species include arsenic bound with carbon and hydrogen groups. Not all arsenic species are toxic. The most toxic arsenic species is arsine gas (AsH_3). Other arsenic species in order of decreasing toxicity include inorganic arsenite (As+3), inorganic arsenate (As+5), monomethylarsonic acid (MMAA), dimethylarsine oxide (DMAA), trimethylarsine oxide (TMAO), arsenobetaine (AsB), and arsenocholine (AsC). An Eh versus pH diagram was used to explain conditions during which different species would be present. The purpose of the study is to quantify arsenic species (As(III), As(V), DMAA, and MMAA) in groundwater samples and leachates from MSW and C&D landfills. Analytical methods for arsenic analysis require "hyphenated techniques" which include one step for separation and another for detection. The SDDC method was described. One drawback of this method is that it is capable of analyzing only for As(III) and As(V). The detection limit for this technology is 12.5 ug/l. Due to earlier comments, the research team has decided to also analyze for DMAA and MMAA. The primary analytical method that will be used for this analysis is HPLC-HG-AFS. The use of a cartridge system for the preservation of the samples in the field was described.

Filters for use in this preservation system have been evaluated; a PVDF filter will be used. The use of the cartridge system for the separation of the different arsenic species was described. A discrepancy was found with the separation of the DMAA species. To date groundwater samples were analyzed from two MSW landfills and from two C&D landfills. Leachates were also analyzed from the MSW landfills. Field sampling methods were described and output from the HPLC-HG-AFS equipment was presented. The results for all the groundwater samples were below detection limits. The leachate samples from the MSW landfills measured at 4.3 and 7.3 ug/L for As(III) and As(V) for MSW#1, respectively, and 5.7 and 13.3 ug/L for As(III) and As(V) for MSW#2. Future goals of this portion of the project are to continue quantification of the arsenic species from C&D & MSW landfills, analyze the leachates from lysimeters, and analyze the leachate from TCLP and SPLP tests.

The research plan for the complimentary study on chromium speciation was presented by Tim Townsend. The most common oxidation states for chromium are 0, +3, and +6. Cr+6 is much more toxic and mobile than Cr+3. The difference between Cr+6 and Cr+3 is factored into regulations. EPA's soil screening guidance value is 78,000 mg/kg for Cr+3 and 390 mg/kg for Cr+6. Cr+6 exists in alkaline and strongly oxidizing environments. Cr+3 exists in moderately oxidizing and reduced environments. An Eh versus pH diagram was presented to describe conditions during which the different species would be present. Chromium in the CCA preservative solution is Cr+6. Upon fixation in the wood, Cr+6 is converted to Cr+3. Cr+6 may be found if wood is improperly fixed or potentially when CCA-treated wood is in contact with oxidizing chemicals such as deck brighteners. In the natural environment, some oxidation may occur as a result of interactions with manganese (hydr)oxides. The selected method for chromium analysis is ion chromatography. Tasks in the project include a literature review, an assessment of pH and ORP as indicators of Cr speciation, an evaluation of the kinetics of conversion of Cr+6 to Cr+3 in natural soils, and the development of a guidance document. Three different soil types have been selected for the kinetics study. They will be spiked with CCA solution to add a known amount of Cr(VI). The chromium species (total and leachable) will be measured over time. The soils to be analyzed include a clay, organic, and sandy soil. Future work will focus on the kinetic study and measuring Cr(VI) in various environmental matrices as a function of ORP and pH.

The objectives of the year 5 study were summarized by Helena Solo-Gabriele. Year 5 is essentially a continuation of the year 4 study. For the alternative chemicals, leaching tests were the focus of year 4 and the toxicity tests are the focus of year 5. For arsenic speciation portion of the study, evaluation of arsenic species in MSW and C&D landfills is the focus of year 4. During year 5, arsenic species will be measured in leachates from TCLP and SPLP tests and in leachates from lysimeters.

<u>Questions</u>

Bill Hinkley: Has there been work evaluating the amount of copper from the alternatives versus that from other sources in the environment. For example, work has shown that cruise ships release a significant amount of copper.
Response: That topic has not been investigated in detail.

Bob Gruber: The research team should analyze for boron in ACQ.
Response: The boron can be measured.

George Parris: It may be worthwhile to measure the groundwater samples without filtering them first.

Bill Hinkley: Does the arsenic from MSMA speciate differently than arsenic from CCA?
Response: That is not known. One way to address the problem would be to analyze MSMA.

Bob Johns: Where were the landfills located?
Response: The location of the landfills is confidential. They were all located south of Lake Okeechobee.

George Parris: Why is the cartridge system being used?
Response: For preservation in the field. It immediately separates As(III) from As(V).
George Parris: Data has shown that As(V) has been found in the Miami area. This data was presented by Lisa Smith of the arsenic task force.

Bob Gruber: It would be of use to conduct a literature review concerning the conversion of chromium in the environment.

Bill Hinkley: The work on chromium speciation was initiated through a separate program. The primary motivation for the chromium study was due to a boiler wash issue associated with Florida Power and Light.
Bob Gruber: So why is chromium from CCA used? Why not use Cr(VI)?
Response: The research team plans to obtain ancillary data concerning CCA from this study. In particular information will be gathered concerning metals partition coefficients in various soils.

Bill Hinkley: There are concerns about manganese catalyzing Cr(III) to Cr(VI). There's a new groundwater clean-up technology that injects a permanganate solution into the soil for bioremediation purposes. This technology may be capable of converting the chromium to Cr(VI).

8. Future Innovative Recycling Grant Proposal

Helena Solo-Gabriele asked for the audiences comments concerning ideas for a future Innovative Recycling Grant (IRG) Proposal. The topics considered to date include pyrolysis, wood-cement composites, and recapture of CCA-treated wood prior to disposal. Pyrolysis does not necessarily fit into the recycling objectives of an IRG unless the metals can be recovered from the ash. Wood cement composites are clearly a recycling alternative. Expertise available at the University of Miami was described as well as a description of the research team's visit to Environmental Building Systems owned by Bill Loftus. Recapture would involve evaluating the feasibility of sorting CCA-treated decks, fences etc.. prior to mixing with the remainder of the demolition stream. Currently the research team is focusing on wood cement composites along with recapture as a potential IRG topic. Tim Townsend described his visit to Jean Hery's Chartherm pyrolysis facility located in Bordeaux, France.

George Parris: Copper and arsenic in the ash can be utilized for the production of bronze. The primary challenge would be getting the chromium out. If that can be done then recycling of the ash may be an option. If you pursue pyrolysis technology, a contribution from Alex Green should be considered. Also, C.Y. Wu may be able to provide a contribution. Pyrolysis is helpful for volume reduction.

Mitch Kessler: It would be necessary to have a County partner to apply for an Innovative Recycling Grant.
Response: Sarasota County has indicated to the research team that they would like to partner together for a future submission of an Innovative Recycling Grant.

Bill Hinkley: There is roughly 23 million dollars available for this years Innovative Recycling Grants. Next year it will be roughly ½ and it could disappear the following year.

Frank Klasnik: It may be possible to incorporated the ash within mining operations so the metals can be put back into the system. Perhaps it can be incorporated into a steel mill process.

Question: It would be of interest to determine the amount of metals that would leach from the wood/cement composite.

Bob Gruber: A research proposal was submitted by Bob Smith to the Environmental Protection Agency. He was unsuccessful in obtaining funds from the EPA. The focus of that proposal were the logistics of collecting the wood from decks, fences, etc.. that were to be discarded.

Bill Hinkley: If industry is truly interested in seeing results, they should provide research funds.

Bob Gruber: The industry agreed to provide 10% of the funds needed for the Bob Smith study.