ABOUT TAPPI

TAPPI is the leading technical association for the worldwide pulp, paper, and converting industry.

TAPPI’S MISSION
...to engage the people and resources of our Association in providing technically sound solutions to the workplace problems and opportunities that challenge our current and future members.

TAPPI’S VISION
...is to make a significant difference in the professional lives of our members.

TAPPI provides its members rapid access to:
• the largest international group of technically experienced people in the industry
• the most comprehensive collection of reliable technical information and knowledge in the industry
• the highest quality products and services created to meet the needs of people who solve technical problems in the industry.

To learn more about TAPPI, call us at 1.800.332.8686 (U.S.), 1.800.446.9431 (Canada) or +1.770.446.1400 (International). Or, visit our website at www.tappi.org.

STATEMENT OF COPYRIGHT

Statements of fact and opinion expressed in TAPPI publications are those of the authors and TAPPI assumes no responsibility for them; they are not intended nor should they be construed as solicitation of or suggestion by TAPPI for any agreed-upon course of conduct or concerted action of any kind. Within the context of this work, the author(s) may use as examples specific manufacturers of equipment. This does not imply that these manufacturers are the only or best sources of the equipment or that TAPPI endorses them in any way. The presentation of such material by TAPPI should not be construed as an endorsement of or suggestion for any agreed upon course of conduct or concerted action.

Copyright © 2005 by TAPPI. All rights reserved.

To obtain copyright permission to photocopy pages from this publication for internal or personal use, contact Copyright Clearance Center, Inc.(CCC) via their website at www.copyright.com. If you have questions about the copyright permission request process, please contact CCC by phone at 978-750-8400.

To obtain copyright permission to use excerpts from an article in another published work, send your specific request directly to the author.
TAPPI 15 Technology Parkway South, Norcross, GA 30092 USA 1.800.332.8686 (U.S.) 1.800.446.9431 (Canada) +1.770.446.6947 (International) www.tappi.org
Session 6: Nonwood Pulping

Lora, Jairo

6-1 Byrd, Medwick
North Carolina State University
Chemical and Pulping Characteristics of Corn Stalk Fractions 1

6-2 Chute, Wade
Alberta Research Council, Inc.
Refining response of wheat straw pulp and wood pulp blends 20

6-3 Pekarovic, Jan
Western Michigan University
Two-step straw processing - a new concept of silica problem solution 32

Resalati, Hossein
University of Agric. Sciences and Natural Resources, Gorgan
Mixed hardwood CMP Pulp Reinforcement by Wheat Straw Chemical Pulps 42

Session 7: The State of the North American Pulp and Paper Industry

McDonough, Tom

7-1 McNutt, Jim
State of the North American Pulp & Paper Industry 48

Session 8: Recycling Stickies

Doshi, Mahendra

8-1 Haynes, R. Daniel
Eka Chemicals
Establishing the Techniques to Relate Paper Machine Issues To Colloidal Microstickies 56

8-2 Sarja, Tiina
Kemira Oyj, Oulu Research Centre
Addressing the Nature of Stickies in Deinked Pulp 79

8-4 de Jong, Robert
2 Fiber Consulting
Determination of Macro and Microstickies in the Same Stock and Water Samples 88

Session: 9 Bill Babbington Maintenance Roundtable

Kahn, Jerry

Session 10: Alkaline Pulping

Archibald, Bruce

10-1 Kisara, Koki
Oji Paper Co., Ltd
The possibility of controlling formation and cleavage reactions of HexA during kraft pulping 95
Ana Gabriela Monnerat Carvalho
Bassa University of Sao Paulo - Brazil

The effect of alkali charge on Eucalyptus spp. kraft pulping 109

Mohlin, Ulla-Britt
STFI-Packforsk

How Fiber Dimensions influence refining response and paper properties - using acacia and eucalypt as examples 119

Session 11: Understanding Materials Performance - How to Save your Mill Millions of Dollars Panel
Thompson, Chris

11-1 Hoffman, Nancy
Equipment Reliability & Integrity Sub-Committee 135

11-2 Nixon, Robert A. (Randy)
Corrosion Probe, Inc
Non-Metals Knowledge: Saving Your Mill Big Dollars 141

11-3 Grocki, John
Advantage Resources Consulting, L.L.C.
The Metals Subcommittee and The Paper Industry: Yesterday, Today and Tomorrow 183

Session 13: Trends in Global Paper Demand & Industry Innovation
Walker, Colleen

13-1 McCarthy, Patrick
Georgia Institute of Technology
Shifts in regional consumption for the paper and pulp industry 192

13-2 Ghosal, Vivek
Georgia Institute of Technology
The Role and Value of Innovation in the Pulp and Paper Industry 210

Session 14: Optimizing Chip and Fiber Quality
Fuller, Bill

14-2 Havu, Ari
Metso Paper
Utilization of optical wood chip analyzer in pulping and chipping process 228

14-3 Twaddle, Alastair
International Paper Company
Chip Quality Scorecard 'Moving Forward, But Still in Need of Improvement' 234

Session 15: Process Simulation / Engineering I
Laperriere, Luc

15-1 Pemberton, Mike
ITT IBG/Pump Start Control Solutions
Strategies to Improve Pump Efficiency and Life Cycle Performance 238

15-2 Duchowski, John K.
Hydac Technology Corporation

15-3 D'Souza, Teresa & Tran, Honghi
University of Toronto
Effects of process variability on ring formation in lime kilns 257
Session 16: What to Do with the Sludge  
Bliss, Terry

16-1  Hartong, Bradley H.  
Georgia Institute of Technology
Improved Sludge Dewatering with Cyclodextrins  265

16-2  Shemi, Akpojotor  
Georgia Institute of Technology
Evaluation of treatment methods for de-inking mill sludge  270

Session 17: Recycling - Deinking  
Haynes, Danny

17-1  Pescantin, Marco  
Comer SpA
A new flotation system for high efficiency at low energy input.  283

17-2  Emerson, Zachery I.  
Auburn University
Visualization of toner ink adsorption at bubble surfaces  292

17-3  Haynes, R. Daniel  
Akzo Nobel, Eka Chemicals, Inc
Global Application of Sulphite Based Neutral Deinking Technology  304

17-4  Dorris, Gilles  
Pulp and Paper Research Institute of Canada
On-line Measurement of Air Content in Pulp and Papermaking Systems. Application to Ink Flotation.  321

Session 18: Bleach Plant Operations  
Bucher, Wayne

18-1  Parthasarathy, V.R. (Perry)  
Canexus NA Limited
Final Chlorine Dioxide Bleaching in Multi-stage Bleaching as an Option for the Production of Very High Brightness and optically balanced pulps - Comparison of DD Versus DP Bleaching Sequences in the Bleaching of Kraft Pulps  336

18-2  Pryke, Douglas C.  
Progress Towards “Best in Class”: A Summary of Bleaching Chemical Consumption Reduction and Optimization  361

18-3  Parthasarathy, V.R. (Perry)  
Canexus NA Limited
Use of Hydrochloric Acid or Sulfuric Acid in the Pre-Acidification of Pulps Prior to Chlorine Dioxide Delignification and Multistage Bleaching  388

Session 19: Nonwood Processing and the Biorefinery  
Lewis, Mark

19-1  Lewis, Mark  
University of Washington
Observations on Using Wheat Straw Pulp on Papermachines  405

19-2  Riddlestone, Sue  
BioRegional MiniMills UK Ltd
BioRegional MiniMill Technology – report on UK Demonstration Mill  412

19-3  Rousu, Pasi P.  
Chempolis Oy
A novel biorefinery – production of pulp, bioenergy and green chemicals from nonwood materials  425

19-4  Anttila, Juha R.  
Chempolis Oy
Chemical recovery in nonwood pulping based on formic acid  432
Session 20: Engineering / Pulping/ Environmental NTS

Session 23: Water Quality
Jernigan, Bill

23-1 Chopakatla, Sreenivasa
Battelle – Marine Sciences Laboratory
A Detailed Study of the Zone of Initial Dilution to Evaluate Temperature Exposure and Fish Entrainment—Fort James Operating Company’s Wauna Mill Outfall 440

23-2 Flinders, C. A.
National Council for Air and Stream Improvement (NCASI)
Findings from Long-term Studies in Four US Rivers Receiving Pulp and Paper Mill Effluent 455

23-3 Kilgore, Stephanie
Georgia-Pacific
Determining Labile and Recalcitrant Organic Nitrogen for TMDL Projections 472

Session 24: Project Management Fundamentals Tutorial Part 1
Dowe, Steve

Session 25: Recycling Tutorial: Using Optical Properties to Measure Fiber
Houtman, Carl

25-1 Corscadden, Kenneth W.
OpTest Equipment Inc.
Online Measurement of Dirt Specks in Sheets 476

25-2 Verhulst, Ryan P.
University of Minnesota
Properties of Pressure Sensitive Adhesives Found in Paper Recycling Operations 487

Session 26: Cracking Issues in Kraft Pulp Mills
Sharp, Sandy

26-1 Yang, Dong
Georgia Institute of Technology
Mechanism of Stress Assisted Corrosion on Carbon Steel Boiler Tubes 494

26-2 Bhattacharya, Ananya
Georgia Institute of Technology
Stress Corrosion Cracking of Different Duplex Stainless Steel Grades in Pulping Liquor 507

26-3 Gorog, Margaret
Weyerhaeuser
Digester Outlet Device Scraper Arm Cracking 519

Session 27: Process Simulation of Kraft Pulping (joint with Alkaline Pulping & Bleaching)
Clark, Cal

27-1 Smith, Sean
Rock-Tenn Mill Company, LLC
Long Feedback Compensated Kappa Factor Control: Part II of Process Optimization at Rock-Tenn Company, Demopolis Alabama Mill 543

Volume 2
Session 28: Recovery Boiler Emissions
Tavares, Alarick

28-1 Tran, Honghi
University of Toronto
Effects of SO₂ on Superheater Fouling in Kraft Recovery Boilers 551

28-2 Dietel, Christopher T.
DTE Energy Services
Black Liquor Enrichment with Petroleum Coke 565

28-3 Clement, J.L.
Clement Consulting Inc.
Investigation and Analysis of the Causes of Recovery Boiler Economizer Failures 584

Session 29: Combustion Process: An Environmental Perspective Tutorial
Jain, Ashkok/Miner, Reid

29 Perez-Garcia, John and Miner, Reid
University of Washington
NCASI Greenhouse gas and carbon profile of the global forest products industry N/A

Session 30: Project Management Fundamentals Tutorial Part I1
Dowe, Steve

Session 31: TMDL Panel
Stein, Bob

Session 32: Low Temperature Black Liquor Gasification
Shenassa, Reyhaneh

32-1 Whitty, Kevin
The University of Utah
Performance of a Small Scale Fluidized Bed Black Liquor Steam Reformer 602

32-2 Iisa, Kristiina
Georgia Institute of Technology
Measurement of Tars Produced during Low-Temperature Black Liquor Gasification 611

32-4 Grant, Thomas J.
American Forest & Paper Association
AF&PA Recovery Boiler Program Update N/A

Session 33: Bleaching: Minimizing Scaling and Improving Fiber Properties
Hart, Peter

33-1 Rudie, Alan W.
USDA Forest Service
Modeling and Minimization of Barium Sulfate Scale 623

33-2 Dang, Zheng
Georgia Institute of Technology
Chemical Modification of ECF Softwood Kraft Pulp by Alkaline Peroxide Treatment 633

33-3 Zhang, Dongcheng
Georgia Institute of Technology
The effect of sequential bleaching on total fiber charge of SW kraft pulp fibers 648

Session 34: Recycling / Fiber Processing
Bliss, Terry

34-1 Yli-Viitala, Pirjo
University of Oulu, Finland
Defiber OCC in High Dry Content 656
<table>
<thead>
<tr>
<th>Session 35: Recycled Paper Fundamentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
</tr>
<tr>
<td>Jokinen, Hanna</td>
</tr>
<tr>
<td>University of Oulu, Finland</td>
</tr>
<tr>
<td>Pressure Screen Capacity – Current Findings on the</td>
</tr>
<tr>
<td>Role of Wire Width and Height</td>
</tr>
<tr>
<td>Carlsson, Johan</td>
</tr>
<tr>
<td>Metso Paper</td>
</tr>
<tr>
<td>Pressurized Tail Screen - Improved Fiber Recovery</td>
</tr>
<tr>
<td>Using Intermediate Dilution</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 36: The Wonderful World of Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
</tr>
<tr>
<td>Anderson, H. Charles</td>
</tr>
<tr>
<td>QBM Management</td>
</tr>
<tr>
<td>The Wonderful World of Contracts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 37: Evaporators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
</tr>
<tr>
<td>Verrill, Christopher L</td>
</tr>
<tr>
<td>Georgia Institute of Technology</td>
</tr>
<tr>
<td>Evaporator Boilout Guidelines</td>
</tr>
<tr>
<td>Bayuadri, Cosmas</td>
</tr>
<tr>
<td>Georgia Institute of Technology</td>
</tr>
<tr>
<td>Stability of Sodium Sulfate Dicarbonate in Black</td>
</tr>
<tr>
<td>Liquor Concentrators</td>
</tr>
<tr>
<td>Stern, Randy</td>
</tr>
<tr>
<td>Kvaernner Power</td>
</tr>
<tr>
<td>Evaporation System Solutions – Energy and the</td>
</tr>
<tr>
<td>Environment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 38: Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
</tr>
<tr>
<td>Davis, Chuck</td>
</tr>
<tr>
<td>Georgia-Pacific</td>
</tr>
<tr>
<td>Conservation Through Energy Supply Optimization</td>
</tr>
<tr>
<td>Rodin, Jonathan B.</td>
</tr>
<tr>
<td>Emerson Performance Solutions</td>
</tr>
<tr>
<td>Purchased Power Optimization in an Energy Management System At a Paper Mill</td>
</tr>
<tr>
<td>Kinstrey, Robert</td>
</tr>
<tr>
<td>Jacobs</td>
</tr>
<tr>
<td>Pulp and Paper Industry Energy Bandwith Study</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 39: Assessing Kraft Pulp Bleachability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
</tr>
<tr>
<td>Francis, R.C.</td>
</tr>
<tr>
<td>The State University of New York</td>
</tr>
<tr>
<td>An Attempt at Quantifying Bleachability of Hardwood Chemical Pulps</td>
</tr>
<tr>
<td>Connell, Daniel</td>
</tr>
<tr>
<td>Eka Chemicals, Inc</td>
</tr>
<tr>
<td>Relationship between the pulp yield, bleachability</td>
</tr>
<tr>
<td>and cooking conditions of Loblolly pine</td>
</tr>
</tbody>
</table>
Optimization of ECF Bleaching of Kraft Pulp: I. Optimal Bleaching of Hardwood Pulps Made with Different Alkali Charges

Session 40: Sustainability / Climate Change (in conjunction with Session 29)
Fleischauer, Pat

Session 41: In Mill Pollution Reduction
Sparapany, John

Wessman, Helena
KCL
Environmental Development of Kraft Pulping Technology

Harrison, Ray
North Pacific Paper Corporation (NORPAC)
Refiner Bleaching With Magnesium Hydroxide (Mg(OH)₂) And Hydrogen Peroxide

Mahmood, Talat
Paprican
Resource Recovery and Pollution Prevention at Source

Onodera, Isao
Nippon Paper Industries Co., Ltd
Application of Methane Fermentation Technology in Pulp and Paper Industry - Treatment of a Mixture of Hardwood and Softwood Kraft Pulp Mill Evaporate Condensate

Session 42: Current Topics in Asset Management
Kahn, Jerry

Kolstad, David
Porous Media Corporation
Achieving World Class Lubrication at SAPPI Fine Paper

Silenius, Seppo
Andritz Oy
Chip Quality Optimization and Chipper Condition Monitoring Concept

Session 43: Experience With State of the Art Fiber Lines
McDonough, Tom

Chai, Xin-Sheng
Georgia Institute of Technology
Determination of Sulfate Ions in Kraft Black Liquors by a Turbidity Method

Kulig, John A.
The Babcock & Wilcox Co
NOx Control Using Quaternary Air – Mill Experience

Tandra, Danny
Clyde-Bergemann, Inc.
Extended Recovery Boiler Runtime Using Smart Sootblower

Rauscher, John W.
Andritz, Inc.
State of the Art Evaporation System

Volume 3
**Session 45: Determining the Benefits of the Biorefinery**  
*Lisa, Kristiina*

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Title</th>
<th>Author(s)</th>
<th>Institution/Sponsor</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-1</td>
<td>Frederick, Jr. Jim</td>
<td>Industrial Symbiosis as a Model for BioRefineries</td>
<td>ChBE and IPST at Georgia Tech</td>
<td>N/A</td>
</tr>
<tr>
<td>45-3</td>
<td>Larson, Eric R.</td>
<td>Cost-Benefit Analysis of Gasification-Based Biorefining at U.S. Kraft Pulp Mills</td>
<td>Princeton University</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Session 46: Equipment Inspection and Repair Strategies**  
*Crowe, David*

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Title</th>
<th>Author(s)</th>
<th>Institution/Sponsor</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>46-1</td>
<td>Wensley, Angela</td>
<td>Inspection and Repair of Kraft Steaming Vessels</td>
<td>Angela Wensley Engineering, Inc.</td>
<td>1045</td>
</tr>
<tr>
<td>46-2</td>
<td>Orr, Jeremy</td>
<td>Appropriate Use of Tank and Pressure Vessel &quot;In Service&quot; Codes When Assessing Localized Corrosion and Cracking Damage</td>
<td>Applied Technical Services, Inc.</td>
<td>1084</td>
</tr>
<tr>
<td>46-3</td>
<td>Bennett, David C.</td>
<td>Best Practice for Inspecting and Repairing Brick &amp; Tile Linings – protecting equipment and the bottom line.</td>
<td>Corrosion Probe, Inc</td>
<td>1094</td>
</tr>
<tr>
<td>46-4</td>
<td>Lansing, Ronald W.</td>
<td>Life Extension Strategies, Condition or Risk Based Assessment; A Pulp &amp; Paper Industry Material EngineerÓs Point of View.</td>
<td>M&amp;M Engineering</td>
<td>1122</td>
</tr>
</tbody>
</table>

**Session 48: Improving Pulping with Additives**  
*Wilson, Joe*

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Title</th>
<th>Author(s)</th>
<th>Institution/Sponsor</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-1</td>
<td>Lindstrom, Mathias</td>
<td>The Effect of Integrating Polysulfide Pulping and Black Liquor Gasification on Pulp Yield and Delignification</td>
<td>North Carolina State University</td>
<td>1127</td>
</tr>
<tr>
<td>48-2</td>
<td>Watanabe, Keigo</td>
<td>New process of producing highly concentrated polysulfide liquor by electrolysis of white liquor (IV) -Utilization of cathode cell liquor-</td>
<td>Nippon Paper Industries Co., Ltd</td>
<td>1137</td>
</tr>
<tr>
<td>48-3</td>
<td>Ransdell, John C.</td>
<td>Seasonal Impacts on the Performance of AQ/Penetrants.</td>
<td>Charleston Technical Center</td>
<td>1142</td>
</tr>
</tbody>
</table>

**Session 49: 02 Delignification & Enzymes**  
*Berry, Richard*

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Title</th>
<th>Author(s)</th>
<th>Institution/Sponsor</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>49-1</td>
<td>Jain, R.K.</td>
<td>Enzyme Prebleaching of Kraft Pulp – A Success Story in Indian Paper Industry</td>
<td>Central Pulp &amp; Paper Research Institute</td>
<td>1152</td>
</tr>
<tr>
<td>49-2</td>
<td>Tao, L.</td>
<td>Oxygen Delignification of Southern Softwood Kraft Pulps With High Lignin Content</td>
<td>University of Maine</td>
<td>1164</td>
</tr>
<tr>
<td>49-3</td>
<td>Epiney, Michel</td>
<td>A new White Liquor Oxidation Technology: Experience from a recent start up at Metsa-Botnia, Kaskinen</td>
<td>Air Liquide Canada Inc.</td>
<td>1192</td>
</tr>
<tr>
<td>Session 50: Workshop on Nitrogen Chemistry in Recovery Cycle (Joint Environmental / Engineering)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **50-1** | **Hupa, Mikko**  
Åbo Akademi University  
Nitrogen oxide emissions from the kraft recovery cycle -Do we know enough?“  
N/A |
| **50-2** | **DeMartini, Nikolai**  
Georgia Institute of Technology  
Cyanate and Ammonia in the Kraft Recovery Process  
1199 |
| **50-3** | **Saviharju, Kari**  
Andritz Oy  
Nitrogen balances in recovery boilers  
1208 |

<table>
<thead>
<tr>
<th>Session 51: Gulf Coast Hurricanes - Preparation and Response in the Pulp and Paper Industry</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session 52: Controlling Pulp Yield and Composition</strong></td>
<td><strong>Foster, Mike</strong></td>
</tr>
</tbody>
</table>
| **52-1** | **Hart, Peter W.**  
MeadWestvaco Corporation  
Seasonal Variation in Wood: Perceived and Real Impacts on Pulp Yield  
1236 |
| **52-2** | **Johansson, D.**  
Karlstad University, Sweden  
A kinetic study of softwood kraft cooking -carbohydrate Dissolution as a function of the cooking conditions  
1246 |
| **52-3** | **Qiao, Ming**  
University of Washington, Seattle  
Influence of Fiber Scale Heterogeneity on Softwood Kraft Pulp Kappa Uniformity  
1281 |

<table>
<thead>
<tr>
<th>Session 53: High Temperature Black Liquor Gasification</th>
<th><strong>Whitty, Kevin</strong></th>
</tr>
</thead>
</table>
| **53-1** | **Young, C.A.**  
Georgia Institute of Technology  
On Pressurized High-Temperature Black Liquor Gasification Kinetics  
1290 |
| **53-2** | **Keiser, James R.**  
Oak Ridge National Laboratory  
Studies and Selection of Containment Materials for High-Temperature Black Liquor Gasification  
1301 |
| **53-3** | **Lindblom, Mats**  
Chemrec AB  
Status of the Swedish National Black Liquor Gasification (BLG) Development Program  
1312 |

<table>
<thead>
<tr>
<th>Session 54: Lime Kilns (joint Environmental / Engineering)</th>
<th><strong>Venkatesh, Venki</strong></th>
</tr>
</thead>
</table>
| **54-1** | **Aloqaily, Arafat**  
University of Toronto  
Flame Length in Lime Kilns with Separate NCG Burner  
N/A |
| **54-2** | **Manning, Richard**  
Kiln Flame Systems  
Successful Experience of Firing of Petroleum Coke (Petcoke) in Lime Recovering Kilns  
1322 |
| **54-3** | **Kolozsvary, Michelle**  
DTE Energy Services  
Air Permitting Considerations Related to Firing Petroleum Coke in Lime Kilns  
1334 |
Session 55: Environmental Management System Panel
Phenicie, Dale

Session 56: Sootblowing
Tandra, Danny

56-1 Tavares, Alarick
Diamond Power International
Retrofitting Existing Sootblower Systems To Use a Lower Pressure Steam Source 1345

56-2 Marling, Bruce
Emerson Process Management
Replacing Sootblower Control System with Open Control Solutions 1395

56-3 Moore, Jason D.
Diamond Power International, Inc.
Intelligent Recovery Boiler Cleaning Management – A Tiered Approach to Saving Steam while Improving Boiler Cleanliness 1406

Session 57: Implementing the Biorefinery
Amidon, Tom

57-1 Frederick, W.J. Jr.
Georgia Institute of Technology
Co-Production of Ethanol and Cellulose Fiber from Southern Pine: A Technical and Economic Assessment 1416

57-2 Amidon, T. E.
State University of New York
Effect of Hot Water Pre-Extraction on Alkaline Pulping of Hardwoods 1428

57-3 Yoon, Sung-Hoon
University of Maine
Pre-Extraction of Southern Pine Chips with Hot Water followed by Kraft Cooking 1439

57-4 Anand, Farminder S.
Georgia Institute of Technology
Evaluating Biorefinery Options in a Pulp and Paper Mill: Carbon Balances 1454

57-5 Hazlewood, Patrick E.
Georgia Institute of Technology
Downstream Process Effects Related to Wood Chip Pre-Extractions 1466

Session 58: Process Issues in Corrosion Problems
Lukezich, Steve

58-1 Nixon, Robert A. (Randy)
Corrosion Probe, Inc
Corrosion in Waste-Water Treatment Plants at Pulp and Paper Mills 1476

58-2 Kish, Joseph R.
Paprican
Biogenic H₂S0₄ Corrosion of Concrete in Pure Oxygen Activated Sludge Bioreactors 1485

58-3 Hazlewood, Patrick E.
Georgia Institute of Technology
Pulp Mill Corrosion and Wood Chip Extractives 1500

58-4 Shim, Winston W.
Corrosion Service Co. Ltd
Insitu Study of the Effects of Anthraquinone, White Liquor Concentration and Temperature on Lower Zone Digester Corrosion 1510

Session 59: Making Functional Modifications to Pulp
Bogdon, Brian

59-2 Suchy, Miro
Western Michigan University
Caustic Treatment of the Pulp: Caustic Recovery by Reverse Osmosis 1520

59-3 Germgard, Ulf
Karlstad University, Sweden
The Influence of Wood and Dissolving Pulp Properties on the Carboxymethyl Cellulose Reaction 1531