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**8th Annual Joint EPA, DOE, EEI, EPRI Conference on
Air Quality, Global Climate Change & Renewable Energy
January 24-26, 2005 – The Westin La Paloma Resort, Tucson, Arizona**

Welcome to the 8th Annual Electric Utilities Environmental Conference with over 850 pre-registered attendees listed in this book. The final conference program agenda is arranged in four color coded concurrent tracks and posted on site:

- Track A – AIR QUALITY (Grand Ballroom 1 - Pink)
- Track B – GLOBAL CLIMATE CHANGE (Grand Ballroom 2 - Green)
- Track C – RENEWABLE ENERGY (Canyon Ballroom -Yellow)
- Track D – OTHER (Verbena – Downstairs – Blue)

All coffee breaks ((9:30 to 10 AM, and 3 to 3:30 PM); lunches (12-1PM), and receptions (6-7PM) will be held in the exhibit area to facilitate networking.

- All Power-Point presentations are limited to 20 minutes including 5 minutes for Q&A.
- Speakers should submit a short bio to the session chair before the start of each session.

This book provides the conference agenda, abstracts of presentations, workshops, exhibits, attendee list, local attractions, restaurants and conference maps.

CD proceedings containing Power-Point presentations will be published and mailed to all participants in February 2005.

Authors wishing to publish papers in the official online publication of the Electric Utilities Environmental Conference may submit manuscripts of papers to info@euec.com.

Early registration for hotel and exhibits are available for the 9th Annual EUEC 2006 to be held January 23-25, 2006 at the Westin La Paloma, Tucson, AZ. Please contact the registration desk for assistance.

The purpose of the Electric Utility Environmental Conference is to facilitate technical information exchange and foster cooperation between industry, government, regulators, academia and stake-holders for the protection of our environment.

Thank you for your participation. Please do not hesitate to contact me or any of the conference directors if we can be of assistance.

Sincerely,

Prabhu Dayal, Ph.D., P.E., Chair, EUEC
P.O. Box 66076, Tucson, Arizona, 85728-6076
Phone: 1-520-615-3535 Fax: 1-602-296-0199
E-mail: pdayal@euec.com Web: www.euec.com

PRELIMINARY PROGRAM-AT-A-GLANCE					
Sunday 1/23/2005 Free Pre-Conference Workshops					
Time	Monday 1/24/2005				
9:30 - 12:00	Plenary Session: Prabhu Dayal, Chair, Electric Utilities Environmental Conference - "Introduction & Welcome" Sen. John McCain (Invited) - McCain-Lieberman "Climate Stewardship Act" Brian McLean, US Environmental Protection Agency - "Clean Air Rules" John McManus, American Electric Power - "A Utility View of the Future" Larry Selzer, The Conservation Fund - "Climate Policy" Ron Wyzga, EPRI - "CAIR and Health Effects" US Department of Energy - "Climate VISION" Gary Serio, Entergy - "GHG Program"				
	12 - 1 PM Networking Lunch in Exhibit Area				
		TRACK A (Grand Ballroom)	TRACK B (Grand Ballroom)	TRACK C (Canyon Ballroom)	TRACK D (Verbena Room)
		AIR QUALITY	CLIMATE CHANGE	RENEWABLE ENERGY & OTHER	EHS/EMIS/VISIBILITY/ OTHER
	1:00 - 3:00	A1: Multi-Emissions Birch, Cashin, Collamer, Jenkins, Lomax	B1: Climate Policy Forrister, Bluestein, Baer, Greene, Quillian, Daneke	C1: Particulate Matter Chow, Anderson, Andracssek, Doraiswamy, Wilber, Norfleet, Hovan	D1: EHS Grahame, Walther, Wyzga, Barnes, Chatham, Diosey
3:30 - 6:00	A2: CAIR Kinsman, Culligan, Helme, Zebell, Brown	B2: Climate Actions Seby, Sankovski, Ogonowski, Dreschel, Turner, Fine, Shropshire, Glaser	C2: Particulates Jansen, Hormel, Slocomb, Mamane, Mamane, Hadad	D2: EMIS Drerup, Biggs, Schnelle, Toth, O'Brien, Gasperecz, Keehn	
6 - 7 PM Networking Reception in Exhibit Area					
Tuesday 01/25/2005					
7:30 - 9:30	A3: Mercury - Control Offen, Sjostrom, Eckberg, Landreth, Smith	B3: Corporate Strategies Wintergreen, Nelson, Tanzer, Drexler, Diamant, Jenkins	C3: NSR Harrison, Byers, Hiser, Hoefs, Poffenberger, Traylor	D3: Visibility Kumar, McVehil, Pearson, Rowe, Oestmann, Austin	
10:00 - 12	A4: Mercury Chu, Cremer, Schofield, Alix, Bland, Masuraha	B4: Power Partners Holdsworth, Fitzgerald, Williams, Boyd, Batcher	C4: Monitoring Boyden, Evans, Head, Kinder, Drevik, Crabbe	D4: Regional Haze Campbell, Lavery, Morris, Paine, Seby, Divita	
12 - 1 PM Networking Lunch in Exhibit Area					
1:00 - 3:00	A5: Mercury Nelson, Lissianski, Minkara, Staudt, Bustard, Baek	B5: Carbon Trading Fusaro, Rosenthal, Lack, Townsend, Kolwey, Kim Burnett	C5: Monitoring McRanie, Jernigan, Worthington, Spellicy, Swanson, Herman	D5: Water & Other Cogen, Hoffmann, Dudley, Modesitt, Rabadi, Wysong	
3:30 - 6:00	A6: Mercury Rossler, Abbott, Levin, Gustin, Vijayaraghavan, Whipple, Kita	B6: Carbon Sequestration Klein, Ruether, Lanoe, Ralston, Atwood, Zannes, Lague, San Martin	C6: Permitting Freeman, Born, Cline, Weilert, Petermann, Fraser, Tierney	D6: Multi-Pollutant Control Technology Ochs, Partanen, Russell, Anderson, Crynack, Smith, Swanson	
6 - 7 PM Networking Reception in Exhibit Area					
Wednesday 01/26/2005					
7:30 - 9:30	A7: Mercury Tran, Quick, Senior, Niksa, Xin, Singhvi	B7: Terrestrial Carbon & Forestry Issues Caster, Diamant, Konrad, Updegraff, Esposito	C7: Renewable Energy Bayless, Coakley, Stuebi, Davis, Johnson, Golden, Jayaraman		
10:00 - 12:00	A8: NOx Control Albanese, Broderick, Higgins, Piche, Staudt, Sun	B8: Inventories & Registries Balentine, Camp, Worhach, Chan, Kadyszewski, Kempka	C8: Energy Efficiency Mercado, Kotas, Mayes, Sprott, Clouse, Aggarawal,		
12 - 1 PM Networking Lunch in Exhibit Area					
1:00 - 3:00	A9: Multi-Pollutant Control Technology Khan, Spitznogle, Staehle, Boren	B9: Monitoring & Verification Canterbury, Chatham, Kirk, Jacques, Tremblay, Wintergreen, Kim	C9: RE Financing Trexler, MsWilliams, Schiller, O'Hop, Mercado, South, Golove, Tran, Dayal, Austin		

Track A - Air Quality

Monday, 1/24/2005

A1 Multi-Emissions Monday; 1-3pm

Chairs: Sam Napolitano – EPA
Steve Lomax – EEI

- a. Comparison of Proposed State and Federal Multi-Pollutant Strategies**
– *Erich Birch - Birch & Becker, LLP*
- b. Incremental Control Costs for Multi Pollutant Control Planning**
– *Michael G. Cashin P.E. - Minnesota Power (Allete)*
- c. Impacts of Multi-pollutant Regulations on Fuel Diversity**
– *Nate Collamer - ICF Consulting*
- d. State Efforts to Get Ahead of the Feds in Regulating Emissions (CO2 and Mercury)**
– *Angela Jenkins and John M. Holloway III - Hunton and Williams, LLP*
- e. Emission Reduction Accomplishments of the Electric Generation Industry**
– *Steve Lomax and John Kinsman - EEI*

A2 CAIR & IGCC Monday; 1-3pm

Chairs: Kevin Culligan – EPA
John Kinsman – EEI

- a. Clean Air Interstate Rule and Other Air Quality Regulations**
– *John Kinsman and Steve Lomax – EEI*
- b. CAIR and other EPA Air Regulations that May Affect the Power Sector**
– *Kevin Culligan – EPA*
- c. Opportunities to Control Emissions from Industrial Boilers and Implications for Power Generators**
– *Ned Helme, Stacey Davis, Matt Ogonowski, David Waggoner - Center for Clean Air Policy*
- d. IGCC - Environmental Attributes and Issues**
– *Mike Zebell, Robert Fraser, Fred Pope - ENSR Corporation; Bruce MacDonald*
- e. Siting and Permitting Process for IGCC Coal Power Plants**
– *Gary D. Brown, PE – CH2M HILL*

Tuesday, 1/25/2005

A3 Mercury - Control Tuesday; 7:30-9:30am

Chairs: George Offen – EPRI
Ram Srivastava – NETL

- a. Mercury Control for Coal-fired Power Plants - An Update of Technology Options**
– George Offen, Ramsay Chang, Paul Chu and Richard Rhudy - EPRI
- b. Full-Scale Evaluations of Mercury Control Technologies with PRB Coals**
– Sharon Sjostrom, Travis Starns, Jerry Amrhein, and Jean Bustard - ADA ES, Inc.; Wayne Penrod and Corey Lineville - Sunflower Electric Power Corporation; Rich Phillips and Tom Hart - Ameren; Andrew O'Palko - U.S. DOE-NETL; Ramsay Chang, Ph.D. – EPRI
- c. Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler**
– Craig Eckberg, John Hudspeth, Mike Meyers and Jim Russell - Texas Genco; Katherine Dombrowski and Carl Richardson - URS Corporation; Ramsay Chang – EPRI
- d. Full-Scale B-PAC Mercury Control with Bituminous, Subbituminous, Lignite, and Blended Coals with Cold-Side ESPs, Fabric Filters, and a Hot-Side ESP**
– Ronald Landreth, Ph.D. and Jon Miller - Sorbent Technologies Corporation; William Rogers and Melanie McCoy - DTE Energy/Detroit Edison; Robert McMurry, Donald G. McGinnis and Quincy Corey - Duke Energy; Lynn Brickett - U.S. DOE-NETL
- e. Evaluation of Dedicated Mercury Control Technologies at Saskatchewan Power's Poplar River Station** – Dave Smith and Doug Daverne – Saskatchewan Power; Sean Black and Leif Lindau – ALSTOM Environmental Control Systems; John Pavish – Energy and Environmental Research Center

A4 Mercury Tuesday; 10a-12pm

Chairs: Paul Chu – EPRI
Mike Rossler – EEI

- a. Impact of SCR on Mercury** – Paul Chu - EPRI
- b. CFD Modeling of Activated Carbon Injection for Mercury Control in Coal-fired Power Plants**– Marc Cremer, Constance Senior, Andrew Chiodo, Dave Wang, and Jim Valentine - Reaction Engineering International
- c. A Potentially Efficient Low Cost Method for Mercury Control Based on its Newly Resolved Combustion Chemistry**– Keith Schofield - University of California at Santa Barbara
- d. Photochemical Oxidation for Elemental Mercury Removal from Subbituminous Flue Gas Streams.**
– Frank Alix and Chris McLarnon,- Powerspan; Evan Granite & Henry Pennline - U.S. DOE-NETL
- e. Mercury Control at Low Rank Coal-Fired Power Plants by a Pre-Combustion Thermal Treatment Process - An Update**
– Alan Bland, Kumar Sellakumar, Lyle Johnson, Gary Walling, Duane Steen ,and Edgar Klunder - Western Research Institute
- f. Evaluation Of Compliance Options For Proposed Mercury MACT Regulation**
– Vineet Masuraha and Deborah Walden - Trinity Consultants; Joe Bentley - Lower Colorado River Authority

A5 Mercury Tuesday; 1-3pm

Chairs: Sid Nelson – Sorbent Technologies
Ravi Srivastava – US EPA

- a. **8 TPY of Utility Mercury by 2008: The Roadmap**
– Sid Nelson Jr. - Sorbent Technologies Corporation
- b. **Integrated and Cost Effective Approach to Mercury Control**
– Vitali Lissianski, Randy Seeker, and Peter Maly - GE Energy
- c. **Further Progress Toward Concrete-Safe Mercury Sorbents**
– Rafic Minkara, Ph.D., P.E. - Headwaters Clean Coal Corporation; Qunhui Zhou, Ph.D. and Yinzhi Zhang, Ph.D. - Sorbent Technologies Corporation
- d. **Mercury Control from Coal Fired Electric Utility Plants - A Review of Technology Status and Cost**
– James E. Staudt - Andover Technology Partners; Ravi K. Srivastava - U.S. Environmental Protection Agency
- e. **Full Scale Evaluation of TOXECON IITM on a Lignite Fired Boiler**
– Jean Bustard, Jerry Amrhein, Cam Martin, Chris Rusin, Travis Starns – ADA ES, Inc.; Charlie Bullinger - Great River Energy, Coal Creek Station; Ramsay Chang, Ph.D. – EPRI; Mark Strohfus - Great River Energy
- f. **Elemental Mercury Removal by the Raw and Chemically treated Oil-fired Fly Ashes**
– Jeom-In Baek, Kyung-il Park, Kwang-Chul Song and Kyung-Ryong Jang - Korea Electric Power Research Institute; Si-Hyun Lee - Korea Institute of Energy Research

A6 Mercury - Measurement & Modeling Tuesday; 3:30-6pm

Chairs: Leonard Levin – EPRI
Anne Smith – Charles River Associates

- a. **Electric Generation Mercury Reductions: Policy-Making Landscape**
– Michael Rossler – EEI
- b. **How Do We Assess the Environmental Benefits from U.S. Mercury Emission Control Regulations? - A Proposed Monitoring Plan**
– Michael L. Abbott - Idaho National Laboratory; Robert P. Mason - Chesapeake Biological Laboratory; R.A. Bodaly - Freshwater Institute; O. Russell Bullock, Jr. - NOAA; Charles T. Driscoll - Dept. Civil & Environ. Eng.; David Evers - BioDiversity Research Institute; Steven E. Lindberg - Oak Ridge National Laboratory; Michael Murray - National Wildlife Federation; Edward B. Swain - Minnesota Pollution Control Agency
- c. **Integrative Analysis of U.S. Mercury Sources and Deposition** – Leonard Levin - EPRI; Anne Smith - Charles River Associates; Christian Seigneur -AER Inc.; Chris Whipple - ENVIRON
- d. **Why Do We Care About Terrestrial Sources and Sinks of Atmospheric Hg?**
– Mae Sexauer Gustin - Univ of Nevada-Reno; Steven E. Lindberg, Oak Ridge National Lab
- e. **Modeling of Mercury Emission Control Scenarios for Coal-fired Power Plants**
– Krish Vijayaraghavan, Kristen Lohman, Shu-Yun Chen and Christian Seigneur - Atmospheric & Environmental Research, Inc.; Anne Smith - Charles River Associates; Leonard Levin - EPRI; John J. Jansen - Southern Company Services
- f. **Mercury Exposure Across the United States Under Regulatory Scenarios**
– Chris Whipple - ENVIRON International Corporation; Christian Seigneur - AER Inc.; Anne Smith - Charles River Associates; Leonard Levin - EPRI
- g. **Field Demonstration of a Mercury Continuous Emissions Monitor**
– Dieter Kita, Jerry Amrhein, Jean Bustard and Trent Taylor - ADA ES, Inc.; Jeff Socha, Dieter Kita, and Mike Nemergut - Thermo Electron Corporation

Wednesday, 1/26/2005

A7 Mercury - Measurement & Modeling Wednesday; 7:30-9:30am

Chairs: Raj Singhvi – US EPA/ERTBI

Constance Senior – Reaction Engineering International

- a. A Multipathway Health Risk Assessment Model for Mercury Emissions**
– Khanh Tran - AMI Environmental
- b. Geographic Variation of Mercury Content, and Mercury Emissions Predicted for Existing Technologies, by U.S. County of Coal Origin.**
– Jeffrey C. Quick - Utah Geological Survey
- c. Measurement and Control of Mercury Emissions in Utility Boilers**
– Constance Senior and Bradley Adams - Reaction Engineering International
- d. The Impact of Wet FGD Scrubbing On Hg Emissions From Coal-Fired Power Stations**
– Stephen Niksa - Niksa Energy Associates; Naoki Fujiwara - Coal Research Laboratory
- e. Mercury Release From Coal Combustion By-products**
– Mei Xin and Mae Gustin - University of Nevada-Reno; Kenneth Ladwig – EPRI
- f. Comparison of Real-Time and Laboratory Analysis of Mercury Vapor in Indoor Air: Statistical Analysis Results**
– Raj Singhvi - USEPA/ERTBI

A8 NO_x Control Wednesday; 10am-12pm

Chairs: Vince Albanese – Fuel Tech

Brian Higgins – Mobotec USA

- a. Hybridization of Urea-SNCR with SCR -- A Fit for the Future**
– Vince M. Albanese and W. H. Sun - Fuel Tech; Rich Abrams - Babcock Power
- b. Cost-effective NO_x Reduction Technology with OFA and Burner Modifications: Case Studies of Two No. 6 Oil Fired Utility Boilers**
– R. Gifford Broderick - Combustion Components Associates
- c. SCR Levels Of NO_x Reduction With ROFA And Rotamix (SNCR) At Dynegy's Vermilion Power Station**
– Brian Higgins, Jay Crilley, and Mark Shilling - Mobotec USA; Kristopher Coombs - Dynegy Midwest Generation
- d. Reduction of NO_x Emissions from a Fleet of Boilers using Model Predictive Control**
– Steve Piche, Jianhu Jia, Paul Sabiston, and Ray Johnson - Pegasus Technologies
- e. SCR Catalyst Management Strategies - Modeling and Experience**
– James E. Staudt - Andover Technology Partners
- f. Commercialization of Urea Decomposition Process for SCR System**
– William H. Sun, John Boyle, Paul Carmignani and Vince Albanese - Fuel Tech, Inc.

A9 Multi-Pollutant Control Technology Wednesday; 1-3pm

Chairs: Sikander Khan – EPA

Gary Spitznogle – AEP

- a. Mercury and Multipollutant Control Technologies for Electric Utility Boilers**
– Sikander Khan and Sarah Dunham - U.S. EPA, Office of Air and Radiation, Clean Air Markets Division; Ravi Srivastava and Nick Hutson - U.S. EPA, National Risk Management Research Laboratory, Air Pollution Prevention and Control Division
- b. Oxidation of Mercury Across a Slipstream SCR Reactor Equipped with Various Catalyst Formulations**
– Gary Spitznogle, Keith McDonald, Chao Lin, Anja Vesanen, Aimee Toole, and Dan Duellman - American Electric Power Co
- c. Drivers, Rationale and Methodology in the Application of Wet Electrostatic Precipitators to Electric Utility Fossil Power Plants**
– Richard C. Staehle and Albert L. Moretti - The Babcock & Wilcox Company; Paul J. Ireland - Washington Group International; Randy Cothron - AES Deepwater; Gary Ross - NB Power
- d. Multi-Pollutant Test Results for NO_x, SO₂, and Hg Utilizing EnviroScrub's Oxides of Manganese Pahlmanite Sorbent**
– Richard M Boren - EnviroScrub Technologies Corporation
- e. Demonstration of Enabling Oxy-Combustion Technology for Zero-Emissions Power Plants**
– Roger Anderson, Keith Pronske and Fermin Viteri - Clean Energy Systems, Inc.

Track B - Climate Change **Monday, 1/24/2005**

B1 Climate Policy & Economics Monday; 1-3pm

Chairs: Dirk Forrister – NatSource

Mitchell Baer – U.S. DOE

- a. Opportunities in the EU CO₂ Emissions Trading Market**
– Dirk Forrister, NatSource
- b. New Actions on CO₂ Mitigation - Where Will They Lead Us?**
– Joel Bluestein – EEA
- c. The United Nations Efforts on Climate Change and Mercury - Update and Policy-Relevant Implications**
– Mitchell Baer – U.S. DOE
- d. Dirty Little Secrets About "Clean Power": Why Clean Power Doesn't Necessarily Mean Cleaner Air**
– Andrew Greene and Albert Ferrer – Navigant Consulting, Inc.
- e. Nuclear Power as A Tool for Economic Air Emission Reduction Programs**
– Mary M. Quillian – Nuclear Energy Institute
- f. A Real Economic Appraisal of Climate Policy Options?**
– Gregory A. Daneke – Arizona State University

B2 State & Regional Climate Actions Monday; 3:30-6pm

Chairs: Paul Seby – Friedlob Sanderson Paulson & Tourillott, LLC
Scott Turner – Nixon Peabody, LLP

- a. CO2 Regulation in the Courts?** – *Paul M. Seby- Friedlob Sanderson Paulson & Tourillott, LLC*
- b. Analyzing Joint Benefits of Air Pollution Control Policies and Climate Change Mitigation with a Stochastic Climate Change Modeling Framework**
– *Alexei Sankovski and William Pepper - ICF Consulting; Jane Leggett - U.S. EPA*
- c. Update on State Climate Actions, with Focus on New California Analysis**
– *Matt Ogonowski, Ned Helme, and Stacey Davis - Center for Clean Air Policy*
- d. The Regulation of CO2 Emissions from New and Expanding Power Plants in the Northwestern United States** – *Chris Drechsel - Trinity Consultants*
- e. The Northeast Regional Greenhouse Gas Initiative: Flash or Fizzle?**
– *Scott M. Turner - Nixon Peabody, LLP*
- f. Regional Greenhouse Gas Initiative (RGGI) Implications for Electric Generators**
– *Steve Fine and Chris MacCracken, ICF Consulting, Inc.; Karl Michael - NYSERDA*
- g. Future Energy Growth in the Big Sky Region** – *David Shropshire and Susan Capalbo - Big Sky Regional Carbon Sequestration Partnership, Idaho National Laboratory*
- h. CO2 Lawsuits: Will the Plaintiffs' Bar Do to the Utility Industry What It Did to the Tobacco Industry?** – *Peter Glaser - Troutman Sanders, LLP*

Tuesday, 1/25/2005

B3 Corporate Strategies Tuesday; 7:30-9:30am

Chairs: Eric Kuhn – Cinergy Corp
Mark Trexler – Trexler Climate + Energy Services, Inc

- a. Climate Change and GHG Shareholder Resolutions**– *Jay Wintergreen - First Environment*
- b. Climate Change: Advancing Corporate Strategy Under Uncertainty**
– *Hal Nelson - Trexler Climate + Energy Services, Inc.*
- c. Distinguishing Hyperbole from Action in Corporate Strategic Responses to Global Climate Change** – *Laura S. Tanzer & Mitchel P. McClaran - School of Natural Resources, University of Arizona*
- d. Can We Make Consumer Markets Work?** – *Mark Trexler - Trexler Climate+Energy Services*
- e. Analyzing the Cost-Effectiveness of Electric Company Options to Reduce GHG Emissions: Price Uncertainty, Real-Options, and Discounting**
– *Adam Diamant - EPRI; Eric Kuhn - Cinergy Corp.*
- f. Creating Integrated, Low-Cost, Emission Reduction Strategies for Networked Companies Using Emissions Optimizer Technology** – *Beth Brandes Jenkins, Richard E. McAllister, Bruce E. Snyder, Semra Alici, Carlos A. Valenzuela, and Mark M. Daichendt - Air Products & Chemicals, Inc.; Derrick P. Schertz and Joseph F. Pekny - Advanced Process Combinatorics, Inc.; Kasi Kasireddy - VisionMonitor*

B4 Power Partners & CLIMATE VISION Tuesday; 10am-12pm

Chairs: Eric Holdsworth – Edison Electric Institute
John Kinsman - EEI

- a. Power Partner's Meeting the Challenge: An Update** – *Eric Holdsworth - Edison Electric Institute*
- b. AEP's GHG Program Supporting Power Partners & CLIMATE VISION**
– *Diane Fitzgerald - AEP*
- c. Entergy's Voluntary Greenhouse Gas Stabilization Commitment: Progress During First Commitment (2001 - 2005) & Newly Announced Second Commitment (2006 - 2010)**
– *Jeff Williams - Entergy*
- d. Southern Company Sulfur Hexafluoride Inventory and Emission Reduction Program**
– *Ken Boyd - Southern Company*
- e. Dick Bratcher (EPRI)**
- f. DOE (to be determined)**

B5 Carbon Trading and Markets Tuesday; 1-3pm

Chairs: Joe Wisniewski – Environmental Synergy
Peter Fusaro – Global Change Associates

- a. Emissions Trading Markets: An Overview of Where We are in 2005**
– *Peter C. Fusaro - Global Change Associates Inc.*
- b. Cap Or Trade: The Evolution of Emissions Control and Market Decisions Since 1990**
– *Peter Rosenthal - Washington Bureau Chief*
- c. A look Ahead: An Update of the Regional Emissions Markets**
– *Randall N. Lack - Element Markets, Inc.*
- d. US Greenhouse Gas Project Offsets: Viable, Plentiful and Cost-effective**
– *Bill Townsend, Greg Spencer and Lauren Rector - Blue Source*
- e. Acquiring Quality Offsets With a Non-Profit Partner: The Climate Trust's Greenhouse Gas Offset Partnership Program** – *Mike Burnett - The Climate Trust*
- f. Endowment Effect of CO2 Permits In Experimental Economic Framework**
– *Hyo-Sun Kim - Korea Gas Corporation*
- g. Proactive Strategies to Manage GHG Risks**
– *Neil Kolwey - Platts/E Source*
- h. Voluntary GHG Reduction Goals and Strategies** – *Neil Kolwey - Platts/E Source*

B6 GHG & Carbon Sequestration Technologies Tuesday; 3:30-6pm

Chairs: Dan Klein – Twenty-First Strategies
John Ruether – DOE

- a. New Developments in DOE's Carbon Sequestration Program**
– *Daniel E. Klein - Twenty-First Strategies; Robert L. Kane - U.S. Dept. of Energy*
- b. Coal-to-Power and Coal-to-Liquid Fuels Technologies Used in a Technoeconomic Study of the Hydrogen Economy**
– *John Ruether and Peter Balash - U.S. DOE-NETL; Dale Keairns - U.S. DOE-NETL SAIC; Donald Hanson - Argonne National Laboratory*

- c. A Sustainable Development Technology for Capture, Recycling and Sequestration of Industrial CO₂ Emissions, Using a Biochemical Catalyst.**
– Jo Lanoë - CO₂ Solution Inc.
- d. An Innovative Process To Sequester CO₂**
– Jack Ralston - RITA, USA; Erik Fareid - EicProc
- e. The Benefits and Challenges of Sulfur Hexafluoride Recycling**
– Ted Atwood, P. Czepiel, and I. K. Klimovitsky - Xenon Specialty Gas, Inc
- f. Waste-to-Energy's Contribution to Lowering Emissions of Greenhouse Gas: An American Example**
– Maria Zannes - Integrated Waste Services Association; Frank Ferraro - Wheelabrator Technologies; D. Karsten Millrath - Columbia University Earth Engineering Center
- g. A Global Standard for Reducing Venting and Flaring of Associated Gas**
– John Lague - URS Corporation, CA; Lisa Campbell - URS Corporation, London
- h. Overview of GHG Emission Estimation for the Electric Utility Industry**
– Gregory San Martin and Sven Thesen - PG&E

Wednesday, 1/26/2005

B7 Terrestrial Carbon and Forestry Wednesday; 7:30-9:30am

Chairs: Gary Kaster – AEP

John Kinsman – EEI

- a. UtiliTree Carbon Company and PowerTree Carbon Company Experience with Forest Carbon Sequestration**
– Gary Kaster, AEP; Mike Rodenberg DTE; Eric Kuhn, Cinergy; Paul Pike, Ameren; John Kinsman, EEI
- b. Estimating and Comparing the "Levelized Cost" Per Ton (\$/ton CO₂e) of Greenhouse Gas Emissions Reductions That May Be Produced by Four Different Approaches to Developing and Managing Forest Carbon Sequestration Projects**
– Adam Diamant - EPRI
- c. A Comparison of Sequestering Carbon in Northern vs. Southern Forests of the U.S.**
– Dr. Gary Konrad and Dr. Ching-Hsun Huang - Arthur Temple College of Forestry, Stephen F. Austin State University
- d. Implementing a Pilot Trade in Soil Carbon Sequestration**
– Karen Updegraff, P. Zimmerman, P. Kozak, W.J. Capehart and M. Price - South Dakota School of Mines and Technology
- e. The Value of Collaborative Tools in Advancing Carbon Sequestration Projects and Other Climate Initiatives** – Michelle Varga Esposito - Augusta Systems, Inc.; Sarah Forbes - U.S. DOE-NETL

B8 Inventories & Registries Wednesday; 10am-12pm

Chairs: Ram Srivistava – SAIC

Sarah Forbes – DOE

- a. Overview of GHG Emission Estimation for the Electric Utility Industry**
– Howard Balentine and Wilma Dreessen - ENSR International
- b. Standardized GHG Emissions Reporting for Electric Utilities: A Report on the Voluntary Reporting and Certification Protocols Developed by the California Climate Action Registry**
– Robyn Camp - California Climate Action Registry
- c. Electricity GHG Inventories: Issues and Approaches**
– Paul Worhach, Ph.D. and Scott Olson - Nexant, Inc.
- d. Carbon Sequestration Role in State and Local Actions**
– Melissa Chan and Sarah Forbes - U.S. DOE-NETL
- e. Carbon Benefits from Improved Fire Management**
– John Kadyszewski – Winrock International
- f. Targeting and Tracking Terrestrial Sequestration Offset Projects as Part of an Emissions Reduction Strategy**
– Dick Kempka - Ducks Unlimited, Inc.

B9 Monitoring & Verification Wednesday; 1-3:30pm

Chairs: John Kadyszewski – Winrock International

Robert S. Chatham – PSEG Global

- a. Silver Lining: Where Global Environmental Program Meet Economic Reality**
– Michael Canterbury - ESP
- b. Certifying Greenhouse Gas Projects**
– Robert S. Chatham, PE, CPEA - PSEG Global
- c. Learnings from an Aspiring CDM Project Participant: Four Years of Visible Results**
– Ed Kirk - CAAC; Benoit Bosquet -World Bank; David Shoch –Winrock
- d. CO2 Emissions from Semi-Arid Reservoirs and Natural Aquatic Ecosystems**
– Robert Jacques - Ecubed; Alain Tremblay - Hydro-Quebec; J. Therrien - Groupe Conseil Génivar
- e. Greenhouse Gas Emissions From Hydroelectric Reservoirs: From Boreal To Tropical Regions** – Alain Tremblay and Louis Varfalvy - Hydro-Quebec; Charlotte Roehm and Michelle Garneau - University of Quebec in Montreal
- f. The California Climate Action Registry and GHG Report Verification**
– Jay Wintergreen & Tod Delaney – First Environment
- g. Analysis of LFG Generation Rate from Landfill Site with Relation to CDM**
– Hyung-Taek Kim and Jun-Kyu Park – Department of Energy Studies; Duk-Seang Lee – Big Trust Technology

Track C - Renewable Energy & Other Issues

Monday, 1/24/2005

C1 Particulate Matter Monday; 1-3pm

Chairs: Judy Chow – Desert Research Institute

Peter G. Hyde – Arizona Department of Environmental Quality

- a. XRF Speciation of Particulate Monitoring Filters – A Wise Investment for Electric Utilities Under the Regional Haze Rule**
– Darcy J. Anderson – Matrix Consulting Group, Inc.; Peter G. Hyde – Arizona Department of Environmental Quality; Dr. Prabhu Dayal – C Trade
- b. Particulate Emissions- When Test Methods Don't Reflect Actual Emissions**
– Robyn Andracsek – Burns & McDonnell
- c. Contribution of Coal-Fired Power Plants to Ambient PM2.5 Concentrations in TN**
– Prakash Doraiswamy, Wayne T. Davis, Terry L. Miller and Joshua S. Fu - Dept. Civil and Environmental Engineering University of Tennessee, Knoxville
- d. Continuous Particulate Monitoring - The Next Challenge for Point-Source Monitoring for the Electric Utility Industry**
– Karl R. Wilber – ESC; Frances Hardrick – We Energies
- e. Opacity and Particulate Measurement and Regulatory Issues Affecting Utilities**
– Steve Norfleet – RMB Consulting
- f. Particulate Monitoring: Technology and Regulations**
– Richard A. Hovan - Forney Corporation

C2 Particulates - Science & Modeling Monday; 3:30-6pm

Chairs: Judy Chow – Desert Research Institute

John Jansen – Southern Company

- a. A SEARCH Update: Trends, Sources of Carbon, and More**
– John Jansen – Southern Company
- b. Recent Developments in Meteorological Data for Use in CALPUFF**
– Thomas R. Hormel and Edward Addison - McVehil-Monnett Associates, Inc.
- c. Lessons Learned from PEMS Development**
– Stephen H. Slocomb, PE and Sean R. Gregory – Epsilon Associates, Inc.
- d. Characterization of Ash Aerosols from Ancient Roman Bath Hypocaust**
– Yaacov Mamane – Faculty of Civil and Environmental Engineering, Haifa, Israel; Robert Willis – ManTech
- e. Characterization of Coarse and Fine Particles Downwind of a Coal Power Plant Along the East Mediterranean Coast.**
– Yaacov Mamane, Osnat Yossef, and Ety Melamed - Faculty of Civil and Environmental Engineering, Haifa, Israel
- f. Determination of Shiraz Air Pollution Monitoring Network Using Geostatistical Techniques and Kriging Method**
– Kamal Hadad – S.U.

Tuesday, 1/25/2005

C3 New Source Review (NSR) Tuesday; 7:30-9:30am

Chairs: Craig Harrison – Hunton & Williams

Eric Hiser – Jorden Bischoff McGuire Rose & Hiser, PLC

- a. Will 2005 Resolve the Debate About EPA's Utility Enforcement Initiative and the NSR Rules?**
– *Craig S. Harrison – Hunton & Williams*
- b. New Source Review Planning - What's the Right Approach to Implementing Plant Upgrades? A Case Study**
– *Andrew Byers and Brian O'Neal – Black & Veatch*
- c. The Hidden Side of NSR Reform: Changes in the Interpretation of Reactivation, Method of Operation, and Hours of Operation**
– *Eric L. Hiser – Jorden Bischoff McGuire Rose & Hiser, PLC*
- d. Lessons Learned Under New Source Review Reform: A Year in the Life of a Delegated State.**
– *Edward A. Hoefs, P.E. and Jon P. Sandstedt, P.E. – Wenck Associates, Inc.*
- e. Outstanding Legal Issues for NSR Reform**
– *Clara Poffenberger - Baker Botts*
- f. New Source Review Inoculation: An Environmental Risk-managed Approach to Planning and Implementing Maintenance Projects at Electric Utilities**
– *Patrick D. Traylor – Hogan & Hartson, LLP*

C4 Emission Monitoring Tuesday; 10am-12pm

Chairs: Steve Drevik – ESC

Sean Black – ALSTOM Power

- a. Asset Optimization: Rolling-Average Emission Control and Plant Area Limit/Fleet-wide Air Pollution Control Optimization**
– *Scott Boyden, Sean Black and Frank Licavoli – ALSTOM Power*
- b. The SO3 Challenge**
– *Scott Evans – Clean Air Engineering*
- c. Issues Related To Gas Turbine Startup Emissions**
– *Sara J. Head and Robert Fraser – ENSR*
- d. Long-Term Field Evaluation of Mercury Continuous Emission Monitors at a Coal-Fired Steam Plant**
– *Kris Kinder, Jim Dunn, and Debbie Lander – Shaw Environmental and Infrastructure; Jim Pruett - Environmental Systems Corporation*
- e. Data Management Techniques for Electric Utilities**
– *Steve Drevik – ESC; TBD – Eastman Chemical*
- f. Ammonia Monitoring on SCR's and SNCR's in Coal Fired Applications**
– *K. Crabbe, CEMTEK; H. Gamble, Unisearch*

C5 Emission Monitoring Tuesday; 1-3pm

Chairs: J. Ron Jernigan – Thermo Electron Corporation
Richard D. McRanie – RMB Consulting & Research

- a. Hg Continuous Emissions Monitoring Significant Technical Issues Associated With The Technology**
– Richard D. McRanie – RMB Consulting & Research, Inc.
- b. Overview of EPA's Changes to Part 75 CEMS "Guidance on Recertification and Diagnostic Test Events"**
– J. Ron Jernigan, P.E., DEE – Thermo Electron Corporation
- c. CEMS Networks and Asset Management Result in Cost Reduction**
– Bill Worthington – ABB, Inc.
- d. Optical Monitoring, Providing Capabilities; Difficult or Impossible with Conventional CEM's?**
– Dr. Robert L. Spellicy and Dr. Ralph J. Brewer – Industrial Monitor & Control Corp.
- e. (SmartPEMST) Field Demonstration of a Cost-Effective Advanced Monitoring Solution - Deployment of a Predictive Emissions Monitoring System as a Complete Compliance Solution for a Large Cogeneration Facility in Southeastern Michigan.**
– Brian G. Swanson – CMC Solutions, L.L.C.
- f. Simultaneous Measurement of NO and NO2 on a Single NDUV Based Analyzer**
– Bruce Herman – ABB

C6 Permitting Tuesday; 3:30-6pm

Chairs: Lauren Freeman – Hunton & Williams
David Gaige – Burns & McDonnell

- a. Developments under the Title V Permitting Program**
– Lauren Freeman – Hunton & Williams
- b. Defining Compliance In and Out of Your Title V Permit: What Your CEM and Parametric Monitoring is Really Telling You as a Matter of Law.**
– Mike Born and Lou Tosi – Shumaker, Loop & Kendrick
- c. Permitting Of New Coal-Fired Generation**
– Debra Cline – Troutman Sanders LLP
- d. What is BACT for a Coal Plant? Process Versus Add-on Controls**
– Carl Weilert – Burns & McDonnell Engineering
- e. Fast Track PSD Permitting of the BPU Nearman Creek CTG - A Lesson in Successfully Herding Cats**
– Brian Petermann – Segal Inc.; Curt Deitz – Board of Public Utilities
- f. The Coal Asset Environmental Survey - Not your Father's Due Diligence**
– Robert G. Fraser – ENSR International
- g. Siting Critical Electric Infrastructure: What Will it Take to Site Power Projects?**
– Dr. Susan Tierney – The Analysis Group

Wednesday, 1/26/2005

C7 Renewable Energy Wednesday; 7:30-9:30am

Chairs: Charlie Bayless – Primary Energy
Coke Coakley – FPL

- a. Recycled Energy Projects can Reduce Emissions**
– Charlie Bayless; Mark Hall – Primary Energy
- b. Offshore Wind Parks - Status of U.S. Development**
– Louis "Coke" Coakley – FPL; Patricia Fleischauer & Frederick Pope – ENSR
- c. Developing an Integrative Clean Energy Resource Plan**
– Richard T. Stuebi - NextWave Energy, Inc.
- d. Energy Required to Neutralize Off-Gassing from HVAC Systems Located in the Attics of Residential Houses**
– Charles I. Davis – Regal Air Quality
- e. Recycling the Solid Waste Stream - CIRCA's Promotion of CCP Use**
– Doug Johnson - Manitoba Hydro, CIRCA; Anne Weir – CIRCA
- f. Utilization of Photovoltaics to Mitigate the Urban Heat Island Hysteresis Lag Complexity**
– Jay S. Golden – Arizona State University Sustainable Technology Program
- g. Accelerating and Achieving Targets for Renewable Energy Market Penetration: Options and Tools for Policy Makers**
– Kamala R. Jayaraman and Jaunita M. Haydel – ICF Consulting

C8 Renewable Energy Wednesday; 10am-12pm

Chairs: Edgar Mercado – US EPA
Jerry Kotas – DOE

- a. Energy Efficiency, Renewable Energy and Clean Distributed Generation**
– Edgar Mercado – US EPA
- b. EERE/Air Quality Integration Pilots: Improving Air Quality through Energy Efficiency & Renewable Energy Technologies**
– Jerry Kotas – U.S. Dept. of Energy, EERE
- c. How Much Renewable Energy Is Really Produced?**
– Fred Mayes and Louise A. Guey-Lee - Energy Information Administration, U.S. Dept. of Energy
- d. Using Supplemental Environmental Projects to Transform Renewable Energy Markets**
– Rick Sprott – Utah Division of Air Quality
- e. Best of Class in Utility Green Pricing Programs: Tools for Future Success**
– Matt Clouse, Kurt Johnson and Blaine Collison – US EPA
- f. Landfill Gas: A Cost-competitive Renewable Energy Source**
– Vineet Aggarwal, Steve Fine and Josh Smith – ICF Consulting; Rachel Goldstein – U.S. EPA

C9 RE Credits & Financing Alternative Energy Wednesday; 1-3pm

Chairs: Edgar Mercado – US EPA

Mark Trexler – Trexler Climate + Energy Services, Inc.

- a. Renewable Energy: What Will Renewable Energy Credits be Worth?**
– Mark Trexler – Trexler Climate + Energy Services, Inc.
- b. Environmental Credits to Enhance Renewable Energy Project Value**
– Douglas A. McWilliams – Squire, Sanders & Dempsey, LLP with support from the SSD Renewable Energy Project Team
- c. Emission Allowances For Renewable Energy And Energy Efficiency Projects**
– Steven R. Schiller – Schiller Consulting; Edgar Mercado – US EPA; Bill Balcke – PQA
- d. Financing Incentives and Challenges for Renewable Energy Projects**
– Paul A. O'Hop – Squire, Sanders & Dempsey, LLP
- e. Renewable Energy Credits (REC), Green Power & Emission Markets/ Renewable Portfolio Standards (RPS) & RGGI**
– Edgar Mercado, M. Clouse, & T. Kerr, Julie Rosenberg, A. Diem, & Sara Dunn – US EPA
- f. RECs v. RPS: Markets in Conflict?**
– David W. South – Technology & Market Solutions, LLC
- g. ProForm v 4.0 - A Tool for Financial Analysis of Clean Energy Projects**
– Bill Golove – Lawrence Berkley National Laboratory
- h. Computer Weather Forecast System for Wind Energy Plants**
– Khanh Tran – AMI Environmental
- i. Hybrid Solar/Wind Systems for Rural Electrification in Developing Countries**
– Prabhu Dayal – C Trade; Mike Elliot – South West Wind Power
- j. Distributed Generation Using Landfill Gas - Getting the Go-ahead for Pollution Prevention**
–Franklyn Austin – Stone & Webster Management Consultants, Inc; Sarah. J. Simon, P.E., EMCON

Track D - EHS/EMIS/Visibility

Monday, 1/24/2005

D1 EHS/Health & Risk Monday; 1-3pm

Chairs: Thomas J. Grahame – US DOE
Ron Wyzga – EPRI

- a. **What Do the Most Recent Studies of Particulate Matter (PM) Effects on Health Tell Us? A Review of Epidemiological, Toxicological, and CAPs Studies of PM** - *Thomas J. Grahame – US DOE*
- b. **Health Effectiveness of Utility Air Quality Regulations** - *Eric G. Walther, Ph.D. & Uday Singh – TRC*
- c. **Assessment of the Health Effects of Coal Combustion Emissions: Preliminary Results from the TERESA Study** - *Ron Wyzga and Annette Rohr, EPRI*
- d. **New Concerns for Toxic Exposure and Process Safety in Air Pollution Control Reagents** - *William Barnes, PE – Avogadro Environmental Corporation*
- e. **EHS Management Systems - Lessons Learned** - *Robert S. Chatham – PSEG Global*
- f. **Assessing the Impact of Air Toxic Emissions Using HARP** - *Phyllis G. Diosey, Ph.D and Lorraine Farrell, PE – Malcolm Pirnie, Inc.*

D2 EMIS Monday; 3:30-6pm

Chairs: David Drerup – DS&S
Jim Davis – ESP

- a. **Defining a Sustainable EMIS Solution** - *Dave Drerup - Data Systems & Solutions*
- b. **PowerQUEST: Software Tool for Stakeholder Engagement in Integrated Resource Planning** - *Dave Biggs - Envision Sustainability Tools Inc.; Ronald Monk - British Columbia Hydro Corporation*
- c. **Cinergy EMIS** - *Robert C. Schnelle, Jr. – Cinergy*
- d. **Self-Implementing an EMIS: What You Need to Know Before You Get Started** - *Brian D. Toth - Southern Power Company*
- e. **Cyber Infrastructure for Effective Deployment of Environmental Management Systems** - *Jeremiah O'Brien - Process Data Control Corp; Andy Srinivasan - Bayer Material Sciences; Tim Aldredge - Eastman Chemicals*
- f. **Compliance Survival Tactics: How to Protect Yourself From the Title V Data Explosion in the Absence of a Flak Jacket** - *Greg Gasperecz – Enviance*
- g. **Beyond Compliance: The Role of Software in Environmental Management and Emissions Portfolio Management at DTE Energy** - *Jim Keehn - Specialist Licensing at DTE*

Tuesday, 1/25/2005

D3 Visibility Tuesday; 7:30-9:30am

Chairs: John Watson – Desert Research Institute
Robert Pearson – CH2M Hill

- a. Should IMPROVE Light Extinction Reconstruction be IMPROVED?**
– Naresh Kumar – EPRI; Patrick A. Ryan – Sonoma Technology, Inc.; Doug Lowenthal - Desert Research Institute
- b. Sensitivity of CALPUFF Visibility Impacts to Meteorological Data, Emissions, and Model Inputs**
– George E. McVehil, Thomas R. Hormel, and Edward Addison – McVehil-Monnett Associates, Inc
- c. Recent Advances in Demonstrating Acceptable Visibility Impacts in Class I Areas**
– Robert Pearson and James Nall – CH2M Hill
- d. AirControlNET – An Emissions Inventory and Control Technology Tool**
– Steve Rowe and Frank Divita – E.H. Pechan & Associates, Inc.; Larry Sorrels and Tyler Fox – US EPA
- e. Topographical and Climatological Influences On Class I Impact Analysis Results**
– Allan R. Oestmann and James D. Hodina – Stanley Consultants, Inc.
- f. A Survey of Recent Generation Company Environmental Disclosure Practices**
– Franklyn Austin – Stone & Webster Management Consultants, Inc

D4 BART& Regional Haze Tuesday; 10am-12pm

Chairs: John Watson – Desert Research Institute
Frank Divita – E.H. Pechan & Associates

- a. Innovative Mitigation for Regional Haze Impacts: Cleaning up Smoldering Coal Refuse Piles with CFB Boilers**
– William Campbell, Robert Paine, and David Shea - ENSR Corporation
- b. Regional Haze and PM2.5 Aerosols in Minnesota, Wisconsin, Michigan, and Southern Ontario**
– Thomas F. Lavery - Thielsch Engineering, Inc.; Christopher M. Rogers - MACTEC Engineering & Consulting, Inc.
- c. Use of a Full-Science 3-D Photochemical Grid Model to Address the BART Visibility Modeling Requirements**
– Ralph Morris, Gary Wilson and Greg Yarwood - ENVIRON International Corporation; Kirk Baker and Mike Koerber - Lake Michigan Air Directors Consortium
- d. Gazing into the Crystal Ball: Source-Specific Regional Haze BART Assessments**
– Robert Paine and David Heinold - ENSR Corporation
- e. EPA's Ongoing Efforts To Implement Regional Haze Rules - Are They Becoming Any Clearer?**
– Paul M. Seby - Friedlob Sanderson Paulson & Tourtillott, LLC
- f. The Contribution of Electricity Generating Units to Regional Haze Modeling Inventories**
– Frank Divita, Stephen Roe, Randy Strait - E.H. Pechan & Associates, Inc.

D5 Emerging Issues/EMIS & Water Tuesday; 1-3pm

Chair: Richard Cogen – Nixon Peabody, LLP

a. Negotiating Clean Water Act Section 316(b) Conditions in SPDES Permits for Phase II Existing Facilities

– Richard Cogen - Nixon Peabody, LLP

b. DOE/NETL's Water Management R&D Program - Responding to Emerging Power Plant Water Issues

– Jeffrey W. Hoffmann, Thomas J. Feeley III and Barbara A. Carney - U.S. DOE-NETL

c. Optimizing Investments in Sustainable Technologies: Incorporating Co and Dis-Benefits into Decision-Making

– Bruce Dudley – The Delphi Group

d. Choosing the Right EMIS: Maximizing Value While Minimizing IT Risk

– Keith Modesitt, CCSE - Perillon Software, Inc.

e. Integrating Handheld Visible Emissions Tool with an Environmental Management Information System (EMIS). A Case Study: Westar Energy

– Khal Rabadi, Nicolas Johnson - Trinity Consultants; Dan Wilkus, Craig Swartzendruber - Westar Energy

f. Beginning-of-Pipe EIS: How Proactive Utilities Are Reducing Their Toxic Footprint

– Mark Wysong - Dolphin Software, Inc

D6 Multi-Pollutant Control Technology Tuesday; 3:30-6pm

Chairs: Cathy Summers – DOE

Larry Swanson – GE Energy

a. Integrated Pollutant Removal: Modeling and Experimentation

– T.L. Ochs, D.B. Oryshchyn, and C.A. Summers, US DOE - Albany Research Center

b. VOC/HAP Mitigation Using a Combustion Turbine

– William Partanen, P.E. - Neill and Gunter, Incorporated

c. Use of Ammonia Flue Gas Conditioning to Control SO3 Emissions and Stack Plume

– Jeffery M. Russell and Jeffrey S. Gratz - MPR Associates, Inc.; Shawn E. Smith and Kevin P. Panzino - Reliant Energy, Cheswick Station

d. Performance of the Indigo Bi-Polar Agglomerator at Plant Watson

– Robert R. Crynack - Indigo Technologies, LLC

e. Magnesium Enhanced Lime FGD and SO3, Hg, and CO2 Emissions

– Kevin Smith, Lew Benson and Michael Schrock - Carmeuse North America

f. Emissions Control Technologies for Steam Turbine Upgrades: A Value Story

– Larry Swanson, David Moyeda, and Randy Seeker - GE Energy

Track A - Air Quality

Monday, 1/24/2005

A1 Multi-Emissions Monday; 1-3pm

Chairs: Sam Napolitano – EPA
Steve Lomax – EEI

a. Comparison of Proposed State and Federal Multi-Pollutant Strategies

Erich Birch – Birch & Becker, LLP

This presentation will compare the key components of the major multi-pollutant proposals. Several states are also considering multi-pollutant strategies and the proposals of key states will be included in the comparison. The purpose of this presentation is to identify common features of the proposals and to highlight technical, legal, and policy issues in the proposals.

b. Incremental Control Costs for Multi Pollutant Control Planning

Michael G. Cashin P.E. – Minnesota Power (Allete)

Electric utilities face differing challenges for emission control and performance planning depending on their generation mix, their regional energy resource mix and local and regional air quality. Incremental control costs for SO₂, NO_x and mercury emission reductions will be presented and compared with EPA estimated control costs. In turn, emission allowance allocation equity issues will be examined for prospective application under the Clean Air Interstate Rule, the mercury MACT and the Clear Skies Act.

c. Impacts of Multi-pollutant Regulations on Fuel Diversity

Nate Collamer – ICF Consulting

Extremely high fuel prices and volatility have pushed fuel diversity to the forefront of policy-making and generation strategy. This presentation will present recent ICF analysis forecasting the impacts of alternative multi-pollutant policies on the economics and penetration of alternative generation options including pulverized coal, coal IGCC, nuclear, renewable, and gas. Specific focus will be placed on the impact of high gas prices, renewable portfolio standards, potential CO₂ legislation, and continued high coal prices.

d. State Efforts to Get Ahead of the Feds in Regulating Emissions (CO₂ and Mercury)

Angela Jenkins and John M. Holloway III – Hunton and Williams, LLP

A discussion of recent efforts by state regulators to jump ahead of EPA to regulate emissions of CO₂ and mercury and a brief analysis of how these efforts are shaping up in light of EPA actions and proposals.

e. Emission Reduction Accomplishments of the Electric Generation Industry

Steve Lomax and John Kinsman - EEI

A2 CAIR & IGCC Monday; 1-3pm

Chairs: Kevin Culligan – EPA
John Kinsman – EEI

a. Clean Air Interstate Rule and Other Air Quality Regulations

John Kinsman and Steve Lomax – EEI

b. CAIR and other EPA Air Regulations that May Affect the Power Sector

Kevin Culligan – EPA

This talk will discuss CAIR and other ongoing EPA air regulatory actions that may impact the power sector. It will provide a status of those regulations and discuss their possible implications for the power sector.

c. Opportunities to Control Emissions from Industrial Boilers and Implications for Power Generators

Ned Helme, Stacey Davis, Matt Ogonowski, David Waggoner – Center for Clean Air Policy

The Center for Clean Air Policy is undertaking analysis of air quality mitigation options in a number of sectors and emissions categories, such as industrial boilers, to identify opportunities for additional NO_x and fine particle emissions reductions at the national and levels. These evaluations will consider several criteria, including the availability and cost of technical approaches to control emissions, total projected emissions, the geographic distribution of projected emissions, and the availability of good inventories and emissions monitoring programs, among others. Largely uncontrolled, we hypothesize that emissions reductions from industrial boilers will cost less per ton of emissions reduced than additional measures to control criteria pollutant emissions from the power sector. Regulatory treatment of industrial boilers and other sectors could be linked with legislative or regulatory trading programs to control emissions from power plants, lowering the marginal cost of compliance for the power sector. We will explain the results of our analysis and potential implications of a joint regulatory approach.

d. IGCC - Environmental Attributes and Issues

Mike Zebell, Robert Fraser, Fred Pope – ENSR Corporation; Bruce MacDonald

Interest in the development of Integrated Gasification Combined Cycle (IGCC) Technology has been increasing as a result of the current and anticipated fuel costs of natural gas. The primary advantage of this electric generation technology is the use of abundant fuel (coal or petroleum coke) with the resulting air emissions more similar to natural gas fired generation than solid fuel fired generation. The cost of IGCC is becoming competitive versus a new state-of-the-art coal fired boiler and some renewable technologies.

The air quality benefit of IGCC versus a typical new coal and natural gas fired plants is presented for SO₂, NO_x, PM, CO and HAP emissions. The control technologies that can be employed on IGCC plants (and end of line combined cycle unit) will be discussed along with anticipated levels of control as well as levels currently achieved at operating IGCC plants. A Best Available Control Technology will be suggested and discussed based on recently permitted IGCC plants. Methods for estimating fugitive VOC emissions that may arise from process leaks will be provided.

In addition, other environmental issues associated with IGCC are discussed and their potential impacts presented. Siting issues are discussed including proximity to fuel source, water availability, and land requirements. Issues such as by-product (slag) disposal, water use, feedstock preparation, feedstock transportation and noise are discussed.

A case study is presented for development of an IGCC plant at an existing refinery with petroleum coke as the feedstock. Potentially applicable air quality regulations will be presented along with the somewhat specialized air impacts analyses required to permit the proposed plant. Some of the air topics covered will include source definition interpretation, emissions netting and trading, ambient equivalence and considerations for modified existing boilers.

e. Siting and Permitting Process for IGCC Coal Power Plants

Gary D. Brown, PE – CH2M HILL

New coal-fired power plant projects in the United States are now considering Integrated Gasification Combined Cycle (IGCC) technology as an option in addition to pulverized coal (PC) and circulating fluid-bed (CFB) technologies. ConocoPhillips/Fluor, GE Energy/Bechtel and Shell Global Solutions are all offering IGCC technology for new coal/petroleum coke based power plants in the U.S. Since 2001 CH2M HILL has included IGCC in alternative energy and technology assessments as part of siting studies for two new western/midwestern baseload coal-fired units. During this same time period CH2M HILL has also been asked to address IGCC as a combustion technology option during the PSD permitting process for two other new western baseload coal-fired units. All new IGCC generating units will be required to use state of the art emission controls to meet or exceed current BACT and NSPS requirements. This presentation will identify potential environmental and land use regulatory licensing, permitting and approval requirements for new IGCC electric utility projects to be located in the western or midwestern area of the United States.

An estimate of the schedule required for preparing the necessary permit applications and agency review of each of the required licenses, permits, and approvals will be included. Permitting experience with operating and planned IGCC plants will be compared to recent permitting experience with conventional PC units in the U.S. The permitting status of all currently planned IGCC plants will be presented. Alternative SO₂ and NO_x control technologies for an IGCC facility will be discussed. The environmental performance of commercially operating IGCC plants relative to actual emission rates will be included in the presentation. This data will be compared to the projected emission rates for new IGCC units.

Tuesday, 1/25/2005

A3 Mercury - Control Tuesday; 7:30-9:30am

Chairs: George Offen – EPRI

Ram Srivastava – SAIC/NETL

a. Mercury Control for Coal-fired Power Plants - An Update of Technology Options

George Offen, Ramsay Chang, Paul Chu and Richard Rhudy – EPRI

As final federal mercury regulations are still pending and various states are adopting their own regulations or legislation, power producers need to continue to develop a range of technologies to meet the needs of the many fuel/air pollution control options and regulatory scenarios. This paper will present an update on the status of the various controls being developed by the industry and evaluated by EPRI (often in collaboration with DOE) for coal-fired power plants, the extent or limits of experience with them, and the ongoing efforts to close data gaps. Details on many of these processes are expected to be presented in other papers at this conference; this paper would set the stage for those presentations by indicating how the various controls could fit into compliance strategies depending the timing and stringency of the final regulations.

b. Full-Scale Evaluations of Mercury Control Technologies with PRB Coals

Sharon Sjostrom, Travis Starns, Jerry Amrhein, and Jean Bustard – ADA ES, Inc.; Wayne Penrod and Corey Lineville – Sunflower Electric Power Corporation; Rich Phillips and Tom Hart – Ameren; Andrew O'Palko – U.S. DOE-NETL; Ramsay Chang, Ph.D. – EPRI

Data indicates that plants firing Powder River Basin (PRB) coals achieve very low native mercury removal when configured with electrostatic precipitators (ESP) or spray dryer absorbers followed by fabric filters (SDA/FF). In addition, full-scale demonstrations indicate that the performance of non-chemically treated activated carbon may be limited in these applications.

ADA-ES, with support from U.S. DOE-NETL and industry partners, is conducting a mercury control demonstration at two units that fire PRB coal: Sunflower Electric's Holcomb Station, and Ameren's Meramec Station. Holcomb Station is a 360 MW unit and has a SDA and FF for emission control. Meramec Station is a 140 MW unit and has low NO_x burners and an ESP for emission control. This paper will present results from testing at these two sites. Results include the effect on mercury emissions of 1) blending PRB with bituminous coal, 2) injecting alternative sorbents specifically designed to operate in a halogen deficient flue gas, and 3) injecting chemical additives onto the coal.

c. Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler

Craig Eckberg, John Hudspeth, Mike Meyers and Jim Russell – Texas Genco; Katherine Dombrowski and Carl Richardson – URS Corporation; Ramsay Chang – EPRI

One mercury control option for western coal-fired power plants equipped with an ESP and wet scrubber is to add halogens into the boiler to improve mercury removal across the ESP and to oxidize the elemental mercury into a soluble species that can be removed in the scrubber. EPRI has funded testing of boiler injection of various halogen compounds at a number of coal-fired power plants. This paper reports on EPRI-funded full-scale halogen injection tests conducted at Texas Genco's Limestone Generating Station Unit 1, which burns a 70/30 blend of Texas Lignite (TxL) and Powder River Basin (PRB) coals. Unit 1 is equipped with an ESP and an FGD scrubber. These tests were the first halogen injection tests to be performed on a plant burning Texas Lignite

coal and employing a high-efficiency wet FGD absorber. Two different halogen containing salt solutions were tested: a chloride and a bromide salt. The solutions were injected at target feed rates ranging from 0.02 to 0.10 wt% halogen in the coal. Flue gas mercury measurements were made at the ESP inlet, FGD inlet, and FGD outlet. Data from this program show how halogen injection technology affects mercury removal and oxidation across an ESP in Texas Lignite flue gas and how this subsequently affects mercury removal across a high efficiency wet scrubber.

d. Full-Scale B-PAC Mercury Control with Bituminous, Subbituminous, Lignite, and Blended Coals with Cold-Side ESPs, Fabric Filters, and a Hot-Side ESP

Ronald Landreth, Ph.D. and Jon Miller – Sorbent Technologies Corporation; William Rogers and Melanie McCoy – DTE Energy/Detroit Edison; Robert McMurtry, Donald G. McGinnis and Quincy Corey – Duke Energy; Lynn Brickett – U.S. DOE-NETL

The injection of brominated powdered activated carbon (B-PAC) into power-plant flue gases for mercury removal has now been tested at at least seven power plants. These plants have burned bituminous, subbituminous, and lignite coals and include testing configurations with cold-side ESPs, hot-side ESPs, spray dryers, and fabric filters. Mercury-removal performance at these sites has varied between 70% and 98% at sorbent consumption rates of approximately \$2,000 to \$20,000 per-lb-of-mercury-removed, considerably less-costly than current estimates.

This paper will describe the results and consequent estimated costs for mercury-removal at each of the plants. Data on balance-of-plant effects will also be provided.

Particular focus will be placed on the recent long-term, full-scale testing at Detroit Edison's St. Clair Plant with subbituminous coal and a cold-side ESP and the results of a second round of testing at Duke Energy's Cliffside Plant with bituminous coal and a hot-side ESP.

e. Evaluation of Dedicated Mercury Control Technologies at Saskatchewan Power's Poplar River Station

Dave Smith and Doug Daverne – Saskatchewan Power; Sean Black and Leif Lindau – ALSTOM Environmental Control Systems; John Pavish – Energy and Environmental Research Center

The presentation will provide an overview of the Emissions Control Research Facility that has been constructed at Saskatchewan Power's Poplar River Facility to evaluate sorbent injection for mercury control. The Poplar River Facility is located in the province of Saskatchewan, Canada. The facility was commissioned in September 2004. The Poplar River Station combusts a lignite coal, which is a specific segment of the market for which little operating data currently exists. This segment may prove to be one of the most difficult applications for the retrofit of dedicated mercury controls that may soon be triggered by regulatory requirements in Canada, as well as developing federal and state regulations in the United States. The project is being supported by numerous public and private agencies in both Canada and the United States. The presentation will cover a number of issues, including: 1) a discussion of the regulatory and other drivers in Canada that could mandate the need for dedicated mercury control technologies on coal-fired boilers; 2) an overview of the design of the pilot research facility, with specific attention to some of the unique design features that provide significant flexibility in the range of tests that can be performed; 3) an overview of the construction of the pilot project; and 4) a summary of the different tests that will be performed during the testing period that is anticipated to run through the end of 2005. This pilot project is expected to yield significant information regarding the control of mercury emissions using sorbent injection and the project will also evaluate a variety of new technologies and/or techniques that offer the potential to enhance the performance of sorbent injection on utility boilers that combust lignite coals.

A4 Mercury Tuesday; 10a-12pm

Chairs: Paul Chu – EPRI
Mike Rossler – EEI

a. Impact of SCR on Mercury

Paul Chu – EPRI

Selective catalytic reduction (SCR) for NO_x control has the potential to catalytically convert elemental mercury (Hg⁰) to oxidized mercury (Hg²⁺) that is more efficiently captured in the downstream flue gas desulfurization (FGD) system. Full-scale measurements at about 15 power plants indicated substantial oxidation could occur across the SCR. However, this increase in

oxidation appears to be more likely for bituminous coals, and less likely for Powder River Basin (PRB) coals. For the power plants with FGD, the combined cobenefit of SCR and FGD increased mercury removal substantially - and may potentially reduce the extent of mercury "re-emissions" across the FGD. The mechanism for the SCR oxidation is being evaluated in a series of bench-scale studies. Additional full-scale tests are on-going to further evaluate the cobenefits of SCR and FGDs and the effect of coal type.

b. CFD Modeling of Activated Carbon Injection for Mercury Control in Coal-fired Power Plants

Marc Cremer, Constance Senior, Andrew Chiodo, Dave Wang, and Jim Valentine – Reaction Engineering International

Utilities must deal with impending regulations on mercury emissions from coal-fired power plants in the most cost-effective manner. Activated carbon injection (ACI) is the most mature technology for control of mercury emissions from coal-fired power plants. Implementing ACI requires knowledge of the chemistry of mercury in flue gas as well as the ability to inject and disperse the sorbent adequately in the ductwork upstream of the particulate control device. Previous research has led to the development of theoretical models aimed at understanding mercury chemistry on a micro-scale. In this work, a CFD model coupled with a single-particle mercury sorbent model was used to predict the distribution of sorbent and capture of mercury in a demonstration of ACI at Pleasant Prairie, which burns a Powder River Basin (PRB) subbituminous coal and has a cold-side ESP. Good agreement between the model and the measured capture was obtained.

c. A Potentially Efficient Low Cost Method for Mercury Control Based on its Newly Resolved Combustion Chemistry

Keith Schofield – University of California at Santa Barbara

It is very probable that the recently observed efficient heterogeneous behavior of mercury is the mechanism by which gaseous HgCl_2 is formed in coal combustors(1). Although a direct heterogeneous channel between gaseous mercury and molecular chlorine was indicated in the literature 25 years ago it has otherwise been overlooked(2). However, it now appears that due to the dominance of HCl in combustion gases the mercury favors the momentary production of a deposit of HgSO_4 that then converts to volatile HgCl_2 via its efficient reaction with HCl, temperature and reaction time permitting.

The operational temperature window for this mechanism has now been shown to be controlled by the thermal dissociation rate of the sulfate intermediate relegating its formation to the cooling flue gases. Being a solid, its dissociation rate is essentially zero order with respect to mass and has a constant rate with an activation energy of about 240 kJ/mole. This value from thermogravimetric measurements reflects into and is confirmed by the observed shape of the measured fall-off of deposition rates with temperature.

The rate of deposition has a linear first order dependence on mercury but this thermal dissociation rate of the sulfate is constant. Consequently, as mercury concentrations are scaled down from the ppmv experimental levels to the ppbv values in flue gases the dissociation rate has to be effectively also slowed by 3-orders of magnitude. This implies that the operational window will be lowered by 100 degrees centigrade to permit a dominance of deposition and minimization of dissociation. As a result of such scaling analyses it is expected that this heterogeneous mechanism will occur on encountered surfaces that are cooler than 250-300C. A metal surface intercepting the flue gases at 150-250C is expected to oxidize atomic mercury.

d. Photochemical Oxidation for Elemental Mercury Removal from Subbituminous Flue Gas Streams.

Frank Alix and Chris McLarnon, Ph.D. – Powerspan; Evan Granite and Henry Pennline – U.S. DOE-NETL

Data collected on mercury emissions from coal-fired power plants indicate that oxidized mercury species, the predominant species present in the flue gas when burning bituminous coals, are readily collected in air pollution control devices such as SO_2 scrubbers. Elemental mercury species, the predominant species present in flue gas when burning subbituminous or lignite coals, are not efficiently removed by existing air pollution control devices. With a federal mercury rule to be finalized by March 2005, and several states promulgating mercury emission limits, the need

exists for a low cost mercury oxidation process that can be applied to flue gas treatment systems of coal-based power plants. The U.S. Department of Energy National Energy Technology Laboratory has developed and patented a method to oxidize elemental mercury in the flue gas of fossil fuel-fired power plants. Powerspan has licensed the technology and initiated a laboratory and pilot test program to develop the Photochemical Oxidation, or PCO, process for commercial application with subbituminous and lignite fuels. The PCO method introduces ultraviolet (UV) light at a wavelength of 254 nm into the flue gas, resulting in the conversion of elemental mercury to an oxidized form. Oxidized mercury is subsequently captured in a downstream collection device such as a scrubber, ESP, or baghouse. Powerspan has conducted preliminary tests of UV-initiated oxidation of mercury in its laboratory test facility, with promising results. Greater than 90% oxidation and capture was achieved in a simulated flue gas stream containing 12 to 15 $\mu\text{g}/\text{Nm}^3$ of elemental mercury. Powerspan will present results of laboratory testing of the process on a simulated, subbituminous flue gas stream. In addition, plans for pilot testing will be addressed.

e. Mercury Control at Low Rank Coal-Fired Power Plants by a Pre-Combustion Thermal Treatment Process - An Update

Alan Bland, Kumar Sellakumar, Lyle Johnson, Gary Walling, Duane Steen, and Edgar Klunder – Western Research Institute

Western Research Institute (WRI) in association with the U.S. DOE National Energy Technology Laboratory (NETL), North Dakota Industrial Commission, Montana-Dakota Utilities and Alliant Energy has embarked upon a program to develop a technology that differs from other mercury control pathways. In this unique process, mercury species are stripped from coal in a gaseous form prior to the fuel being pulverized for firing in a coal combustion furnace.

In order to demonstrate this novel concept, a Process Development Unit (PDU) is being constructed and operated. The design of the PDU encompasses two key reaction steps, which remove moisture and release mercury from raw coal. In addition, the PDU is designed to study the capture of mercury from the high mercury concentrated sweep gas stream. The PDU is designed to process up to 100 lb/hr of raw coal. Powder River Basin (PRB) subbituminous coal and North Dakota lignite are being tested. A description of the PDU was reported earlier. Initial tests using the PRB subbituminous coal has corroborated the bench-scale findings that the WRI process is amenable to removing substantial amounts of mercury. The data shows that up to 80% of the mercury in the raw coal can be removed. Additional parametric testing of various process temperatures and coal residence times has been completed. The ongoing testing also includes evaluation of the processed coal in a pulverized coal (PC)-fired test combustor. Combustion characteristics of the processed coal and the pollutants (Hg, SO_x and NO_x) generated have been studied. The paper will present an update on these tests and an outline of the preliminary evaluations on the commercial viability of the process.

f. Evaluation Of Compliance Options For Proposed Mercury MACT Regulation

Vineet Masuraha and Deborah Walden – Trinity Consultants; Joe Bentley – Lower Colorado River Authority

Recently the U.S. EPA proposed a rule with two alternatives to permanently reduce mercury (Hg) emissions from power plants. Under one alternative, which is the focus of this paper, the utilities would install controls known as Maximum Achievable Control Technologies (MACT) under section 112 of the Clean Air Act (CAA). The proposed rule is to be finalized in March 2005. If implemented, several considerations must be taken into account before preparing successful strategies for meeting the proposed MACT standard. These considerations include, but are not limited to, the accuracy of Hg measurement, the lack of commercially available continuous emission monitoring systems for Hg emissions, and the options available for control technologies. This paper presents a case study of a subbituminous coal-fired power plant owned and operated by the Lower Colorado River Authority (LCRA) in La Grange, Texas, which would be subject to the proposed Hg MACT standard and is currently evaluating the feasibility of compliance with the standard. In this paper, coal composition, Hg content, plant design and operation, available control options, and the effectiveness of several types of Hg emission control methods including precombustion controls, flue gas cleaning technologies, wet scrubbers, particulate controls, etc., are reviewed to identify possible strategies for Hg MACT compliance.

A5 Mercury Tuesday; 1-3pm

Chairs: Sid Nelson – Sorbent Technologies
Ravi Srivastava – US EPA

a. 8 TPY of Utility Mercury by 2008: The Roadmap

Sid Nelson Jr. – Sorbent Technologies Corporation

A great deal of progress has been made over the last two years in understanding how to make cost-effective reductions in coal-fired power-plant mercury emissions. If required, U.S. utilities can lower their Hg emissions from about 50 tons-per-year (TPY) today to about 8 TPY in 2008 for less than 20% of the costs estimated only a couple years ago. This presentation will explain how. Emission reductions from increased and improved scrubbing and the simple injection of advanced sorbents will be detailed and quantified. But in addition, the myriad of ways that utilities can reduce their mercury emissions apart from the installation of control technology will also be covered. The concept of "NCRs," or Non Control Reductions in mercury will be introduced, covering such techniques as burning lower-mercury coal, the rationalization of coal mercury between plants, coal cleaning, modifications to mining practices, and the maximization of a plant's native mercury removal. Each technique will be described and its applicability explored.

b. Integrated and Cost Effective Approach to Mercury Control

Vitali Lissianski, Randy Seeker, and Peter Maly – GE Energy

GE Energy is developing a unique approach to reduce mercury and NOx emissions from coal-fired power plants that is anticipated to cost fifty percent less than the activated carbon injection used for mercury reduction; simultaneously reduce carbon monoxide emissions; and improve plant reliability and heat rate. The customizable approach leverages a broad portfolio of combustion modification and optimization technologies. Elements of the approach include: (1) combustion staging (SOFA, reburning) and combustion optimization to improve mercury oxidation and absorption on fly ash, (2) injection of GE proprietary mercury oxidizing additive to further improve mercury oxidation, and (3) activated carbon injection in front of existing particulate control device. The approach is tailored to the unit configuration and coal fired. Pilot-scale testing was conducted with several coals in a 1 MBtu/hr combustor to characterize and quantify the impacts of coal type, combustion staging, activated carbon and oxidizing additive injection on mercury removal across the ESP. Testing demonstrated that 70-90% mercury control for bituminous coals could be achieved without oxidizing additive and activated carbon injection. Testing demonstrated that combustion staging improved mercury oxidation for PRB coals even without additive injection. All tested additives improved mercury oxidation. Testing with PRB coals demonstrated that combustion staging and oxidizing additive injection significantly reduced requirements for activated carbon injection rate. Following pilot-scale testing, short-term testing of the effect of coal reburning on mercury removal was conducted in 250 MWe unit firing bituminous coal. Testing demonstrated that without the reburn system in operation, mercury emissions were reduced by approximately 40% at the ESP outlet. Following pilot-scale testing in GE's boiler simulation facility of the coal types fired in full-scale unit showed good agreement with baseline field data. When optimized reburning was introduced, tests showed over 90% Hg removal at the ESP outlet.

c. Further Progress Toward Concrete-Safe Mercury Sorbents

Rafic Minkara, Ph.D., P.E. – Headwaters Clean Coal Corporation; Qunhui Zhou, Ph.D. and Yinzhi Zhang, Ph.D. – Sorbent Technologies Corporation

Nearly 20% of U.S. power plant fly ash is currently sold each year for use as a cement substitute in concrete. Unfortunately, if typical powdered activated carbon (PAC) for mercury emission control becomes mixed in with this ash, it can no longer be used in concrete. The PAC severely interferes with air entraining admixture chemicals (AEAs) added to the concrete mixes for workability and freeze-thaw capability. This paper will report on continuing investigations on a specially-formulated PAC-based mercury sorbent that appears to be safe for concrete use. Concrete data will be presented for both regular and these concrete-friendly mercury sorbents, at multiple levels in the ash, with difference commercial AEAs, and with a wide variety of power-plant fly ashes. Foam index, wet-mix air-entrainment levels, concrete strength, slump, and bubble-size data will be presented. Data will also be provided for a second-generation version of the material with lower costs and even better performance. Finally, the relative economic implications of this

data will be discussed.

d. Mercury Control from Coal Fired Electric Utility Plants - A Review of Technology Status and Cost

James E. Staudt – Andover Technology Partners; Ravi K. Srivastava – U.S. Environmental Protection Agency

In this presentation the authors will provide a review of the current state of the art in mercury emissions control from coal-fired electric utility power plants. Control from cobenefit of existing NO_x, SO₂ and PM controls will be discussed. Control of mercury emissions from emerging technologies approaching commercial status - especially dry sorbent injection, including powdered activated carbon and other advanced sorbents - will be reviewed as well. Estimated costs for control of mercury emissions using these technologies will be presented for utility boiler configurations and fuels of interest.

e. Full Scale Evaluation of TOXECON IITM on a Lignite Fired Boiler

Jean Bustard, Jerry Amrhein, Cam Martin, Chris Rusin, Travis Starns – ADA ES, Inc.; Charlie Bullinger - Great River Energy, Coal Creek Station; Ramsay Chang, Ph.D. – EPRI; Mark Strohfus - Great River Energy

Activated carbon injection (ACI) has been successfully demonstrated to remove mercury from coal fired power plant flue gas and reduce stack emissions. In conventional ACI, activated carbon can render the flyash unsuitable for re-use as a cement admixture, which can result in lost revenues and increased waste disposal costs. A potential solution is EPRI's TOXECON IITM, in which the carbon is injected between ESP collecting fields. The majority of the flyash is collected in the inlet ESP fields upstream of carbon injection while collecting carbon with adsorbed mercury in the downstream ESP fields.

In November 2003, ADA-ES conducted a full-scale evaluation of TOXECON IITM at Coal Creek Station through a program funded by Great River Energy and EPRI. This paper presents the results of this evaluation, including the effectiveness of activated carbon injected within the ESP for mercury control and the impacts on ESP performance and particulate emissions.

f. Elemental Mercury Removal by the Raw and Chemically treated Oil-fired Fly Ashes

Jeom-In Baek, Kyung-il Park, Kwang-Chul Song and Kyung-Ryong Jang – Korea Electric Power Research Institute; Si-Hyun Lee – Korea Institute of Energy Research

Mercury removal efficiency was examined for two fly ashes generated from the combustion of heavy oils. The raw oil-fired fly ashes were activated with CO₂ at the temperature of 900 °C to make porous sorbents with larger surface area. Sulfur was impregnated to the CO₂ activated heavy-oil fly ashes at 550 °C. The raw and chemically treated oil-fired fly ash samples were exposed to nitrogen gas laden with elemental mercury in a bench-scale fixed-bed reactor system at a temperature of 130 °C. Physical and chemical properties of the samples were analyzed to get information on the different results in elemental mercury removal efficiency among the samples. The raw and activated oil-fired fly ashes having higher total sulfur content showed higher elemental mercury removal efficiency. The elemental mercury removal efficiencies of activated oil-fired fly ashes were compared to those of commercially available activated carbons. In spite of much smaller surface area, the mercury removal efficiency of CO₂ activated and chemically treated heavy-oil fly ashes were similar to those of commercial activated carbons. The result of this work suggested that the amount of active sites that are beneficial to the adsorption of elemental mercury was more important than the large surface area to get higher mercury removal efficiency.

A6 Mercury - Measurement & Modeling Tuesday; 3:30-6pm

Chairs: Leonard Levin – EPRI

Anne Smith – Charles River Associates

a. Electric Generation Mercury Reductions: Policy-Making Landscape

Michael Rossler – EEI

b. How Do We Assess the Environmental Benefits from U.S. Mercury Emission Control

Regulations? - A Proposed Monitoring Plan

Michael L. Abbott – Idaho National Laboratory; Robert P. Mason - Chesapeake Biological Laboratory; R.A. Bodaly – Freshwater Institute; O. Russell Bullock, Jr. – NOAA; Charles T. Driscoll – Dept. Civil & Environ. Eng.; David Evers – BioDiversity Research Institute; Steven E. Lindberg – Oak Ridge National Laboratory; Michael Murray – National Wildlife Federation; Edward B. Swain - Minnesota Pollution Control Agency

There is a crucial need to document the impact and effectiveness of the regulation of anthropogenic mercury (Hg) emissions on human, wildlife and ecosystem health to ascertain the need for further controls. The impact of elevated methylmercury (MeHg) levels in fish on human and wildlife populations is well documented and is the driver for current and impending controls. Scientists and policy makers need to develop a monitoring framework to accurately evaluate the effectiveness of regulation. The monitoring strategy outlined below is the result of such an effort by a group of 32 Hg scientists from academia, industry, government and non-profit organizations. To monitor change in Hg loadings to aquatic systems and the resultant alteration in MeHg incorporation into fish and wildlife, the proposed monitoring strategy details the need for a comprehensive investigation (in air, water and the watershed) at 5-10 continentally- distributed locations (intensive sites). Additionally, it includes the more limited data collection at a larger number of sites (cluster sites) that are widely distributed across freshwater and coastal ecosystems, but associated with the intensive sites. At the cluster sites, wet Hg deposition would be measured in conjunction with seasonal sediment and water collections for total Hg and MeHg. Biota sampling would consist of yearling fish, piscivorous fish and piscivorous and insectivorous wildlife. To be successful, this program should begin without delay and last 15-20 years. Federal commitment and involvement would be required to maintain such a long-term monitoring effort. This monitoring framework would answer the question of whether change is occurring in atmospheric Hg input and how this change is reflected in a variety of aquatic ecosystems and in their organisms. In addition, this program would provide the information necessary to demonstrate the impact of Hg emission reductions from anthropogenic sources in the USA on fish MeHg concentration.

c. Integrative Analysis of U.S. Mercury Sources and Deposition

Leonard Levin – EPRI; Anne Smith – Charles River Associates; Christian Seigneur –AER Inc.; Chris Whipple – ENVIRON International

Previously independent models of mercury sources, processes, and fate have been linked with integrated databases to assess current and scenario global inventories of mercury. The models that were combined include a mercury costing, emissions, control, and speciation model (EPMM, Charles River Associates); a combined set of atmospheric mercury fate, transport, and deposition models (GCTM and TEAM, AER Inc.); the EPRI Mercury Cycling Model; and an exposure model for mercury via fish consumption (MerExUS, ENVIRON International). Extensive model runs looked at the issue of mercury "hot spots" (isolated peaks in deposition) vs. "not'spots"; sources of US mercury deposition; model verification through experimental and monitoring data; exposure changes over time and space; deposition patterns geographically; and efficiency of approach in affecting public health metrics. Results to date have been resolved to 20 km resolution, within local scales of impact, for effects from emission to deposition, and to state level for exposure. The latter is, to date, limited by sampling data and sample treatment by state and federal agencies. Sample blending has prevented resolution to watershed level or finer, although that is theoretically practicable currently. Results have been verified when possible by other investigators nationally. Extension of the work to alternative scenarios and finer resolution is underway.

d. Why Do We Care About Terrestrial Sources and Sinks of Atmospheric Hg?

Mae Sexauer Gustin – University of Nevada-Reno; Steven E. Lindberg, Oak Ridge National Laboratory

Terrestrial sources and sinks of atmospheric mercury (Hg) must be carefully quantified in order to develop regional and global Hg mass balances, and to assess the potential effectiveness of regulatory controls on anthropogenic point sources. Terrestrial landscapes may act as new sources of atmospheric Hg, permanent reservoirs for deposited atmospheric Hg, or simply a temporary resting place for deposited Hg that is subsequently re-emitted to the atmosphere. Recent research has identified new sources of atmospheric Hg, and the estimated contribution of

some known sources has increased. While some unrealized sinks have been identified, their potential to offset the additional sources is not clear. Mechanistic studies point to the fact that soil-air Hg exchange is a dynamic process, and that re-emission is an integral part of the overall cycle. Rapid Hg cycling between terrestrial surfaces and the atmosphere would give Hg the appearance of exhibiting a longer lifetime in the atmosphere than it actually has. This paper summarizes our current understanding of terrestrial sources and sinks of atmospheric Hg.

e. Modeling of Mercury Emission Control Scenarios for Coal-fired Power Plants

Krish Vijayaraghavan, Kristen Lohman, Shu-Yun Chen and Christian Seigneur – Atmospheric & Environmental Research, Inc.; Anne Smith – Charles River Associates; Leonard Levin – EPRI; John J. Jansen – Southern Company Services

The EPA has proposed mercury emission control regulations for U.S. coal-fired power plants. The corresponding emission scenarios were modeled using a continental/regional 3-D Eulerian model, TEAM, with spatially and temporally varying boundary conditions provided by a global mercury model. The scenarios modeled included a base emission scenario for 2004 and Clean Air Interstate Rule (CAIR), Maximum Achievable Control Technology (MACT), and Cap & Trade (C&T) scenarios for 2020. Model results reveal that the majority of mercury depositing in the U.S. originates in other countries or from natural sources and that about 70% of U.S. utility mercury emissions do not deposit within the continental United States, but are dispersed globally. The C&T scenario results in larger and more widespread reductions in mercury deposition than the MACT scenario, particularly in regions with high current levels of deposition in the U.S. No new areas of significant mercury deposition are created by either the MACT scenario or the C&T scenario.

f. Mercury Exposure Across the United States Under Regulatory Scenarios

Chris Whipple – ENVIRON International Corporation; Christian Seigneur – AER Inc.; Anne Smith – Charles River Associates; Leonard Levin – EPRI

The EPA proposals for reducing emissions of mercury from utilities will both result in lower levels of emissions and of mercury deposition. In turn, fish levels of mercury will drop differentially in different parts of the U.S., depending on upwind sources of mercury and how those change. Modeling has been carried out for each state with sufficient fish mercury data, using a combined modeling framework of a costing/emissions model for mercury under base and regulated scenarios; an atmospheric fate, transport, and deposition model; the results from the EPRI Mercury Cycling Model for various watersheds, and emerging data from national fish sampling by the U.S. EPA and the various states. Changes in deposition by state under each base and regulatory scenario translate into moderate lowering of mercury in fish (the multiyear periods over which emissions reductions and, later, reductions of mercury in fish and freshwater systems occur have been ignored). The susceptibility of each state population to lower exposure is calculated by modifying regional fish consumption rates by the proportion of state population engaged in sport fishing. Results indicate that, with a 70% drop by 2020 in utility mercury emissions under proposed Cap and Trade, exposure by state will drop from a fraction of a percent in the western U.S. to over 6% in West Virginia (due primarily to sportfishing fractions in each state). The drop in some eastern states is in the range of the theoretical limit based on national wild freshwater fish consumption.

g. Field Demonstration of a Mercury Continuous Emissions Monitor

Dieter Kita, Jerry Amrhein, Jean Bustard and Trent Taylor – ADA ES, Inc.; Jeff Socha, Dieter Kita, and Mike Nemergut – Thermo Electron Corporation

The EPA published the proposed NESHAP rule for mercury in the January 30, 2004 Federal Register. Accurate measure mercury emissions at the stack are required and a reliable continuous emissions monitor (CEM) that could be integrated with other compliance monitors is an ideal solution. However, mercury can be difficult to measure and care must be taken to choose the optimum CEM package, including the extraction probe, converter, transport line, monitor, and calibrator. Thermo Electron Corporation, in cooperation with ADA-ES, Inc., has been developing mercury CEM to meet the rigorous requirements of the most demanding sites, in a package that can be integrated with other plant CEMs. This paper presents a description of component development and recent field results. Field results will include data from component testing at plants burning subbituminous, low, and high sulfur bituminous coals; and extended CEM operation

A7 Mercury - Measurement & Modeling Wednesday; 7:30-9:30am

Chairs: Raj Singhvi – US EPA/ERTBI

Constance Senior – Reaction Engineering International

a. A Multipathway Health Risk Assessment Model for Mercury Emissions

Khanh Tran – AMI Environmental

A health risk assessment model has been developed for mercury emissions from power plants. The model can interface with regulatory dispersion models such as ISCST3 and AERMOD for localized impacts, and CALPUFF for long-range transport. The model treats mercury in both gaseous and particle phases, its speciation as divalent and elemental forms, its deposition and methylation. The model uses the algorithms recommended by the U.S. EPA to predict health risks through inhalation and other pathways such as ingestion of soil, drinking water and food such as fish. Results of a model application to a fisher scenario and evaluation of its performance will be presented and discussed.

b. Geographic Variation of Mercury Content, and Mercury Emissions Predicted for Existing Technologies, by U.S. County of Coal Origin.

Jeffrey C. Quick – Utah Geological Survey

Switching to low-mercury-emission coal may be an effective strategy to comply with impending regulations that are intended to reduce mercury emissions from electric utilities. For example, despite proven emission control technology, burning low-sulfur coal is the most popular method to reduce sulfur emissions. Because the effectiveness and availability of technology to reduce mercury emissions is considerably less certain, burning low-mercury coal is a likely method to reduce mercury emissions. Like sulfur, the amount of mercury in U.S. coal shows substantial geographic variation. Furthermore, mercury emissions from similar types of power plants are largely correlated with the amount of mercury in the coal. However, unlike sulfur, mercury emissions also vary with the abundance of other elements in the coal such as chlorine and sulfur. Published equations (based on the part 3 ICR data from the USEPA), which predict mercury capture by existing emission control technologies, are used with selected coal quality data (part 2 ICR, COALQUAL, FERC 423 and CTRDB data sets) to predict mercury emissions from coal aggregated by U.S. county-of-origin. The results are used to map the potential uncontrolled mercury, sulfur, and chlorine emissions, as well as mercury emissions predicted for coal burned in power plants classified by emission controls. The maps indicate that much subbituminous and some lignite coal should comply with the proposed MACT rule using existing technology. Bituminous compliance coal for power plants with ESP controls is rare. Plants equipped with FGD controls may find bituminous compliance coal in the western U.S., the Eastern Interior Province, and the central Appalachian region. With notable exceptions, fabric filters appear to be an effective mercury control technology for most bituminous coal.

c. Measurement and Control of Mercury Emissions in Utility Boilers

Constance Senior and Bradley Adams – Reaction Engineering International

This presentation summarizes the current status of measurement and control of mercury in utility boilers. Previous mercury measurements at coal-fired power plants obtained from the ICR program suggest that mercury emissions are dependent on coal rank with bituminous coals having lower average emissions than sub-bituminous coals and lignites. Different operating conditions and NO_x pollutant control devices, such as SCRs, impact the amount of mercury removal. ICR data also show that less mercury exits the stack than enters the boiler, suggesting that mercury is removed in boilers even without new controls. For plants with existing "downstream" pollution control equipment, including ESPs, fabric filters, spray dryers and FGDs, those firing bituminous coals were found to have a higher level of mercury capture. Among the control technologies, fabric filters provided higher capture than ESPs. Scrubbers were also shown to effectively capture mercury. The presentation concludes with a discussion of emerging add-on control technologies such as activated carbon injection, other sorbent injection, and multi-pollutant control strategies.

d. The Impact of Wet FGD Scrubbing On Hg Emissions From Coal-Fired Power Stations

Stephen Niksa – Niksa Energy Associates; Naoki Fujiwara – Coal Research Laboratory

Companies contemplating Hg control with wet FGDs need to know in advance how much of the Hg at the FGD inlet will be retained in the scrubber. This paper introduces a predictive capability for Hg retention in any Ca-based wet FGD, given Hg speciation at the FGD inlet, the flue gas composition, and the SO₂ capture efficiency. A preliminary statistical analysis of data from 17 full-scale wet FGDs connects flue gas compositions, the extents of Hg oxidation at FGD inlets, and Hg retention efficiencies. These connections clearly signal that solution chemistry within the FGD determines Hg retention. A more thorough analysis based on thermochemical equilibrium yields highly accurate predictions for total Hg retention with no parameter adjustments. For the most reliable data, the predictions were within measurement uncertainties for both limestone and Mg/lime systems operating in both forced and natural oxidation mode. With the ICR database, the quantitative performance was almost as good for the most modern FGDs, which probably conform to the very high SO₂ absorption efficiencies assumed in the calculations. The large discrepancies for older FGDs are tentatively attributed to the unspecified SO₂ capture efficiencies and to the possible elimination of HCl in prescrubbers. The equilibrium calculations suggest that Hg retention is most sensitive to inlet HCl and O₂ levels; weakly dependent on SO₂ capture efficiency; and insensitive to HgCl₂, NO, Ca/S ratio, and slurry dilution level in limestone FGDs, and to MgSO₃ levels in Mg/lime systems. Consequently, systems with prescrubbers to eliminate HCl probably retain less Hg than fully integrated FGDs. The analysis also predicts re-emission of Hg₀, but only for wide variations in the inlet O₂ to levels that are much lower than those in full-scale FGDs.

e. Mercury Release From Coal Combustion By-products

Mei Xin and Mae Gustin – University of Nevada-Reno; Kenneth Ladwig – Electric Power Research Institute

With the recent focus on Hg removal from flue gas, attention has also been directed towards Hg releases from associated coal combustion by products. Solids collected from systems with components thought to enhance Hg removal (i.e. activated carbon injection, flue gas desulfurization (FGD), and selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR)) may have higher Hg concentrations and therefore a higher potential for Hg release. For this study we investigated the potential for Hg release to the air and water from solids and liquids collected from coal-fired units with FGD equipment and SCR equipment, and derived during sorbent injection for Hg removal. Data was collected in controlled laboratory studies and at landfills containing coal combustion by-products. Recent studies have shown that mercury (Hg) in coal fly ash derived from subbituminous and bituminous type coals is unlikely to be released through volatilization or leaching. However, lignite-based ash was found to emit Hg to the air. For those solids collected from systems with components thought to enhance Hg removal, laboratory studies showed that most dry samples acted as sinks for atmospheric Hg in the dark at 25°C. When exposed to light or increased temperature (45°C), deposition of Hg to the substrates in most cases continued but decreased. Wet FGD samples emitted Hg. Most sample extracts (EPA method 1312 (SPLP)) had low Hg concentrations (<6.5ng/L). In situ emissions measured at a bituminous ash landfill were very low and comparable to that occurring from surrounding low Hg soils. Data will also be presented on emissions from the lignite-based ash and FGD solids landfills.

f. Comparison of Real-Time and Laboratory Analysis of Mercury Vapor in Indoor Air: Statistical Analysis Results

Raj Singhvi – USEPA/ERTBI

Metallic mercury vapor levels in indoor air were measured under various conditions inside a van and a trailer using Lumex RA915+ (Lumex) and Mercury Tracker 3000 (Tracker) real-time mercury analyzers and were confirmed by laboratory analysis using a modified National Institute for Occupational Safety and Health (NIOSH) 6009 method. Mercury monitoring data from several mercury spill sites around the United States were also used in this comparison study. Based on statistical analysis, Lumex and Tracker field analyzers provide real-time screening to assess initial extent of metallic mercury contamination, to identify "hot spots", and to monitor progress of decontamination procedures at a spill site. Statistical analysis showed that field and laboratory (NIOSH 6009) data for analyses of mercury in air samples were comparable for Lumex and Tracker Hg readings of about 0.03 and 0.1 µg/m³ or greater, respectively, provided that the

factory calibrations of the real-time analyzers were adjusted based on the mercury concentration measured from a standard mercury gas source in a laboratory environment. In order to meet final clean-up action levels (0.3-1.0 µg/m³) for indoor mercury spills, time averaged Lumex and Tracker results may be used instead of the NIOSH method under certain circumstances, such as during emergency responses, depending on site requirements. Additional work is in progress to define the conditions when real-time metallic mercury vapor monitoring instruments, such as the Lumex or Tracker, may be used.

A8 NOx Control Wednesday; 10am-12pm

Chairs: Vince Albanese – Fuel Tech
Brian Higgins – Mobotec USA

a. Hybridization of Urea-SNCR with SCR -- A Fit for the Future

Vince M. Albanese and W. H. Sun – Fuel Tech; Rich Abrams – Babcock Power

The use of urea-SCR in tandem with a down-sized SCR is explored in this paper. Though both are well-known, commercially utilized NOx reduction programs on a stand-alone basis, use of urea-SCR to supply NOx reductant to the SCR provides certain advantages.

This paper discusses the advantages of hybridizing the two processes. It also presents the benefits of deployment for NOx SIP Call, 8-hour ozone SIP, CAIR rule and Regional Haze rule purposes.

Preliminary field data and designs are presented illustrating NOx reduction up to 90%.

Newer design for recently awarded DOE funded demonstration is also presented.

b. Cost-effective NOx Reduction Technology with OFA and Burner Modifications: Case Studies of Two No. 6 Oil Fired Utility Boilers

R. Gifford Broderick – Combustion Components Associates

Two utility boilers located in the Northeast were required to meet new state defined NOx emissions rates. The first was a 630 MWg rear-wall faced fired boiler with 30 burners equipped with an existing non-effective over-fire air (OFA) system and FGR. The second was a 125 MWg T-fired boiler with 16 burners capable of firing No. 6 fuel oil only.

Objective

The project goal was to achieve an excess of the guaranteed NOx reduction in a simple and cost-effective manner. Several technologies were proposed including SNCR, Reburn, OFA, and Burner Modifications. A combined OFA and Low NOx burner modification approach was selected based upon cost and guaranteed NOx reductions. The advantages of this technology approach are primarily the simplicity of its process and low capital-cost.

Final Results

For the 603 MWg boiler, baseline NOx emissions were 0.276 lbs./mmBtu, based upon the units load schedule. The NOx reduction technologies employed, achieve a reduction of 0.167 lbm/MMBtu, below the guaranteed level of 0.185 lbm/MMBtu. The overall NOx emission reduction was 40.8%. The lifecycle cost for this technology modification was less than \$700/ton of NOx removed (based on a 5 year recovery period). NOx emissions for the 125 MW T-Fired unit was reduced from a baseline emission level of 0.240 lbm/MMBtu to 0.157 lbm/MMBtu that was below the guaranteed level of 0.173 lbm/MMBtu. The overall NOx emission reduction was 34.6%. The lifecycle cost for this technology modification was approximately \$1,402/ton of NOx removed. The presentation will review the design and CFD modeling results of the #6 oil firing burner and OFA system for both units. Additionally, pre and post modification results will analyze data for NOx, excess O₂, opacity, CO, FEGT, and Econ Outlet Temperatures.

c. SCR Levels Of NOx Reduction With ROFA And Rotamix (SNCR) At Dynegy's Vermilion Power Station

Brian Higgins, Jay Crilley, and Mark Shilling – Mobotec USA; Kristopher Coombs – Dynegy Midwest Generation

Nox was reduced 83% at full load (80 MW) to 0.10 lbs/MMBtu using a boosted over-fired air system (ROFA) and an advanced SNCR system (Rotamix). ROFA and Rotamix, two-thirds of the Mobotec System, were installed at Dynegy's Midwest Generation's Vermilion Power Station Unit 1, a 1955, bituminous coal, Combustion Engineering, tangentially fired boiler. ROFA was installed in summer 2002 and Rotamix in spring 2004. The total installed cost over 10 ozone seasons for the

MobotecSystem installed at Vermilion is under \$400 per ton of NOx removed for ROFA and under \$200 per ton of NOx removed for Rotamix. Recurring chemical costs (urea) are below \$250 per ton of NOx removed. With Nox credits as low as \$3000 per ton the payback period for the Vermilion installation is under 10 months (two ozone seasons). ROFA and Rotamix can inexpensively reduce NOx emission levels previously only achieved with an SCR installation. ROFA and Rotamix provide additional benefits detailed in the presentation.

d. Reduction of NOx Emissions from a Fleet of Boilers using Model Predictive Control

Steve Piche, Jianhu Jia, Paul Sabiston, and Ray Johnson – Pegasus Technologies

The amount of nitrogen oxides (NOx) emitted from a power utility boiler is affected by a number of process variables that can be manipulated by an operator such as O₂, windbox to furnace differential pressure, fuel distribution, primary/secondary and over-fired air. Although operators can manipulate many process variables, it is often difficult for them to determine the optimal setpoints for the unit to minimize NOx due to changes in load, ambient conditions, fuel characteristics and also due to the need to observe constraints on other environmental variables such as CO and opacity. Therefore, the unit may operate in sub-optimal conditions because operators typically rely on predetermined DCS curves and simple rules of thumb to determine the setpoints for many of the variables that affect NOx. Model predictive control (MPC) technology offers an enhancement to operator control. An MPC approach can be used to optimally determine setpoints of a boiler on a minute-by-minute basis as load, ambient conditions and fuel characteristics change. MPC technology is based upon using a dynamic, nonlinear (often neural network) model of the furnace. Given this model, an optimizer is used to solve for the optimal trajectory of control moves over a predetermined time horizon, typically 30 minutes, to reduce NOx. Feedback biasing is used to update the models and improve accuracy of the resulting control system. In addition to NOx, an MPC system can be used to simultaneously control heat rate, CO, opacity, and furnace temperatures. Using a model predictive control approach, a major US utility reduced NOx emissions across a fleet of power utility units by an average of 15% while observing constraints upon CO and maintaining temperatures within tight control limits. The units ranged in size from 600 MW to 850 MW.

e. SCR Catalyst Management Strategies – Modeling and Experience

James E. Staudt – Andover Technology Partners

For coal-fired boilers equipped with SCR, catalyst contributes to a major operating expense. Strategies for minimizing catalyst cost while preserving system performance - generally referred to as catalyst management - are receiving greater attention. Approaches for managing catalyst can vary widely. Therefore, analysis of catalyst management strategies requires accurate predictive tools for assessing SCR system performance that have the flexibility to address a wide range of scenarios. These predictive tools may also be used to investigate performance issues that facility operators may encounter. However, until recently, operators have not had access to these tools, except through catalyst suppliers or consultants. In this paper, various catalyst management strategies will be examined. Using software currently used by several power plant operators and SCR technology suppliers, we will illustrate some of the important considerations of a catalyst management strategy and provide an example of how catalyst management strategies can be evaluated with such a software tool.

f. Commercialization of Urea Decomposition Process for SCR System

William H. Sun, John Boyle, Paul Carmignani and Vince Albanese – Fuel Tech, Inc.

A urea decomposition system that feeds SCR has been in commercial operation on three large coal fired utility boilers and two gas turbines, and is under a commercial contract on two MSW combustors. This on-line process, called NOxOUT ULTRA[®], thermally converts urea to SCR reagents and supplies this reagent to the SCR through a traditional ammonia injection grid. The Ultra process uses air blowers to supply filtered ambient air to a decomposition chamber. In the chamber, a natural gas fired burner raises the temperature to greater than 1000 iÆF prior to urea injection. Finely sprayed urea solution decomposes rapidly in the hot chamber. The outlet of the decomposition chamber is connected directly to the AIG header. This urea-based process avoids handling, storage and transportation hazards associated with ammonia, the traditional SCR reagent.

The first full commercial installation of the NOxOUT ULTRA ϕ ç system was completed in 2003 at NIPSCO's Michigan City Generation Station, with the Unit #12 SCR system. The boiler is a B&W cyclone-fired unit rated at 520 MWe. With a baseline NOx of approximately 500 ppm, the SCR system required a reagent feed rate equivalent to 1200 lb/hr and reduced NOx to 50 ppm. Two additional Ultra installations on utility boilers were also completed for NIPSCO. NOxOUT ULTRA ϕ ç systems were constructed, installed, and initialized at Bailly Station, a 360 MW cyclone fired utility boiler burning coal, and at Schahfer Station, a 520 MW cyclone fired utility boiler also burning coal. These Ultra installations included dry urea storage, a urea solutionizer, aqueous urea storage tanks and a circulation system, as well as metering and distribution modules to supply the injectors. A PLC-based system control and a burner management system were supplied to complete the system. All three installations operated continuously during the 2004 ozone season. The NOxOUT ULTRA ϕ ç Process was also commercially installed on two 15 MW Turbine/HRSG units for MATEP. These systems started up in Spring, 2004 and are in continuous operation. The two systems were designed to provide SCR reagent equivalent of up to 25 lb/hr of ammonia to each of two separate exhaust streams. The two supply trains are interlocked, and so may be operated together to provide redundancy. In this small application, the customer selected electrical heating instead of a natural gas burner. Although this is a less energy efficient system, the specific site condition dictated electrical heating.

The performance of the Ultra systems was consistent with the system design. The process performed equivalently to an ammonia system in reagent usage, load-following capability, and rapid response to system shutdown and start-up. The ULTRA process maintained control of NOx to the target limit. The short residence time allowed the ULTRA system to respond rapidly to changes. This NOxOUT ULTRA process experience testing confirms that the process is safe, responsive, and equivalent to NH3 system in performance.

A9 Multi-Pollutant Control Technology Wednesday; 1-3pm

Chairs: Sikander Khan – EPA
Gary Spitznogle – AEP

a. Mercury and Multipollutant Control Technologies for Electric Utility Boilers

Sikander Khan and Sarah Dunham – U.S. EPA, Office of Air and Radiation, Clean Air Markets Division; Ravi Srivastava and Nick Hutson – U.S. EPA, National Risk Management Research Laboratory, Air Pollution Prevention and Control Division

A number of human health impacts are associated with exposure to mercury. In this context, the Environmental Protection Agency (EPA) has recently taken regulatory actions to control mercury emissions from coal-fired electric power plants. Further, EPA's Clean Air Interstate Rule and other multipollutant reduction bills in the Congress are aimed at requiring future reductions in power plant emissions of mercury and/or other air pollutants. As a consequence of this focus, attention is being given to characterizing and developing relevant control technologies. This presentation will describe the science relating to mercury behavior in a boiler and control of mercury emissions as a cobenefit of existing, commercially-available NOx, SOx and PM controls. Research underway to better understand and improve this cobenefit will be addressed. Subsequently, the presentation will describe the state of understanding relative to capture of mercury via injection of sorbents into flue gases of coal-fired boilers. Ongoing field evaluations will be covered. Finally the presentation will provide current information on practical mercury and multipollutant control technologies.

b. Oxidation of Mercury Across a Slipstream SCR Reactor Equipped with Various Catalyst Formulations

Gary Spitznogle, Keith McDonald, Chao Lin, Anja Vesanen, Aimee Toole, and Dan Duellman – American Electric Power Co

Effective reduction of mercury using the cobenefits of an SCR-FGD combination requires a large percentage of oxidized mercury at the FGD inlet. Various full-scale tests have been shown to demonstrate high levels of mercury oxidation across an SCR, many of which are equipped with catalysts that also promote high conversion rates of SO2 to SO3. High SO3 is not a desired result of SCR operation, so great efforts have been made by catalyst manufacturers to develop deNOx catalysts which greatly reduce the formation of SO3. Very little work has been done to quantify the impacts of these catalyst modifications on mercury oxidation. AEP has installed a slipstream SCR reactor at a high sulfur eastern bituminous plant site to evaluate a number of catalysts in

parallel and quantify relative differences in performance under like conditions. Catalysts from different manufacturers with a range of SO₂ to SO₃ conversion rates were tested. One catalyst was compared with the same formulation catalyst that was exposed to flue gas for three ozone seasons. The slipstream SCR was built with full-scale catalyst depth, four full layers, and ammonia injection for NO_x control. Space velocities were representative of typical AEP SCR installations. Mercury speciation and NO_x measurements were made at the exit of each layer. The testing was performed using typical coal flue gas and repeated with a 15% blend of PRB. Results of this work should provide insight into mercury oxidation as it relates to SO₂ to SO₃ conversion rate, catalyst volume, the presence of ammonia, and slight blends with PRB. Additional testing will study the effects of catalyst aging.

c. Drivers, Rationale and Methodology in the Application of Wet Electrostatic Precipitators to Electric Utility Fossil Power Plants

Richard C. Staehle and Albert L. Moretti – The Babcock & Wilcox Company; Paul J. Ireland – Washington Group International; Randy Cothron – AES Deepwater; Gary Ross – NB Power

The permit requirements for new power plants designed to burn medium to high sulfur fuels with wet FGD are drivers for the installation of wet electrostatic precipitators (WESP) to reliably control total particulate emissions and visible opacity to very low levels. WESP technology has demonstrated itself for many decades to be capable of achieving these requirements at many industrial and at some utility plants. There are a number of different types of commercial WESPs available today which apply for both for new plant construction as well existing plant retrofits. Features, types, functions and benefits of commercially available WESPs will be discussed. Future development needs to further optimize and characterize the performance for this technology in this application, including mercury and metals control, opacity correlations, and design/materials optimization will be included. The need to achieve ultra-low emission limits on a consistent basis is requiring that all components of total particulate emissions, which include acid mist as well as other fine dry and wet particulates, be addressed. The control of visible acid mist stack plumes from power plants is another need that can be addressed by WESPs.

d. Multi-Pollutant Test Results for NO_x, SO₂, and Hg Utilizing EnviroScrub's Oxides of Manganese Pahlmanite Sorbent

Richard M Boren – EnviroScrub Technologies Corporation

EnviroScrub Technologies Corporation's Pahlman ProcessT Technology is a multi-pollutant technology capable of removing target pollutants such as oxides of sulfur (SO₂-99%), oxides of nitrogen (NO_x-98%), and mercury (Hg-95% total, 99% elemental) from the flue gas stream emitted by combustion processes (i.e. utilities that burn coal, natural gas, oil, etc.). Through chemical processing the captured pollutants are then converted into saleable sulfate and nitrate by-products and the regenerable sorbent, termed PahlmaniteT, is then reused in the system for further pollutant removal, eliminating process waste streams. The presentation seeks to provide a technical overview of recent pilot testing results for NO_x, SO_x, and Mercury removal preformed at DTE Energy's River Rouge Plant and Minnesota Power's Boswell Energy Center conducted by the Energy & Environmental Research Center (EERC). An overview of the Pahlman ProcessT Technology will be presented including: 1) process equipment required in a full scale installation. 2) technical summary of the reaction mechanisms by which the Oxides of Manganese sorbent (PahlmaniteT) captures NO_x, SO₂, and Hg. 3) third party capital and operating cost estimates and 4) plans for full commercial scale technology demonstration.

e. Demonstration of Enabling Oxy-Combustion Technology for Zero-Emissions Power Plants

Roger Anderson, Keith Pronske and Fermin Viteri – Clean Energy Systems, Inc.

As natural gas use in power plants increases, it is predicted that gas prices will climb to levels beyond that of syngas derived from coal, refinery residues, or biomass or from biogas from landfills or bio-digesters. Consequently, these alternative syngases or bio-fuels are receiving more attention and evaluation. Clean Energy Systems has developed and offers an enabling technology, which uses oxy-combustion in combination with natural gas, syngas , or gaseous bio-fuels. With co-funding support from the State of California, the Federal Department of Energy, and other industry partners, CES has developed a 5 MWe demonstration plant near Bakersfield CA.

This recently commissioned plant demonstrates the clean burning technology, which enables: (1) low cost separation and capture of generated carbon dioxide, and (2) zero emission plant operation, when the separated carbon dioxide is used for enhanced oil recovery, enhanced coal bed methane recovery, enhanced gas recovery, or is sequestered in appropriate underground formations. This paper describes the basic technology employed, the present 5 MWe demonstration plant, the plans for demonstrating operation on syngas or biomass-derived fuel, and planned commercialization of zero-emissions power plants. Comparative economic data are presented for the CES system and other zero-emission, climate-neutral systems.

Track B - Climate Change

Monday, 1/24/2005

B1 Climate Policy & Economics Monday; 1-3pm

Chairs: Dirk Forrister – NatSource
Mitchell Baer – U.S. DOE

a. Opportunities in the EU CO2 Emissions Trading Market

Dirk Forrister – NatSource

b. New Actions on CO2 Mitigation - Where Will They Lead Us?

Joel Bluestein – EEA

Another year has passed without passage of multipollutant legislation and CO2 mitigation remains a highly controversial issue. U.S. regional groups are establishing their own programs, the EU proceeding with its program and the Kyoto Protocol is likely to be ratified. While most would agree that CO2 limits will be in place in the U.S. within the power industry planning horizon, there is no clear consensus on a viable U.S. approach. This paper will briefly review the current U.S. regional and international activities proposals. It will identify the key programmatic structures that differentiate them and the implications of those structures on the environmental and economic outcome and prospects for resolution. Finally, the paper will suggest some alternative structures that might break the CO2 stalemate.

c. The United Nations Efforts on Climate Change and Mercury - Update and Policy-Relevant Implications

Mitchell Baer – U.S. DOE

The United Nations-led international scientific community, through the World Meteorological Organization and the Intergovernmental Panel on Climate Change, and the United Nations Environment Program, are addressing, among other issues, two that are the subject of the EUEC 2005 Conference: climate change and mercury. This presentation will provide a brief history on the most current efforts by the UN organizations for these two issues, the Fourth Assessment Report on Climate Change (AR4) and the Global Mercury Assessment and Program, provide a status of these international efforts, and discuss the policy-relevant aspects to United States industrial sectors of the two programs. A review of ongoing EPA and Congressional initiatives for the mercury issue will also be briefly discussed.

d. Dirty Little Secrets About "Clean Power": Why Clean Power Doesn't Necessarily Mean Cleaner Air

Andrew Greene and Albert Ferrer – Navigant Consulting, Inc.

There is no question that air pollution and climate change are serious public policy concerns and that electric generators are on the hot seat today. According to governmental officials, environmental organizations, and even the electric industry, clean energy sources (such as renewables, distributed generation, energy conservation and perhaps even nuclear power) are critical elements in crafting the solution to the numerous air quality challenges we face. As it turns out, this is not necessarily true --and neither Enron, OPEC, nor "Big Oil" are to blame. The culprit:

well-meaning regulators who have created cap and trade rules that either completely ignore or give only limited consideration to clean power sources - and prevent them from actually reducing aggregate air emissions by shrinking the supply of emission allowances in circulation. The author will provide specific examples that illustrate how well-meaning regulations (and emerging regulations in RGGI) can actually undermine the ability of clean power sources to create real reductions in various air emissions. The presentation will also show why the current crop of allowance set-asides for renewables and energy efficiency do not solve the problem. The problem can be cured through four steps:

- Mandatory inclusion of small distributed generation sources in cap and trade program under simplified "rules of engagement" so their emissions are not off the radar screen.
- Allocation of emission allowances to non-emitting sources based on their output (or energy savings).
- Non-emitting sources wanting to prove air quality benefits for capped emissions would be obligated to retire allowances.
- Allowances sold by non-emitting sources would invalidate any claim or representation by the non-emitting source of providing an air quality benefit for the capped emission.

e. A Real Economic Appraisal of Climate Policy Options?

Gregory A. Daneke – Arizona State University

Various benefit cost analyses (CBAs) of proposed policy changes tend to ignore fundamental flaws in the logic and application of such tools. Primary among these are misplaced assumptions about the distribution of costs and uncertainties regarding potential benefits. New tools are needed which control these sensitivities as well as the profound political valence associated with certain policy options.

f. Nuclear Power as A Tool for Economic Air Emission Reduction Programs

Mary M. Quillian – Nuclear Energy Institute

Non-emitting electric generation clearly plays a role in reducing air emissions. However, most emissions reduction programs do not formally recognize non-emitting generation as a tool for increasing air quality. By incorporating non-emitting capacity into emission reduction programs and policies, the cost of emission reductions could be reduced and the effectiveness increased. Non-emitting generating capacity has the least variable operating cost and is therefore called to run before fossil-fired power plants. Every kilowatt-hour of electricity produced by a non-emitting source is a kilowatt-hour that a fossil-fired plant did not produce. As a result, non-emitting generating capacity reduces emissions by preventing or avoiding emissions. For perspective, EPA's proposed Clean Air Interstate Rule would limit the sulfur dioxide (SO₂) and nitrogen oxides (NO_x) emissions in 28 states to 3,863,566 tons and 1,600,799 tons respectively in 2010. There are 91 nuclear plants in this 28-state region that prevented approximately 3.2 million tons of SO₂ and 1.2 million tons of NO_x in 2002 (source data: EPA, EIA) - nearly the amount of the proposed caps. Using a nationally recognized economic power markets model, analysis is underway to detail the impacts on both air emissions (SO₂, NO_x and CO₂) and the cost of emissions reductions under various nuclear capacity scenarios, such as plant retirements, plant license renewals and new plant construction. This study expands on modeling work ongoing in the northeastern United States as part of the Regional Greenhouse Gas Initiative (RGGI). RGGI is analyzing a regional, electric industry cap on carbon dioxide (CO₂). Using results from the RGGI work and this study focused on nuclear capacity, the value of nuclear energy to emission reduction programs and to fossil-fired capacity affected by those programs will be analyzed.

B2 State & Regional Climate Actions Monday; 3:30-6pm

Chairs: Paul Seby – Friedlob Sanderson Paulson & Tourillott, LLC
Scott Turner – Nixon Peabody, LLP

a. CO₂ Regulation in the Courts?

Paul M. Seby – Friedlob Sanderson Paulson & Tourillott, LLC

A. CO₂ Challenges Under the Clean Air Act

On October 23, 2003, 12 states, an island government, three cities and several environmental groups filed eight petitions for review appealing both the August 28 EPA decision denying the ICTA petition and the August 28 EPA General Counsel's opinion supporting that decision which

addressed both the mobile source and national ambient air quality standards programs under the Clean Air Act. See, *Massachusetts et al. v. EPA*, Nos. 03-1361 – 03-1368 (D. C. Cir. Oct. 23, 2003)

Eleven states (Alaska, Idaho, Indiana, Kansas, Michigan, Nebraska, North Dakota, Ohio, South Dakota, Texas and Utah) filed a brief supporting the position of the U.S. EPA that it does not have authority to regulate greenhouse gas emissions (including carbon dioxide emissions) under the federal Clean Air Act. The state brief was filed in response to litigation brought by a group of primarily northeastern states and a number of environmental organizations seeking to compel EPA to set limits on greenhouse gas emissions.

The subjects of possible global climate change and limitations on greenhouse gas emissions have been widely debated in recent years. Congress so far has consistently refused to adopt greenhouse gas limitations, and the Kyoto Protocol which would mandate such limitations was not submitted to the Senate for ratification either by the Clinton or Bush Administrations. Possible global climate change is a complex international issue that could have huge economic and social impacts for all Americans. The northeastern states' efforts to compel regulation of greenhouse gases through litigation is not the appropriate way to address the issue. Congress and the Administration must decide America's response to possible global climate change, not the courts.

B. CO2 Nuisance Cases

1. Connecticut et al. v. American Electric Power Co., Inc. et al., No. 1:04 – CV-05669-LAP (S.D.N.Y. July 21, 2004).

On July 21, 2004, eight state attorneys general (CT, NY, NJ, VT, RI, CA, WI and IA) and the corporation counsel of New York City filed suit against five major utilities in federal district court seeking to: 1) hold each defendant jointly and severally liable for contributing to the "ongoing public nuisance of global warming," and; 2) direct each defendant to cap its CO2 emissions and then reduce them by a specified percentage (e.g., 3 percent) annually for at least a decade. Plaintiffs do not seek monetary damages but seek injunctive relief "under the federal common law of public nuisance or, in the alternative, under state law of public nuisance."

2. Open Space Institute, Inc. et al. v. American Electric Power Co., Inc. et al., No. 04-CV-05670 (LP)/ECF Case (S.D.N.Y July 21, 2004).

On July 21, 2004, three land trust and environmental groups (Open Space Institute, Open Space Conservancy and Audubon Society of New Hampshire) sued five major utilities in federal district court seeking to: 1) hold each defendant jointly and severally liable for contributing to the "ongoing public nuisance of global warming," and; 2) direct each defendant to cap its CO2 emissions and then reduce them by a specified percentage annually for at least a decade. Plaintiffs do not seek monetary damages, but seek injunctive relief "under the federal common law of public nuisance, or, alternatively, under state private and public nuisance law."

Mr. Seby's presentation will discuss all three efforts to obtain CO2 regulation through judicial action.

b. Analyzing Joint Benefits of Air Pollution Control Policies and Climate Change Mitigation with a Stochastic Climate Change Modeling Framework

Alexei Sankovski and William Pepper – ICF Consulting; Jane Leggett – U.S. EPA

The objective of this study is to evaluate (via modeling) the interaction and joint benefits of multi-pollutant abatement policies in combination of strategies to reduce GHG emissions. The questions to answer are whether and to what degree efforts to reduce local pollution lead to sizable changes in future radiative forcing and reduced climate change impacts and, visa versa, whether attempts to control GHG emissions have local pollution co-benefits. The simulation of emissions, emission controls, and climate effects is conducted using the Climate Change Risk Assessment Framework (CCRAF), which was developed to help assess the risk the future climate change and implications of different strategies to mitigate and adapt to climate change. The CCRAF is unique in that it explicitly represents uncertainty in its stochastic formulation, and it allows policies to adapt endogenously to changing conditions over time. Uncertainty is estimated in some variables utilizing regression analysis of historical data and in others using subjective expert analysis of the input variables. The CCRAF projects GHG and local pollutant emissions from energy production, consumption and conversion; residential use of traditional biofuels; burning of agricultural waste; other industrial sources; and savannah burning. In CCRAF, uncertainty of future emissions is estimated as a result of uncertainties in underlying socio-economic and technological variables as

well as from "model uncertainty" about the future forms and magnitudes of social decisions to abate pollution.

c. Update on State Climate Actions, with Focus on New California Analysis

Ned Helme, Stacey Davis and Matt Ogonowski – Center for Clean Air Policy

The Center for Clean Air Policy is working with the state of California to analyze the potential costs and emissions reductions from a variety of greenhouse gas mitigation measures in the transportation, power and industry sectors. Preliminary results of this analysis are expected in December 2004 and are intended for use by state agencies and stakeholders to inform the level of emissions goals and targets and to guide the selection of specific policy measures. This is the latest of a number of similar CCAP efforts to aid states to develop comprehensive climate change programs. In addition to California, the Center has recently assisted the states of Maine, Connecticut, Massachusetts, New York, New Jersey, Wisconsin and Puget Sound. The Center expects to describe the approach used to analyzed measures in California, and provide preliminary results. We will also give an update on recent state and regional climate policy developments, including measures to control emissions from electricity production.

d. The Regulation of CO2 Emissions from New and Expanding Power Plants in the Northwestern United States

Chris Drechsel – Trinity Consultants

Even without any significant action on a federal level to regulate carbon dioxide (CO2) emissions from power generation plants, several states are moving ahead and passing their own CO2 laws and regulations. The states of Oregon and Washington both have passed CO2 mitigation laws and/or regulations within the last two years. Both of these programs are specifically focused on the reduction or mitigation of CO2 equivalent emissions for new and expanded fossil fuel power plants located in these states. This paper provides a detailed description of both these programs, including an analysis of how the reduction/mitigation requirements will impact the siting of new generation in these states. In addition, this paper provides a comparison of this type of CO2 regulation to other approaches being implemented or proposed in other states or regions. For example, the Oregon and Washington laws both provide "command-and-control" type programs, which are focused on one industry and require the plant owner to provide funds to "offset" CO2 emissions. These programs are in contrast to efforts by certain states in the northeastern United States to regulate CO2 emissions on a regional level with a "cap-and-trade" regulatory scheme. Also, the state of Maine has passed a law that sets goals for greenhouse gas reductions across the transportation, commercial, industrial, government, and residential sectors, versus a focus on the power generation industry. Overall, an analysis of the Oregon & Washington laws/regulations, the impacts of these programs upon the power generation industry in these states, and comparison to other state or regional approaches provides useful information for when other states continue down the path or begin the explore the regulation of CO2 emissions on a state level.

e. The Northeast Regional Greenhouse Gas Initiative: Flash or Fizzle?

Scott M. Turner – Nixon Peabody, LLP

This paper will examine the background behind the Northeast Regional Greenhouse Gas Initiative, examine its progress to date and its possible outcomes, and evaluate its significance regionally and nationally.

f. Regional Greenhouse Gas Initiative (RGGI) Implications for Electric Generators

Steve Fine and Chris MacCracken, ICF Consulting, Inc.; Karl Michael – NYSERDA

The Regional Greenhouse Gas Initiative, or RGGI, is a cooperative effort by nine Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions. The initial effort of the initiative is to develop a regional CO2 cap on emissions from the electric power sector, although other sectors might be brought in later. To this end, RGGI's goal is to develop a model rule that could be adopted by individual states. ICF is currently conducting the electric sector modeling to assist the RGGI State Working Group and stakeholders analyze and quantify the impact on the electric sector of implementing such a program. Using the Integrated Planning Model (IPM®), forecasts of emissions levels, power prices, renewable power premiums (REC values), as well as the impact on

the relative competitiveness of regional generators under the different scenarios is being evaluated. Integral to this analysis is a detailed treatment of the renewable resource cost, performance and availability in the northeast and mid-atlantic and how renewable portfolio standard requirements will interact with conventional wholesale power markets and impact the CO2 emissions trajectory in the region. In addition, specific packages of energy efficiency measures will be evaluated relative to the construction of renewable and conventional power sources. Preliminary results of this analysis will be presented at this session.

g. Future Energy Growth in the Big Sky Region

David Shropshire and Susan Capalbo – Big Sky Regional Carbon Sequestration Partnership, Idaho National Laboratory (Big Sky Partnership)

Future energy development in the Big Sky region consisting of Idaho, Montana, Wyoming, and South Dakota is positively influenced and balanced by many dynamic factors. This paper examines some of the key factors including population demographics, climate change, land and water availability, regional energy market demands, environmental/regulatory constraints, energy infrastructure, and energy resource availability. Additionally, energy developers may want to consider locating power plants where carbon sequestration resources are available. The Big Sky Regional Carbon Sequestration Partnership is examining regional carbon sequestration resources that could be used to reduce or offset the carbon emissions from fossil power energy production. The paper includes examples of terrestrial and geologic sequestration applications that could be coupled to power plants located in the Big Sky region.

h. CO2 Lawsuits: Will the Plaintiffs' Bar Do to the Utility Industry What It Did to the Tobacco Industry?

Peter Glaser – Troutman Sanders, LLP

Eight states, New York City and various environmental groups recently sued five utility systems alleging that their CO2 emissions were causing an actionable nuisance by contributing to catastrophic global climate change. The lawsuits seek an order requiring the defendants to cap their CO2 emission by an unstated amount and then to reduce them by an unstated amount over the course of "at least" a decade. Is this lawsuit a harbinger of future similar lawsuits that seek to utilize tort law to achieve emissions limitations that advocates are not able to achieve through the legislative or regulatory process? The experience of other industries - including tobacco, breast implants, asbestos, firearms, lead paint and now the food industry - suggests that an initial lawsuit is often but the first step in a concerted legal strategy targeting an industry. The initial lawsuit tests the water, attempts to develop or move the law, and paves the way for additional future suits, perhaps in different jurisdictions. The utility industry has already seen tort lawsuits based on mercury emissions. Other tort lawsuits based on other emissions may follow. Global warming lawsuits seeking damages in addition to injunctive relief may also lie in wait. The PowerPoint presentation will provide an update on where the CO2 lawsuit stands, examine the theories advanced in the parties' papers and discuss the lawsuit in the wider context of tort law as regulatory device. The PowerPoint will also place the CO2 lawsuit in the context of other non-tort litigation attempts, including the D.C. Circuit case testing whether CO2 is a "pollutant" under the Clean Air Act, as well as state legislative efforts, to impose limitations on CO2 emissions.

Tuesday, 1/25/2005

B3 Corporate Strategies Tuesday; 7:30-9:30am

Chairs: Eric Kuhn – Cinergy Corp

Mark Trexler – Trexler Climate + Energy Services, Inc

a. Climate Change and GHG Shareholder Resolutions

Jay Wintergreen – First Environment, Inc.

A shareholder resolution is a formal request to a company's management on a particular issue that is subject to a vote of the shareholders as part of the company's annual meeting process. Corporate actions related to climate change have in recent years increasingly become the subject of shareholder resolutions. Increasing shareholder support for these climate change resolutions demonstrates investor interest and concerns for these issues. This presentation will explore the issue of climate change shareholder resolutions, review recent GHG shareholder resolution initiatives, and discuss how these resolutions are influencing corporate GHG management decisions.

b. Climate Change: Advancing Corporate Strategy Under Uncertainty

Hal Nelson – Trexler Climate + Energy Services, Inc.

Many companies recognize climate change as a potentially material business issue. Shareholders and legislation like Sarbanes-Oxley is stepping up the pressure on companies to proactively respond to potential climate change risk. Yet policy outcomes are fundamentally uncertain, both with respect to their timing and their approach. Corporate strategies that might be welcomed by some environmental stakeholders could easily be seen as financially imprudent by other stakeholders. Given the wide ranging expectations being placed on companies, what does it make sense to do? Act now, or wait and see? Or are there other alternatives that can position companies to satisfy multiple stakeholders and manage company risk, without putting a lot of near-term capital at risk? This presentation will explore how different companies are answering these questions, and provide insights into how companies might best respond to today's climate change uncertainties.

c. Distinguishing Hyperbole from Action in Corporate Strategic Responses to Global Climate Change

Laura S. Tanzer and Mitchel P. McClaran – School of Natural Resources, University of Arizona

There has been an advance in the social, political and corporate dialogue regarding global climate change (GCC) over the past twenty years. The question is: how much has the dialogue influenced corporate strategic action? Industry has learned to respond in a more positive manner to the socio-political dialogue concerning environmental issues, particularly global welfare issues. To distinguish increased dialogue from increased action, we examined 20 years of discussion in the utility industry's main trade journals, *Utility Week* and *Electric Utility Week*, looking for signs of strategic planning and action relating to GCC. We compare that dialogue to the types of strategic GCC activities taken by several randomly selected utility companies regarding GCC. Thus, if words are indeed turned into action, we would expect that there will be a positive correlation between reaching a critical mass in the journal discussion and greater strategic activity at the corporate level. If that is the case, it could be said that corporations are becoming more environmentally 'tuned-in' by incorporating socially important issues into their operations. They might also be said to be more politically positive regarding environmental issues, a change in strategy from the heretofore reactionary stance taken by most firms and industry associations.

d. Can We Make Consumer Markets Work?

Mark Trexler – Trexler Climate + Energy Services, Inc.

We tend to think of climate change as a regulatory challenge, and indeed it is a huge one. But there is a whole other dimension to motivating corporate action on climate change, and that is the consumer marketplace. This marketplace offers many opportunities to educate consumers about the climate change problem, thus influencing long-run policy, and helping pro-active companies

build marketshare based on their company's and their products' climate performance. A number of companies have been active in this space, particularly BP with its marketing of a climate friendly gasoline product in Australia.

This presentation will explore efforts to develop a consumer marketplace around climate change performance, and provide thoughts on how to advance this opportunity in the PNW.

e. Analyzing the Cost-Effectiveness of Electric Company Options to Reduce GHG Emissions: Price Uncertainty, Real-Options, and Discounting

Adam Diamant – EPRI; Eric Kuhn – Cinergy Corp.

Electric utilities can implement a variety of strategies to reduce direct greenhouse gas emissions associated with the combustion of coal and other fossil fuels. One strategy that is receiving increased attention is the potential to co-fire biomass fuel in conjunction with coal in coal-fired powerplants. In this analysis, we used a new, "real-options"-enabled Excel spreadsheet model developed by EPRI to estimate the "levelized cost" (\$/ton CO₂e) of GHG emissions reductions that may be realized by co-firing 2% biomass with coal in a representative coal-fired power plant in the Midwest. The Greenhouse Gas Emissions Reduction Cost Analysis Model version 1.0 (i.e., "GHG-CAM") uses a discounted cash flow (DCF) analysis methodology to evaluate the revenues, costs and expected after-tax gross margin expected to flow from investments that could be made by an electric utility company in different kinds of GHG emissions reduction projects, including Biomass Cofiring. The GHG-CAM incorporates sophisticated statistical and economic tools, including Monte Carlo simulation, real-options analysis, and decision analysis methods that make it possible to explicitly incorporate risk, uncertainty and contingent decision making into the analysis of specific GHG emissions abatement strategies that can be implemented by electric utilities.

f. Creating Integrated, Low-Cost, Emission Reduction Strategies for Networked Companies Using Emissions Optimizer Technology

Beth Brandes Jenkins, Richard E. McAllister, Bruce E. Snyder, Semra Alici, Carlos A. Valenzuela, and Mark M. Daichendt – Air Products & Chemicals, Inc.; Derrick P. Schertz and Joseph F. Pekny – Advanced Process Combinatorics, Inc.; Kasi Kasireddy – VisionMonitor Software, LLC

Air Products & Chemicals, Inc. (APCI) has developed a unique Services & Solutions Business offering, built on a patent-pending business method, which establishes a web-based emissions network that combines, integrates and then optimizes a group of companies' emission-reduction plans to determine the lowest cost compliance strategy. The Emission Optimizer (EO) technology, developed to quickly create optimized strategies, can be used by networked companies within cap and trade programs to help create integrated, low cost emission reduction strategies; by voluntary control regions to avoid new or further governmental regulations; by global companies to optimize their emission reduction strategy and keep it optimized as regulations flex; and by modeling groups tasked with assessing the economic impact of proposed regulatory changes. The web-based management system, customized by Vision Monitor, integrates data from governmental agencies and the customers' forecasted point source emission levels and reduction projects as inputs to the EO. The EO develops a low cost strategy for the networked customers using state-of-the-art mathematical-programming-based optimization techniques. A large-scale Mixed-Integer Linear Programming (MILP) problem, customized for APCI by Advanced Process Combinatorics (APC) using APC's proprietary VirTECS solver technology, is used to determine the lowest compliance cost for the region. A subsequent Nonlinear Programming (NLP) problem, developed by APCI is used to determine the corresponding credit trades and prices. An EO case study was performed in the Houston-Galveston Area (HGA) by combining 10 individual companies emission reduction compliance plans. The HGA is classified as a "serious" ozone non-attainment area. Each company operating in the area must achieve specific NO_x emission level limitations, staged between 2003 and 2008. The EO technology developed an optimized strategy for the networked companies' project implementation by utilizing the regions cap and trade program more efficiently, which has the potential to save over \$30 million dollars.

B4 Power Partners & CLIMATE VISION Tuesday; 10am-12pm

Chairs: Eric Holdsworth – Edison Electric Institute

a. Power Partner's Meeting the Challenge: An Update

Eric Holdsworth – Edison Electric Institute

Paper will present a comprehensive overview of voluntary actions undertaken by the power sector in the U.S. to address greenhouse gas intensity, in response to the President's goal of an 18 percent reduction in U.S. greenhouse gas intensity. The author briefly examines the origins of the current program (Power Partners), then highlights actions taken in the last two years by power sector companies to reduce greenhouse gas emissions. Areas of activity covered include industry-wide initiatives, company-specific actions (including voluntary commitments) and cross-sectoral activities. Paper concludes with a look at next steps in the process. This is an update of a panel presentation given two years ago at EUEC 2003.

b. AEP's GHG Program Supporting Power Partners & CLIMATE VISION

Diane Fitzgerald – AEP

c. Entergy's Voluntary Greenhouse Gas Stabilization Commitment: Progress During First Commitment (2001 - 2005) & Newly Announced Second Commitment (2006 - 2010)

Jeff Williams – Entergy

Entergy believes global warming is one of the most serious environmental threats that our society faces. It's especially threatening to the U.S. Gulf Coast - one of our primary service areas. Here, there is potential for increased flooding of low-lying areas, more powerful tropical storms, and increased spread of mosquito-borne diseases.

In May 2001, Entergy became the first U.S. electric power company to establish a stabilization target for CO₂ emissions. It committed to stabilize CO₂ emissions at year 2000 levels through 2005, and dedicated \$25 million in supplemental corporate funding to achieve this target over the five-year period. By end of year 2003, the company had initiated 36 internal and 12 external greenhouse gas emission reduction projects, resulting in a projected 2 million tons of CO₂ equivalent reductions through the target period. Approximately \$13 million was invested from the \$25 million Environmental Initiatives Fund to support these projects.

Company CO₂ emissions of 53.24 million tons in the baseline year of 2000 fell to 49.58 million tons in 2001. In 2002, emissions declined further to 44.20 million tons and in 2003 they went down to 36.8 million tons.

Some of the projects that were identified as part of the Environmental Initiatives Fund during the first phase follow:

- Red River & Tensas Wildlife Refuge Reforestation & Carbon Sequestration Project
- Coal Mine Methane Recovery Project
- Entergy-Dupont Nitrous Oxide Emissions Trade
- Geologic Sequestration for Enhanced Oil Recovery Trade Through Blue Source
- Entergy's Sustainable Forestry Initiative

Currently, Entergy is engaged in the goal setting process for the next commitment phase of greenhouse gas reductions for 2006 - 2010. Entergy will publicly announce and describe its new voluntary greenhouse gas commitment.

d. Southern Company Sulfur Hexafluoride Inventory and Emission Reduction Program

Ken Boyd – Southern Company

Sulfur hexafluoride (SF₆) is the most potent greenhouse gas ever evaluated by the Intergovernmental Panel on Climate Change. SF₆ is a highly stable, odorless, colorless, nontoxic, nonflammable gas with excellent dielectric properties. Given these properties and characteristics, SF₆ is used for insulation and current interruption in electric power transmission and distribution equipment and is extremely important to the electric utility industry. SF₆ is also used in the magnesium industry, semiconductor manufacturing, and as a tracer gas for leak detection. Although SF₆ is not released in large quantities, it has a global warming potential of 23,900 and the annual carbon-equivalent U.S. emissions total almost 10 million metric tons each year. Emissions rose by almost 20 percent during the 1990s. As a relatively large user of SF₆, Southern

Company set a goal for reducing emissions from 63,000 pounds per year in 1993 to less than 20,000 pounds per year by 2005. Through the inventories and programs implemented to meet this goal, annual emissions have already been reduced to just over 7,300 pounds in 2003. Thus, the program has been highly successful from an environmental perspective and also from safety and economic perspectives. Emissions and reductions are reported to the U.S. Environmental Protection Agency through the SF6 Emissions Reduction Partnership for Electric Power Systems and to the U.S. Department of Energy through the 1605(b) Climate Challenge Program. This presentation will describe the Southern Company SF6 program, inventory, emission reduction activities, accounting procedures, and future plans.

e. TBA - *Dick Bratcher – EPRI*

f. David Berg, DOE, TBA

B5 Carbon Trading and Markets Tuesday; 1-3pm

Chairs: Joe Wisniewski – Environmental Synergy

Peter Fusaro – Global Change Associates

a. Emissions Trading Markets: An Overview of Where We are in 2005

Peter C. Fusaro – Global Change Associates Inc.

This presentation will focus on both the status of the markets but also the market drivers for the increased level of interest in emissions trading as it becomes a serious corporate financial issue. It will focus on insights on what to look for in the emerging portfolio approach of companies to manage their environment financial risk management through trading.

Environmental financial markets in 2005 are accelerating their market maturation process for SO₂, NO_x, and carbon dioxide. They are also being driven by regulatory changes, increased coal burning, higher prices and more volatility for fossil fuels, and a knock effect from the launch of the EU Emissions Trading Scheme for carbon dioxide and the five other greenhouse gases. These markets have now brought in more corporate and trading players due to the growing awareness that emissions trading markets work.

Factors influencing present market developments include (a) the more stringent air quality standards and the increased coal burn have brought sulfur dioxide credits to the highest level ever in recent months. The ratcheting up of environmental regulations through 2015 promise to drive technology changes and increased trading activity for SO₂, (b) increased severity and tight deadlines to reduce NO_x emissions for industry in many regions of the country including the Houston Galveston area by 2008, and the (c) the continued interest in carbon dioxide trading in the US driven by the increased trading volumes on the Chicago Climate Exchange as well as the implementation of the EU ETS on January 1, 2005.

b. Cap Or Trade: The Evolution of Emissions Control and Market Decisions Since 1990

Peter Rosenthal – Washington Bureau Chief

An analysis of the impact of emissions regulations on allowance market prices and the decision to install pollution control equipment. From the launch of the Acid Rain program to proposed rules for further cuts of sulfur dioxide, nitrogen oxides and now mercury, a distinct pattern has emerged in how and whether generators choose to purchase allowances, build new controls or take other paths. The analysis will look at how these were approached under the 1990 Clean Air Act amendments, as well as what the outlook is for prices and controls under new Clean Air Interstate and mercury rules.

The presentation will draw upon a proprietary set of Argus data on pricing and controls and the industry's leading coverage of air markets and regulations.

c. A look Ahead: An Update of the Regional Emissions Markets

Randall N. Lack – Element Markets, Inc.

Mr. Lack will be providing an update of the trading in the regional markets throughout the United States. Over the last few years economics, feedstock constraints and an economic downturn have hindered growth and expansion of new and established businesses in the US. We are about to

enter an upswing in the economy, which will create a constrain of emission credits. Randall will give a forward looking picture of the market, while taking in consideration pending legislation, economic growth, and avialable emissions controls.

d. US Greenhouse Gas Project Offsets: Viable, Plentiful and Cost-effective

Bill Townsend, Greg Spencer and Lauren Rector – Blue Source

As state and regional greenhouse gas emission trading programs continue to evolve across the United States, we have observed that much of the underlying purpose and economic benefits available from utilizing the broadest possible sources of qualified offsets are being weakened by those responsible for structuring these programs. These unnecessary restrictions will result in a clear loss to all parties interested in the success of these programs. The likely reason for these restrictions is a lack of knowledge of the extent to which offset sources are available and the verification rigor for which these offsets can qualify.

This paper would expose the scope of our experience in identifying, creating, verifying and registering offset projects located in the United States across several industries (many of which are talked about, but rarely proven up): transportation, real estate, food and animal processing, retail distribution, enhanced oil recovery, energy conservation management, etc. Our experience in aggregating tens of millions of tonnes of various offset types over the past 5 years has given us practical knowledge that enables us to identify overlooked offsets and lower the cost of verification without lowering the project standards for such offsets. Our discussion of aggregation opportunities in light of the environmental and economic goals of these emerging trading programs should reinvigorate the discussion of the importance of offsets and clarify the rationale for expanding available sources and uses of offsets in these state and regional programs.

The authors' position is based on several years of experience in sourcing and aggregating offsets in partnership with industry-leading and Fortune 500 companies. The authors have 1) secured under exclusive supplier relationships over 250 million tonnes of emission offsets through 2012 and 2) delivered or contracted for delivery over 9 million tonnes of ghg emission offsets to large final emitters.

e. Proactive Strategies to Manage GHG Risks

Neil Kolwey – Platts/E Source

f. Endowment Effect of CO2 Permits In Experimental Economic Framework

Hyo-Sun Kim – Korea Gas Corporation

This study will test the hypothesis whether the endowment effect will determine the market behavior in emissions trading. Experimental economic approach is applied to observe the market behaviors.

g. Acquiring Quality Offsets With a Non-Profit Partner: The Climate Trust's Greenhouse Gas Offset Partnership Program

Mike Burnett – The Climate Trust

The Climate Trust is one of the largest buyers of greenhouse gas offsets in the US, and is the leading US non-profit focused solely on providing quality greenhouse gas offsets. The Trust has successfully acquired a diverse portfolio of quality offset projects as the implemeter of Oregon's Carbon Dioxide Standard. In doing so, the Trust has built a valuable experience base in locating, evaluating, and contracting for offsets. The Trust makes this experience available to companies around the country through its Greenhouse Gas Offset Partnership Program. The elements of this program will be described, the rationale for engaging a non-profit partner is provided, and the the approaches the Trust uses to build quality into its offsets -- portfolio diversity, rigorous review, and contract structures -- are summarized.

h. Voluntary GHG Reduction Goals and Strategies

Neil Kolwey – Platts/E Source

Many U.S. utilities are moving ahead with proactive strategies to manage their GHG risks, including participating in voluntary GHG reduction programs, despite the lack of serious climate change policy activity at the federal level. What are the main drivers affecting proactive GHG

reductions and participation in these voluntary programs? What types of emissions reduction strategies are utilities using, and how much are they spending? We interviewed six U.S. utilities that have set aggressive GHG reduction goals to provide some insights into these important questions. We will also provide a brief comparison of some of the voluntary programs and their relative strengths.

B6 GHG & Carbon Sequestration Technologies Tuesday; 3:30-6pm

Chairs: Dan Klein – Twenty-First Strategies

John Ruether – DOE

a. New Developments in DOE's Carbon Sequestration Program

Daniel E. Klein – Twenty-First Strategies; Robert L. Kane – U.S. Dept. of Energy

There is growing recognition that capturing and permanently sequestering carbon dioxide must be part of the solution to curbing greenhouse gas emissions. The President's February 2002 Global Climate Change Initiative has the goal of significantly reducing the GHG intensity of the United States economy over the next 10 years, while sustaining the economic growth needed to finance investment in new, clean energy technologies.

Carbon capture and sequestration technologies must play a key role if the U.S. is to slow the growth of GHG emissions, and as the emerging science justifies stop and then reverse that growth. DOE's Carbon Sequestration Program uses a two-prong approach to develop a portfolio of technologies and GHG mitigation strategies: (1) Make energy systems more efficient; and (2) Capture and sequester greenhouse gases. The first approach is being addressed by the core fossil energy programs and by FutureGen, a \$1 billion dollar project to build the world's first integrated sequestration and hydrogen production research power plant. The second approach is being addressed by DOE's Carbon Sequestration R&D Program, which focuses primarily on developing capture and separation technologies that dramatically lower the costs of reducing CO₂ emissions from gas and other streams by either pre- or post-combustion processes.

Based on the President's Global Climate Change Initiative, the Carbon Sequestration Program is aggressively accelerating the R&D to help meet the administration goals related to greenhouse gas reduction and climate change. The Carbon Sequestration Program is now focused on both contributing to the emissions reductions required for an 18% reduction in greenhouse gas intensity by 2012 and on bringing cutting edge technologies to a state of readiness in time for 2012 policy review and decision-making process as mandated by the Global Climate Change Initiative.

b. Coal-to-Power and Coal-to-Liquid Fuels Technologies Used in a Technoeconomic Study of the Hydrogen Economy

John Ruether and Peter Balash – U.S. DOE-NETL; Dale Keairns – U.S. DOE-NETL SAIC; Donald Hanson – Argonne National Laboratory

Researchers at NETL and ANL are preparing a technoeconomic modeling study of the U.S. economy as it transitions away from petroleum dependence. The objective is to reduce petroleum consumption by 11 million barrels per day and carbon emissions by 500 million Mt carbon equivalent per year by 2040. The NETL/ANL study will develop two scenarios. In one scenario fuel cell vehicles will dominate the light duty fleet, and in the second scenario other technological advances such as hybrid vehicles will be employed to achieve the targeted reductions of petroleum consumption and carbon emissions. Refinery management will undergo large changes as product sulfur specifications tighten while crude feeds become heavier and natural gas becomes more expensive. Coal use for electricity generation, hydrogen production and liquid fuels production are integral parts of both scenarios. In the present paper technologies are reviewed that will be needed to convert coal to distillate fuels to replace petroleum. Such conversion plants will be operated with carbon capture and storage and will be capable of cogenerating electricity to improve thermal efficiency. Advanced fossil fueled electric generating technologies with good load following capability to complement intermittent renewable energy generators will also be reviewed.

c. A Sustainable Development Technology for Capture, Recycling and Sequestration of Industrial CO₂ Emissions, Using a Biochemical Catalyst.

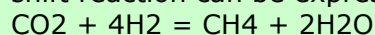
Jo Lanoë - CO₂ Solution Inc.

CO2 Solution Inc has made available for industrial field evaluation a new technological approach that selectively captures CO2 from the GHG emissions and instantaneously transforms it into an easily manageable aqueous bicarbonate ion solution, either for local recycling or for remote sequestration. CO2 Solution patented core process is conducted in a reactor packed with a proprietary biochemical catalyst and operating at ambient temperature and atmospheric pressure. The catalytic process occurring in the reactor generates an aqueous solution of bicarbonate ions. Catalyst is a genetically engineered enzymatic protein immobilized onto a polymeric substrate. The nature of the instant by-product allows for several alternatives to affordably dispose of the CO2 after it has been converted into a stable aqueous bicarbonate ion solution. These alternatives include (1) production of a carbonate derivative (e.g. calcium carbonate, industrial grade for the pulp and paper industry), (2) active desorption (regeneration of industrial grade CO2, e.g. for plant growth in greenhouses), (3) conditioning of the bicarbonate solution (e.g. for injection into deep continental saline aquifers). The presentation will include a brief overview on how this company intends to market its technology in the Electric Utilities market.

d. An Innovative Process To Sequester CO2

Jack Ralston – RITA, USA; Erik Fareid – EicProc

When CO2 is hydrogenated using "The Reverse Shift Reaction", it can be converted into two usable products, methane and water. The H2 required can be generated by the solar electrolysis of water (or by the use of any renewable energy source). The methane generated will be used to generate electricity. This is a process that will be an energy efficient way to sequester CO2. The reverse shift reaction can be expressed as shown below:



This reaction will take place at an elevated temperature and pressure and using the most efficient catalyst. However, development work must be done to make this a commercial process. The presentation will review material balances and possible financial benefits.

e. The Benefits and Challenges of Sulfur Hexafluoride Recycling

Ted Atwood, P. Czepiel, and I. K. Klimovitsky – Xenon Specialty Gas, Inc

The primary end-use of globally manufactured sulfur hexafluoride (SF6) is high voltage electrical equipment. The exceptional dielectric properties and superior chemical stability have made SF6 the principal choice in gas-insulated electrical components. It is used as an insulator and interrupter for breakers, switches, busbars, and distribution equipment. SF6 is chemically unreactive, non-flammable, non-toxic, and non-corrosive. However, it is a very potent greenhouse gas. Its unreactive nature and ability to absorb infrared energy results in an atmospheric lifetime of 3200 years and a Global Warming Potential (GWP) relative to carbon dioxide, over a 100 year period, of 23,900. This high GWP has given impetus to efforts to reduce SF6 emissions to the atmosphere. Attention has been focused on losses from electrical components because they are responsible for the majority of SF6 emissions. Emissions reduction methods examined include substitute gases, better leak detection and reduction techniques, and SF6 recycling. Recycling offers a way to extend the life cycle of SF6 while regenerating a valuable product. Here, we discuss the analytical and quality control challenges confronted in establishing a successful SF6 recycling operation.

f. Waste-to-Energy's Contribution to Lowering Emissions of Greenhouse Gas: An American Example

Maria Zannes – Integrated Waste Services Association; Frank Ferraro – Wheelabrator Technologies; D. Karsten Millrath – Columbia University Earth Engineering Center

America's waste-to-energy facilities dispose of trash, and are an alternative to land disposal that releases methane (a potent greenhouse gas) as trash decomposes. Waste-to-energy also produces electricity, lessening reliance on fossil fuel power plants that release carbon dioxide. Operation of waste-to-energy plants avoid the release of methane that otherwise would be emitted when trash decomposes, and the release of CO2 that would be emitted from generating electricity from fossil fuels. The presentation will discuss existing methodology that has been used to quantify waste-to-energy technology's contribution to preventing the release of forty million metric tons of greenhouse gases in the form of carbon dioxide equivalents that otherwise would be released into the atmosphere on an annual basis, including a discussion of an analysis developed

by the U.S. Environmental Protection Agency and the IWSA. Annual reporting by IWSA to the U.S. Department of Energy's Voluntary Reporting of Greenhouse Gases Program also will be reviewed, showing that waste-to-energy also prevents the release each year of nearly 24,000 tons of nitrogen oxides and 2.6 million tons of volatile organic compounds. In addition, the authors will discuss a project analysis of a single facility's contribution for a 1500-ton-per-day waste-to-energy facility in the northeast. Researchers used plant-specific data and determined that about 270,000 tons of carbon dioxide equivalent emissions are avoided annually because of this one plant's operations. America's 89 waste-to-energy facilities dispose of 95,000 tons of trash each day, and produce 2,500 megawatts of electricity. Waste-to-energy facilities meet the power needs of 2.3 million homes, and serve the trash disposal needs of more than 36 million people.

g. A Global Standard for Reducing Venting and Flaring of Associated Gas

John Laque – URS Corporation, CA; Lisa Campbell – URS Corporation, London

This paper describes the process and results of a project to develop a global standard to reduce flaring and venting of natural gas that is produced in association with crude oil production ("associated gas"). In many parts of the world where infrastructure and/or markets for natural gas are lacking, the gas produced with crude oil is viewed as a waste product and is vented to the atmosphere or combusted by flares. Venting and flaring of associated gas not only result in non-utilization of a significant high quality, clean energy resource, but also lead to adverse environmental impacts, including substantial emissions of greenhouse gases (chiefly carbon dioxide and methane) and degradation of local air quality where these activities occur. It has been estimated that the total volume of flared associated gas worldwide amounts to over 100 billion cubic meters per annum, which is equivalent to the gas consumption rate of France and Germany combined. The Global Gas Flaring Reduction Public-Private Partnership (GGFR) was formed under World Bank sponsorship in 2002 to address widespread venting and flaring of associated gas.. One of the GGFR's key initiatives has been to develop a voluntary standard for reduction of venting and flaring worldwide. Virtually all of the major international oil companies and the national governments of many nations with significant flaring have joined the GGFR Partnership and have committed in principle to the requirements of this standard. Development of the standard was accomplished by means of a collaborative process, with input from member companies and countries. It is believed that the standard will result in an appreciable decrease in world flaring and venting of associated gas over the next five years or so.

h. Overview of GHG Emission Estimation for the Electric Utility Industry

Gregory San Martin and Sven Thesen – PG&E

The electrical utility sector was responsible for approximately 40% of the greenhouse gas (GHS) emissions in the U.S. in 2002, the latest year for which EPA has released GHG emission inventory estimates. As a result, the accurate quantification of GHG emissions from the electrical utility industry is an important goal of GHG registries such as the California Climate Action Registry. However, there are a number of issues associated with the electrical utility industry that make it difficult to estimate GHG emissions for a given utility. One of the first issues to be addressed is definition of the entity to be inventoried and includes apportioning emissions based on ownership or management control. Indirect emissions associated with purchasing power on the spot market or from brokers can be very difficult to quantify because the original generator of the power may not be known and hence the emissions of GHG associated with that power can only be approximated. In addition, many integrated utilities have ownership in plants outside their service territory or state so issues associated with importation of power across registry boundaries can cause complexities in the summation of emissions. This paper will address the complexities in the development of a GHG emission inventory for a typical electrical utility and provide guidance on preparing such inventories.

Wednesday, 1/26/2005

B7 Terrestrial Carbon and Forestry Wednesday; 7:30-9:30am

Chairs: Gary Kaster – AEP
John Kinsman – EEI

a. UtiliTree Carbon Company and PowerTree Carbon Company Experience with Forest Carbon Sequestration

Gary Kaster, John Kinsman, Mike Rodenberg, Eric Kuhn and Paul Pike - AEP

b. Estimating and Comparing the "Levelized Cost" Per Ton (\$/ton CO₂e) of Greenhouse Gas Emissions Reductions That May Be Produced by Four Different Approaches to Developing and Managing Forest Carbon Sequestration Projects.

Adam Diamant – EPRI

Electric utilities can implement a variety of strategies to offset their greenhouse gas emissions. One strategy that has received considerable attention is forest carbon sequestration (i.e., growing trees to store carbon), and in recent years a number of electric utilities have invested in pilot forest carbon sequestration projects. While forest carbon sequestration appears to be a potentially low-cost way to offset utility GHG emissions, utilities continue to wrestle with how to analyze these projects from a financial analysis perspective, and how to compare different approaches that can be used to implement these projects. We have attempted to address these issues using a new, "real-options"-enabled Excel spreadsheet model developed by EPRI to estimate the levelized cost (\$/ton CO₂e) of GHG emissions reductions that may be produced under four different approaches to contracting and managing a forest carbon sequestration project. The GHG-CAM incorporates sophisticated statistical and economic tools, including Monte Carlo simulation, real-options analysis, and decision analysis methods that make it possible to explicitly incorporate risk, uncertainty and contingent decision making into the analysis of specific GHG emissions abatement strategies.

c. A Comparison of Sequestering Carbon in Northern vs. Southern Forests of the U.S.

Dr. Gary Konrad and Dr. Ching-Hsun Huang – Arthur Temple College of Forestry, Stephen F. Austin State University

Global concern over increasing carbon dioxide (CO₂) concentrations in the atmosphere leading to possible future climate changes have generated interest in offsetting CO₂ emissions by storing carbon in forests. Carbon-sequestering forest activities may be one of the least expensive approaches to mitigate the build up of atmospheric CO₂. However, the fact that forest management practices are species, site and management objective specific increases the complexity of using the forestry sector to mitigate global warming. In order to provide useful and timely information concerning carbon sequestration, this study investigated three forestry-based opportunities for sequestering carbon in the U.S.: conversion of marginal agricultural land to forests and reforestation of poorly stocked pine plantations in the South, afforestation of the Lower Mississippi Alluvial Valley (LMAV), and reclamation and afforestation of abandoned mined lands (AML). This study conducted economic analyses on three region-species combinations: loblolly pine (*Pinus taeda* L.) in the southern states, cherrybark oak (*Quercus pagoda* Raf.) in the LMAV, and northern red oak (*Quercus rubra* L.) on AML in West Virginia. The objectives of this study were to determine the profitability of managing these three commercial tree species for timber production only and for the combination of timber production and carbon sequestration, and calculate net tonnes of carbon stored during one rotation and net revenues generated from each ton of carbon sequestered.

d. Implementing a Pilot Trade in Soil Carbon Sequestration

Karen Updegraff, P. Zimmerman, P. Kozak, W.J. Capehart and M. Price – South Dakota School of Mines and Technology

The C-Lock (patent pending) carbon credit estimation system is being used to quantify and certify up to 1.8 million carbon emission reduction credits (CERCs) resulting from cropland and grazing management on one million acres of tribal and Tribal Trust lands on the Cheyenne River Sioux Reservation in South Dakota. Tribal rangeland managers have undertaken to reduce grazing by 20%; in addition about 40,000 acres of tribal lands are in the Conservation Reserve Program, and 20,000 acres are active croplands on which various types of conservation tillage are being implemented. In addition to cropland and rangeland registration, the project will entail producer education, contract design and market discovery. The overall objective is to demonstrate to producers the feasibility of marketing the carbon benefits of their conservation practices. We will present a project overview and preliminary results from land registration and CERC estimation.

e. The Value of Collaborative Tools in Advancing Carbon Sequestration Projects and Other Climate Initiatives

Michelle Varga Esposito – Augusta Systems, Inc.; Sarah Forbes – U.S. DOE-NETL

In order to facilitate wide-scale acceptance and deployment of carbon sequestration and other climate initiatives by the general public, industry decision makers, and government policy makers, it is necessary for these stakeholders to engage in early-stage project development and deployment activities. However, in order for this to occur there is a clear need for more educational and collaborative resources. To meet this need, Augusta Systems, Inc., under the guidance and financial support of the United States Department of Energy's National Energy Technology Laboratory, developed the "Carbon Offset Opportunity Program" (CO-OP). CO-OP is a web-based tool that facilitates collaboration in the development of carbon sequestration and other climate initiatives that offset or reduce greenhouse gas emissions. CO-OP assists industry, government, and other organizations by matching potential industry investors with projects to assist in catalyzing carbon sequestration projects and other activities, in a manner that emphasizes voluntary actions by industry. In addition, an educational component provides information about project development, climate change, and greenhouse gas emissions. This presentation details the value of collaborative tools in advancing carbon sequestration projects and other climate initiatives. More precisely, the presentation covers the following areas: evidence of the high transaction costs on carbon sequestration projects borne by the lack of connectivity in the current GHG emissions management marketplace; documentation of the economic benefits that come from collaborative carbon sequestration projects; and, the detailing of the progress made to-date to establish CO-OP as a method to engage potential stakeholders to pursue collaborative carbon sequestration and other offset and reduction projects.

B8 Inventories & Registries Wednesday; 10am-12pm

Chairs: Ram Srivistava – SAIC

Sarah Forbes – DOE

a. Overview of GHG Emission Estimation for the Electric Utility Industry

Howard Balentine and Wilma Dreessen – ENSR International

The electrical utility sector was responsible for approximately 40% of the greenhouse gas (GHS) emissions in the U.S. in 2002, the latest year for which EPA has released GHG emission inventory estimates. As a result, the accurate quantification of GHG emissions from the electrical utility industry is an important goal of GHG registries such as the California Climate Action Registry. However, there are a number of issues associated with the electrical utility industry that make it difficult to estimate GHG emissions for a given utility. One of the first issues to be addressed is definition of the entity to be inventoried and includes apportioning emissions based on ownership or management control. Indirect emissions associated with purchasing power on the spot market or from brokers can be very difficult to quantify because the original generator of the power may not be known and hence the emissions of GHG associated with that power can only be approximated. In addition, many integrated utilities have ownership in plants outside their service territory or state so issues associated with importation of power across registry boundaries can cause complexities in the summation of emissions. This paper will address the complexities in the development of a GHG emission inventory for a typical electrical utility and provide guidance on

preparing such inventories.

b. Standardized GHG Emissions Reporting for Electric Utilities: A Report on the Voluntary Reporting and Certification Protocols Developed by the California Climate Action Registry

Robyn Camp – California Climate Action Registry

The California Climate Action Registry (CA Registry) is a non-profit public/private partnership that serves as a voluntary greenhouse gas (GHG) registry to protect, encourage, and promote early actions to reduce GHG emissions. GHG emissions are reported to the CA Registry following accounting principles outlined in a general reporting protocol, based on the WRI/WBCSD GHG Protocol. The CA Registry also develops additional standards for key industries to provide guidance, as needed, to enable standardized, accurate and transparent reporting. The CA Registry has recently developed such GHG accounting guidance for Electric & Natural Gas Utilities and Electric Power Generators. This presentation will provide a brief overview of the CA Registry program and the approach it used to develop GHG accounting standards for entity-wide reporting of annual GHG emissions inventories by electric utilities and electric power generators. Guidance includes recommendations for calculating and certifying emissions from electric power generation, transmission & distribution, as well as natural gas transmission & distribution.

c. Electricity GHG Inventories: Issues and Approaches

Paul Worhach, Ph.D. and Scott Olson – Nexant, Inc.

In this presentation, several issues are considered that arise when considering the design of GHG inventories from electricity production. Designing and instituting registries in the near term is important for several reasons: to provide incentives via credits for early reductions; to stay ahead of the technology curve, e.g. for advanced power generation technologies such as gasification with CO₂ sequestration; and to ensure that future negotiated policies are able to take account of past emissions reductions. Emissions registries in the U.S. are initially being implemented at the state level. In order to properly inventory state-level emissions, as in California, the dynamics between regional power pools must be taken into account. A further issue that impacts emissions inventories from electricity production relates to the lifecycle emissions from resource extraction, fuel production, and fuel transportation. Power generation contributes to GHG generation not only via direct emissions from combustion, transmission, and distribution of electricity, but also upon the quantity of fuel consumed, which directly impacts upstream lifecycle emissions. The co-production of multiple products in power generation also presents an issue for GHG inventories. Certain advanced energy technology units will produce multiple products based on how the technology is used. The production of multiple outputs from one facility creates challenges for properly quantifying and categorizing emissions. Finally, the potential for carbon sequestration should be considered in GHG inventories for both advanced and existing technologies. Carbon sequestration may play an increasingly important part in carbon management and mitigation from power production. In anticipation of sequestration programs such as FutureGen, greater coal seam injections, and wider use of carbon dioxide for enhanced oil recovery, inventory protocols should include provisions for the inventory of sequestered carbon, and for the monitoring, measurement and verification of sequestered carbon.

d. The California Climate Action Registry and GHG Report Verification

Tod Delaney – First Environment, Inc.

The California Climate Action Registry (CCAR) is a voluntary GHG registry that offers potential protection of GHG emission baselines and early reduction actions in the event of any future GHG regulations. The CCAR only accepts corporate GHG reports that have been third party certified by a state-approved certifier according to the Registries Certification Protocol. This presentation will provide an overview of the CCAR certification protocol as well as insights into the certification process.

e. Carbon Sequestration Role in State and Local Actions

Melissa Chan and Sarah Forbes – U.S. DOE-NETL

Though there is no national legislation for carbon sequestration activity, nor national market for greenhouse gas (GHG) reductions, several states have developed regulations to encourage carbon

sequestration projects and regional alliances have developed to coordinate efforts and resources to reduce GHG emissions. In the absence of a national directive to address GHG emissions, state opinions regarding the best approach to manage GHG emissions are subject to change due to resource availability, and political flux. For example, some states that have established registries later repeal them, other states seek to create registries and advisory boards but cannot afford to maintain them, and some states that previously sought to restrict regulation of GHGs create carbon sequestration advisory boards. Evaluating the methods that states are taking, and choices being made, in consideration of GHG emissions can lend insight into ways to best address concerns over GHG emissions. This paper summarizes state legislation to address GHG emissions and carbon sequestration, develop registries, private and public regional partnerships to reduce GHG emissions, as well as federal activities and guidance in sequestration application and development.

e. Carbon Benefits from Improved Fire Management

John Kadyszewski – Winrock International

f. Targeting and Tracking Terrestrial Sequestration Offset Projects as Part of an Emissions Reduction Strategy

Dick Kempka – Ducks Unlimited, Inc.

Most energy companies are considering a strategies for reducing Greenhouse Gas emissions. According to the International Panel on Climate Change (IPCC), nearly one-quarter (25%) of man-made carbon dioxide emissions come from land use change or deforestation. Terrestrial carbon sequestration, such as forest or grassland restoration, enhances the natural processes that remove CO₂ from the atmosphere and is thought to be one of the most cost-effective means of reducing atmospheric levels of CO₂. Initiating land restoration projects on marginal agricultural can generate low cost carbon credits and improve important wildlife habitat, water quality, and flood protection. Terrestrial offsets may also be an effective financial investment for those speculating on the future value of the carbon market. The Lower Mississippi Valley, extending from the southern tip of Illinois to southern Louisiana, has experienced millions of acres of land clearing and agricultural conversion since the 1800's. Today, conservation organizations are addressing wildlife habitat loss as well as the associated environmental issues, such as non-point source pollution, increased flooding, and Gulf of Mexico hypoxia. Ducks Unlimited and its partners are implementing a system for tracking reforestation and associated carbon benefits in the southern United States. Satellite imagery and GIS database technology are used to identify, verify and monitor carbon sequestration projects. This sophisticated accounting system helps ensure high quality carbon offsets that are scientifically validated and documented. The database tracks all aspects of terrestrial sequestration projects and provides comprehensive support for investors. Our objective is to expand this system to other regions in the U.S., such as the Great Plains states, and to lend vital scientific support to this segment of the market.

B9 Monitoring & Verification Wednesday; 1-3:30pm

Chairs: John Kadyszewski – Winrock International

Robert S. Chatham – PSEG Global

a. Silver Lining: Where Global Environmental Program Meet Economic Reality

Michael Canterbury – ESP

Environmental compliance programs across the globe are increasingly important variables in every company's economic viability. Corporations that incorporate these programs into daily decision support gain a strategic advantage over their competitors that do not incorporate environmental program. This presentation begins with an examination of the EU ETS program and its mechanics and concludes with a discussion of organizational implementation and economic realities.

b. Certifying Greenhouse Gas Projects - Robert S. Chatham, PE, CPEA – PSEG Global

SAESA, PSEG Global's company in Chile, recently installed three wind turbines to supply electric power to an isolated area of the local grid. This facility will replace the dependency on Diesel-Fired Generators. The wind farm is located near the city of Alto Baguess. Photos are available.

c. Learnings from an Aspiring CDM Project Participant: Four Years of Visible Results

Ed Kirk – CAAC; Benoit Bosquet – World Bank; David Shoch – Winrock

This panel will introduce the BioCarbon Fund (World Bank), its first project – CAAC's TIST (The International Small Group and Tree Planting Program), and TIST's Monitoring Plan as an example of CDM sink monitoring. Just the monitoring section was presented last year, response to which included, "this was the best talk of the conference," as well as requests to replicate TIST sustainable development work in Jordan and Mexico... This talk will tie in better with the surrounding speakers (potentially World Bank & Winrock) rather than standing on its own.

d. Measurement and Monitoring of Terrestrial Carbon Sequestration Projects

J. Kadyszewski – Winrock International

e. CO₂ Emissions from Semi-Arid Reservoirs and Natural Aquatic Ecosystems

Robert Jacques – Ecubed; Alain Tremblay – Hydro-Quebec; J. Therrien – Groupe Conseil Génivar

f. Greenhouse Gas Emissions From Hydroelectric Reservoirs: From Boreal To Tropical Regions

Alain Tremblay and Louis Varfalvy – Hydro-Quebec; Charlotte Roehm and Michelle Garneau – University of Quebec in Montreal

Carbon dioxide (CO₂) and methane (CH₄) are the world's main greenhouse gases and are emitted from both natural aquatic ecosystems (lakes, rivers, estuaries, wetlands) and manmade reservoirs. The role of greenhouse gas emissions from freshwater reservoirs and their contribution in increasing atmospheric GHG concentrations is actually well discussed worldwide. To our knowledge, although they are at the heart of the debate concerning pros and cons of different sources of energy production, there are fairly few emission measurements available for fresh water reservoirs. Increasing the number of measurements will significantly reduce uncertainties surrounding representative mean gross flux from natural systems as well as from reservoirs. This communication presents data of GHG flux measurements taken recently on reservoirs of various ages and sizes as well as on adjacent lakes and rivers from Northern tropical and semi-arid regions. GHG emissions were measured with a floating chamber connected to an automated NDIR instrument giving real-time values. Moreover, these measurement results are compared with data available from the scientific literature. Our results indicate that GHG emissions from reservoirs older than 10 years are generally similar to those from natural ecosystems.

g. The California Climate Action Registry and GHG Report Verification

Jay Wintergreen & Tod Delaney – First Environment

The California Climate Action Registry (CCAR) is a voluntary GHG registry that offers potential protection of GHG emission baselines and early reduction actions in the event of any future GHG regulations. The CCAR only accepts corporate GHG reports that have been third party certified by a state-approved certifier according to the Registries Certification Protocol. This presentation will provide an overview of the CCAR certification protocol and insights into the certification process.

h. Analysis of LFG Generation Rate from Landfill Site with Relation to CDM

Hyung-Taek Kim and Jun-Kyu Park – Department of Energy Studies; Duk-Seang Lee – Big Trust Technology

LFG gas from the Korean landfill site is mainly composed of methane and carbon dioxide by half and half. Determination of composition and capacity is very important, since they will be changed to lower values of calorie due to the governmental regulation of separate treatment of food waste and waste sludge in the future. Furthermore, gas release from the landfill gas can be pointed out in the effect of the global warming to the problem. If we separate the carbon dioxide from the LFG and use the methane as energy source, it can be recognized as renewable energy. In this study, LFG generation rate is predicted at several different landfill sites in Korea through the simulation program that is developed by Big trust Tech. Results of the simulation represents that generation capacity of LFG will decreased from total amount of 9,607,000 Nm³ with inflow of food wastes to 8,608,503 Nm³ with no inflow of food waste.

Track C - Renewable Energy & Other Issues

Monday, 1/24/2005

C1 Particulate Matter Monday; 1-3pm

Chairs: Judy Chow – Desert Research Institute

Peter G. Hyde – Arizona Department of Environmental Quality

a. XRF Speciation of Particulate Monitoring Filters – A Wise Investment for Electric Utilities Under the Regional Haze Rule

Darcy J. Anderson – Matrix Consulting Group, Inc.; Peter G. Hyde – Arizona Department of Environmental Quality; Dr. Prabhu Dayal – Ctrade

Many electric utilities operate ambient air monitors for particulate matter (PM₁₀ and / or PM_{2.5}). The PTFE (Teflon) filters used on most of these ambient particulate monitors can be analyzed by X-ray fluorescence (XRF) at a very low cost. The XRF analysis gives you information on which chemical elements are present in the particulates, such as heavy metals and combustion products. Teflon particulate filters are routinely analyzed by XRF as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. The XRF speciation data from the IMPROVE monitors are currently used to determine visibility impacts on Class I Wilderness Areas, and will also be used under the Regional Haze Rule to determine source attribution for visibility deterioration in Class I areas. By routinely having their particulate filters analyzed by XRF, electric utilities can manage their own data regarding seasonal and operational changes in particulate emissions from their facilities. These data would also be useful to state, federal and regional planning organizations to get a more complete picture of all sources of visibility impacts on a regional scale.

b. Particulate Emissions- When Test Methods Don't Reflect Actual Emissions

Robyn Andracsek – Burns & McDonnell

Particulate emissions from coal combustion can be quantified in several different ways: filterable, condensable, PM, and PM₁₀. Recently issued Prevention of Significant Deterioration (PSD) permits for both pulverized coal boilers (PC) and circulating fluidized bed boilers (CFB) create confusion as to what type of particulate is addressed by the Best Available Control Technology (BACT) limits. Added on top of this issue is the error introduced by required test methods that can misreport ammonium bisulfate and sulfur dioxide as particulate emissions (Methods 5, 201, 202, 039, etc.). This paper will summarize recent PSD particulate determinations, describe the inherent problems of particulate test methods, and provide a blueprint for permit negotiations with EPA and state agencies.

c. Contribution of Coal-Fired Power Plants to Ambient PM_{2.5} Concentrations in TN

Prakash Doraiswamy, Wayne T. Davis, Terry L. Miller and Joshua S. Fu - Dept. Civil and Environmental Engineering University of Tennessee, Knoxville

Fine particle concentrations in the south eastern US consist of more than 50% secondary particles, of which sulfates form a major fraction. These secondary fine particles are formed from photochemical and other reactions involving precursor gases such as sulfur dioxide, NO_x, ammonia and VOCs. Source apportionment of PM_{2.5} is important to identify the source categories that are responsible for the concentrations observed at a particular receptor. Although receptor models have been used to do source apportionment, they do not fully take into account the chemical reactions (including photochemical reactions) involved in the formation of secondary fine particles. This work utilized the Models3/CMAQ modeling system for the photochemical/secondary particulate matter modeling. Point source and on-road mobile source inventories for the State of TN were estimated and compiled by the research group at the University of Tennessee (UT). The national emissions inventory (NEI) for the year 1999 was used for the other states. Hourly emissions data from the continuous emissions monitoring systems (CEMS) were used for the electric generating utilities in the modeling domain. The modeling domain consisted of a nested 36-12-4 km domain. The 4 km domain covered the entire state of TN. The episode chosen for the modeling runs was August 29 to September 9, 1999. This paper attempts to quantify the

contribution of power plants to ambient fine particle concentrations in TN. This paper also shows the relative magnitude of the power plant contributions in comparison to other major source categories such as on-road mobile sources.

d. Continuous Particulate Monitoring - The Next Challenge for Point-Source Monitoring for the Electric Utility Industry

Karl R. Wilber – ESC; Frances Hardrick – We Energies

The electric utility industry in the United States is facing imminent and incremental regulation of point-sources for pollutants such as mercury and particulate mass. With pending regulations in this arena, there will, no doubt, be attendant requirements for continuous emissions monitoring (CEM) of those pollutants, much like is required by the Environmental Protection Agency today for criteria pollutants such as oxides of nitrogen (NO_x) and sulfur dioxide (SO₂). This paper focuses on promising methodologies and initial test results associated with continuous emissions monitoring of particulate mass - or "PM CEMS".

It has long been recognized that, unlike NO_x and SO₂, for instance, there is no direct measurement of particulate mass concentration being performed as part of regulatory-driven CEM Systems in the United States. Rather, opacity has been used as a surrogate measurement of how well particulate control equipment are performing. However, with recent Consent Decrees between EPA and a number of utilities, as well as Title V permitting requirements and Compliance Assurance Monitoring (CAM) rules, a number of utilities are being forced to examine strategies for PM CEMS.

The paper provides an overview of both in-situ and extractive techniques for PM CEMS. It includes applications outside of the United States where some of these methods have been used for nearly two decades, as part of both regulatory and performance-driven (e.g. efficiency tracking of air pollution control devices) situations. Example data from those sites, as well as performance and maintenance issues will be presented.

Finally, the paper will include data from the start up, shakedown and initial operation of a specific PM CEMS approach on two coal-fired power plants, including actual spatial variability in particulate mass concentration, based on traverses of two sources. Data, taken in accordance with EPA's recently-promulgated EPA Performance Specification 11 for particulate monitors, are also presented.

e. Opacity and Particulate Measurement and Regulatory Issues Affecting Utilities

Steve Norfleet – RMB Consulting

Concerns over utility particulate emissions have dramatically increased in recent years. Fine particulate (PM_{2.5}) worries are driving changes such as the proposed Interstate Air Quality (Transport) Rule. EPA has pursued efforts to promote continuous particulate mass analyzers and develop methods to quantify not only filterable but "non-filterable" particulate from sources. Enforcement actions and civil suites regarding opacity compliance appear to be on the rise along with tighter permit limits for new units while related actions like the proposed mercury rule will also make particulate control more critical.

This paper will discuss a number of opacity and particulate measurement and regulatory issues affecting utility boilers. The paper will review the preliminary results of an EPRI project to develop an extractive opacity monitor for wet stack applications and will present data from recent testing performed to satisfy the Compliance Assurance Monitoring Rule (40 CFR Part 64). The role of opacity as a surrogate for particulate, the performance of particulate mass monitors, and the impact of control equipment such as scrubbers and SCRs on particulate emissions will be summarized. Regulatory, permitting, and enforcement trends regarding opacity and particulate emissions will also be highlighted.

f. Particulate Monitoring: Technology and Regulations

Richard A. Hovan - Forney Corporation

Particulate monitoring has been a means of quantitative measure in Europe for many years but has had a slow progression to acceptance here in the US. With the onset of continuous decreasing limits of SO₂ and the concern of SO₃ from SCR installations, traditional means of monitoring, using opacity is becoming less effective. Wet scrubbers have proven to be a highly efficient means of reducing SO₂, SO₃ and fines; however a wet gas effluent is a result. This result is in the form of

wet particulate and water droplets.

Traditional opacity monitor technology has advanced over the last few years such that now some manufactures can measure extremely low levels of dry gas particulate. For wet gas particulate measurement, Beta-ray technology has been used for years by European nations, with the correct designed sampling system has emerged as preferred method. The EPA has developed several tests over the past years to qualify a Performance Specification for Particulate Matter CEMS (pmCEMS), PM-11.

The intent of this paper is to review the present technologies that are available today and provide an understanding as to the correct use of pmCEMS for the correct application. In addition, an understanding of the specific regulations that apply shall be reviewed.

C2 Particulates - Science & Modeling Monday; 3:30-6pm

Chairs: Judy Chow – Desert Research Institute

John Jansen – Southern Company

a. A SEARCH Update: Trends, Sources of Carbon, and More

John Jansen – Southern Company

This paper will present the most recent results from the long-term, comprehensive air quality measurements from the Southeastern Aerosol Research and Characterization (SEARCH) study.

b. Recent Developments in Meteorological Data for Use in CALPUFF

Thomas R. Hormel and Edward Addison - McVehil-Monnett Associates, Inc.

The required use of at least three years of meteorological data for CALPUFF modeling of Class I area impacts for new source review (NSR) applications has increased the importance of selecting data most accurately representing meteorology within the model domain. Modeled near-source impacts of NSR sources consisting primarily of elevated and buoyant emission releases typically present fewer compliance problems than do long range transport modeled impacts at Class I areas. In addition, project constraints resulting from modeled AQRV impacts at the Class I areas, particularly regional haze, are typically more stringent than those dictated by modeled ambient air impacts.

An overview of meteorological database options that can be used for CALPUFF modeling of estimated ambient air and AQRV impacts is provided. These options for prognostic meteorological data used to initialize wind field estimates include MM5, ETA and RUC. User access to these data and the ability to process these data on-site are becoming more widespread through Internet websites maintained by such organizations as NCAR. A significant recent development is speculation that there will be a shift from the traditional use of Mesoscale Model output (e.g., MM4 or MM5) to WRF output as the preferred prognostic model output.

c. Lessons Learned from PEMS Development

Stephen H. Slocumb, PE and Sean R. Gregory – Epsilon Associates, Inc.

This paper will highlight lessons learned from the development of two Parametric Emissions Monitoring Systems: one for two 29 MBtu/hr internal combustion engines and one for a 196 MMBtu/hr boiler.

d. Characterization of Ash Aerosols from Ancient Roman Bath Hypocaust

Yaacov Mamane – Faculty of Civil and Environmental Engineering, Haifa, Israel; Robert Willis – ManTech

In 1993 the remains of the only public bathhouse in Nazareth, dated to the Roman times, were uncovered. It is an elaborate structure, with vaulted ceilings, and marble dressed walls, including both the caldarium and frigidarium. The caldarium were heated rooms, and a sophisticated system of hypocausts supported their floors. The hypocausts were made of one meter piers stacked clay bricks, and were covered with mortar. The hypocausts were sufficiently warmed to heat up the rooms above. The smoke escaped through numerous flues in the wall, providing effective heating system. The Bath used fresh water from the Well of Mary.

Bulk samples were collected from untouched different sites of the underground heating system (hypocaust), from the furnace ash, and from the inner part of the heating pipes in the above caldarium. Samples were prepared for x-ray fluorescence analysis and deposited on Teflon filters. XRF showed that samples were enriched in gold as well as tin and silver. The samples were also

prepared for computer controlled scanning electron microscopy (CCSEM) and puffed onto Nuclepore filters.

Samples had the following colors: (1) Furnace 1A, almost black, like charcoal; (2) Furnace 2A: gray-brown; (3) Caldarium Pipe 1B, light-medium brown; (4) Caldarium Pipe 2B, tan-khaki color; (5) hypocaust 1C, rich, deep brown; (6) hypocaust 2C, medium gray. The CCSEM analyses were limited to particles larger than 5 μm , hopefully limiting carbon contribution from the filter to a minor amount. 50 particles were analyzed and sorted into ten "4-element" classes. Samples contained large number of calcium carbonate, and were enriched with carbon containing particles. Gold and silver particles were also found. Some were isolated particles, some appear to be inclusions in larger particles, and the morphology is not always spherical. Other heavy metals were also found.

e. Characterization of Coarse and Fine Particles Downwind of a Coal Power Plant Along the East Mediterranean Coast.

Yaacov Mamane, Osnat Yossef, and Ety Melamed - Faculty of Civil and Environmental Engineering, Haifa, Israel

This study deals with the characterization of fine (<2.5 micrometer) and coarse (2.5 to 10 micrometer) particles in order to identify the main particle sources at the Israeli coastal region, downwind of a large power plant. The study consisted of the following phases:

- (1) Statistical and meteorological analyses of existing PM10 monitoring data collected by the Hadera Environmental District;
- (2) Twenty four hour sampling of fine and coarse particles and elemental analysis of each fraction using X-ray fluorescence (XRF) during several seasons;
- (3) Scanning electron microscopy (SEM) of selected samples; and
- (4) Modeling of PM10 using several statistical tools.

Results from studies performed over several seasons and at different coastal sites point at these findings:

- (1) Continuous monitoring data showed that PM-10 levels were largest in autumn and spring due to intrusion of dust storms in the region. Dust storms affect also the fine particle fraction.
- (2) XRF and SEM analyses of selected summer and autumn samples showed that S and elemental carbon dominated the fine fraction and Ca dominated the coarse fraction. Elements associated with alumino-silicate minerals were found in smaller quantities. Based on summer air mass back-trajectories, showing that air is flowing from the northwest sector, it is concluded that a large fraction of the sulfates are transported from eastern Europe.
- (3) Sea salt (Na, Cl, and associated elements) particles were found at both fractions. Some of the highest ever measured sea salt concentrations were found immediately following a dust storm.
- (4) V and Ni were highly correlated, indicating the heavy use of crude oil in the area. Some V, Ni metals may also be transported from Europe. Elements associated with coal combustion were also identified.

f. Determination of Shiraz Air Pollution Monitoring Network Using Geostatistical Techniques and Kriging Method

Kamal Hadad – S.U.

An accurate pollution map for Shiraz was prepared based on one-week passive sampling campaign. During the first week of summer 2003, 177 sampling station were set-up through out Shiraz. Pollutant gases including SO₂, NO₂ and BTX were sampled by diffusive sampling tubes for one week. Collected samples were analyzed and pollutant concentrations were determined by using spectrophotometry, gas chromatography or ion chromatography techniques. The results of samples' analysis were mapped using geostatistical approach based on Kriging methodology. The pollution map was used to estimate the type and location of air pollution monitoring network in Shiraz. Based on the results, one traffic, two urban, one industrial and one periurban monitoring stations are suggested for Shiraz.

Tuesday, 1/25/2005

C3 New Source Review (NSR) Tuesday; 7:30-9:30am

Chairs: Craig Harrison – Hunton & Williams

Eric Hiser – Jorden Bischoff McGuire Rose & Hiser, PLC

a. Will 2005 Resolve the Debate About EPA's Utility Enforcement Initiative and the NSR Rules?

Craig S. Harrison, Hunton & Williams, Washington D.C.

Six years after EPA began its enforcement initiative against coal-fired utilities for alleged violations of EPA's new source review rules, no non-settling company has been ordered to install pollution control equipment. States and environmental groups are increasingly filing suits, usually seeking publicity for political or fund-raising purposes. EPA's approach to NSR is schizophrenic and has been exacerbated by turnover among political appointees. EPA's Enforcement Division insists using litigation to impose command-and-control emission reductions on the utility industry while the Air Office prefers market-based regulatory approaches such as the CAIR rule. In addition, Congress may enact the Clear Skies legislation which could dramatically alter the debate. During 2004, Duke Energy was absolved from liability at the trial court level. The U.S. Supreme Court refused to disturb the 11th Circuit Court of Appeals declaration that EPA's administrative compliance order to TVA was "legally inconsequential" and that the Environmental Appeals Board process "entirely ignored the concept of the rule of law." Santee Cooper settled with EPA and WEPCo's attempted settlement was stymied by environmental groups. During 2005, the following will likely occur: the 4th Circuit Court of Appeals will rule on Government challenges to the Duke decision; the D.C. Circuit will rule on challenges to EPA's interpretation of what constitutes an emissions increase under the 1980 and 2002 NSR rules; the district court in the Alabama Power case will determine the governing legal standard for "emission increase" and "routine"; the liability decision in Illinois Power case will be announced; and three liability trials will take place (AEP, a TVA citizen suit, and East Kentucky Power Coop). EPA is also expected to announce its decision on reconsidering the equipment replacement rule that deems a project to be routine if the replaced equipment is functionally equivalent to the old equipment, the basic design parameters are not changed, and the cost of the replacement project does not exceed 20% of the replacement value of the process unit. EPA may propose new rules on the following: routine maintenance, repair and replacement; project aggregation; and debottlenecking. This presentation will review the status of the NSR litigation and the revised rules, and comment on the practical implications of these developments.

b. New Source Review Planning - What's the Right Approach to Implementing Plant Upgrades? A Case Study

Andrew Byers and Brian O'Neal – Black & Veatch

In the midst of continuing NSR uncertainty, electric generators are keenly aware of the ever increasing scrutiny and potential consequences associated with plant upgrade projects. Currently, regulatory reforms are either in transition or under legal challenge, while conflicting court decisions from federal enforcement actions have further obscured the major modification criteria. This presentation will provide an overview of the evolution and current status of NSR applicability to changes at existing generation facilities, and outline sensible strategic approaches to avoid triggering major modification considerations in differing jurisdictions through a recent case study.

c. The Hidden Side of NSR Reform: Changes in the Interpretation of Reactivation, Method of Operation, and Hours of Operation

Eric L. Hiser – Jorden Bischoff McGuire Rose & Hiser, PLC

While the EPA and U.S. Department of Justice national enforcement initiative has drawn considerable industry attention, EPA has been implementing significant changes to the NSR permitting exemption for increases in hours of operation or production rate not prohibited by a permit. The leading case in this interpretive effort is In the matter of Monroe Electric Generating Plant, Entergy Louisiana, Inc., Proposed Operating Permit. The Entergy case involved the reactivation of three units from "extended reserve shutdown" after eleven years without taking the

units through PSD review. EPA objected to the Title V operating permit for reactivating the facility using three lines of analysis: (1) reactivation may create a "new major source" under EPA's Reactivation Policy; (2) reactivation may be a modification due to a physical change resulting in a significant net emissions increase; and (3) reactivation may be a change in the method of operation resulting in a significant net increase in emissions. EPA's objection explored the limits of these three doctrines and advanced an interpretive approach that significantly limits the scope of allowable reactivations and potentially limits the scope of the "increase in hours of operation or production rate" exemption from PSD review. In the first line of analysis, EPA reevaluated the level of intent necessary to avoid application of the Reactivation Policy. In the third line of analysis, EPA determined that prolonged shutdowns were not entitled to coverage under the increase in hours of operation exemption and examined the "baseline" emissions. This paper examines Entergy's efforts to maintain the facilities in operable condition, EPA's rationale for its decision imposing PSD review, and the implications of the interpretive approaches set forth in the Entergy decision for the industry.

d. Lessons Learned Under New Source Review Reform: A Year in the Life of a Delegated State.

Edward A. Hoefs, P.E. and Jon P. Sandstedt, P.E. – Wenck Associates, Inc.

Minnesota is one of the few states nationwide wherein the much-debated New Source Review (NSR) Reforms announced in the December 31, 2002 Federal Register took immediate effect on March 3, 2003. With that distinction has come a certain amount of increased flexibility for Minnesota's electric utilities and industrial sources, some uncertainty in rule interpretation and frequent opportunity for regulatory dialogue and learning for all.

This presentation reviews the issues encountered and lessons learned in securing construction approvals under NSR Reform. Examples of how NSR Reforms have changed PSD applicability assessments, enabled Clean Unit Determinations, and affected dispersion modeling requirements and other permitting strategies are discussed.

The authors believe that making the actual-to-future-projected actual emissions PSD applicability test available to emission source categories besides electric utility steam generating units has reduced the number and complexity of permit applications for "synthetic" minor modifications. As for the Clean Unit provisions, some utilities have encountered difficulty in obtaining Clean Unit designations for units subject to recent BACT requirements in cases where the control strategies relied on other than end-of-pipe controls. Demonstrating Clean Unit eligibility for PM₁₀ using the "comparable-to-BACT" criteria has been complicated by a lack of consistency in the test methods specified by permitting agencies for measuring compliance with PM₁₀ limits. The presenters will also describe Minnesota's own rigorous "off-ramp" scheme for determining on a case-by-case basis whether dispersion modeling is required in order to support a given Clean Unit application.

e. Outstanding Legal Issues for NSR Reform

Clara Poffenberger - Baker Botts

EPA's NSR Reform Rules have been challenged in federal court by various parties including state agencies. A few states have already adopted the NSR Reform rules, several states must implement the NSR Reform rules because they are delegated the federal program, but many other states have either objected to the NSR Reform rules or are awaiting the outcome of the legal challenges to the rules before they will implement the rules in their states. This presentation will provide an outline of the issues in dispute in the challenges filed in court and will provide an update on the status of those challenges. In addition, this presentation will identify the provisions of NSR Reform that theoretically can be implemented by a state without adopting new rules and those provisions that must wait for states to adopt. The presentation will include a discussion of the risks related to the ambiguous status of the NSR Reform rules, including the routine repair rule.

f. New Source Review Inoculation: An Environmental Risk-managed Approach to Planning and Implementing Maintenance Projects at Electric Utilities

Patrick D. Traylor – Hogan & Hartson, LLP

EPA's New Source Review program poses significant regulatory risk to utility maintenance projects, with over 200 utility plants having been targeted for NSR enforcement since 1999. This risk arises

from uncertainty regarding the application of two major NSR issues: the routine maintenance, repair and replacement exemption, and the method by which emissions increases are analyzed. Until NSR regulatory reforms (or litigation outcomes) provide clarity with respect to the RMRR exemption, utility maintenance project planners must rely on objectively quantifying the emissions impacts of proposed projects. "NSR Inoculation" is a program for integrating maintenance project planning into a legal/technical approach that carefully analyzes emissions impacts of proposed projects using a highly conservative prospective emissions calculation method. The goal is to provide corporate planners with the confidence that project justifications do not rest on assumptions related to the RMRR exemption, but are instead based on objectively quantified emission impacts from the project.

C4 Emission Monitoring Tuesday; 10am-12pm

Chairs: Steve Drevik – ESC

Sean Black – ALSTOM Power

a. Asset Optimization: Rolling-Average Emission Control and Plant Area Limit/Fleet-wide Air Pollution Control Optimization

Scott Boyden, Sean Black and Frank Licavoli – ALSTOM Power

Power plant operators can enhance air pollution control equipment (APC) performance and operating revenue by utilizing asset optimization techniques for rolling-average emission control at the unit, site, plant area limit (PAL) and fleet-wide level. The new regulatory limits based on rolling-average emissions present an additional complex constraint on plant operation. Over-compliance is expensive, but there is significant risk and cost associated with emission limit violations. Management of the rolling-average emissions requires integration of past emissions over the rolling-average period with predictions of future emissions. Additional issues that confound the rolling-average emission problem are: changing electrical demand, equipment outages and equipment operational variability. Advanced process control techniques employing a multivariable process control (MPC) engine address the rolling-average emission problem. The MPC controller can explicitly control to a rolling-average emission target. In addition, the MPC controller will dramatically reduce equipment operational variability and improve emission control during operating transients associated with load changes. The MPC-based scheme can be extended from a single APC asset to site, PAL, or fleet-wide objectives; this solution will minimize compliance costs across the units included in the asset optimization scheme. Specific examples will contrast the performance of the conventional control scheme and MPC-based rolling-average control schemes for rolling-average emission control for a simulated WFGD process.

b. The SO3 Challenge

Scott Evans – Clean Air Engineering

In December, a third lawsuit was filed against an electric utility over unintended SO3 emissions from an SCR unit. The rash of litigation is raising a number of issues as EPA is poised to require broad use of SCRs under both the Clean Air Interstate Rule (CAIR) and the Clear Skies legislation. This presentation reviews the issue, the latest developments, and summarizes current technical knowledge on SO3 emissions and measurement.

c. Issues Related To Gas Turbine Startup Emissions

Sara J. Head and Robert Fraser – ENSR

Combustion turbine power plants that have recently started operation have found that assumptions used during permitting on startup and shutdown emission rates and durations were flawed. Many facilities are now working to revise permits related to these limits. This paper will discuss some of these efforts, approaches taken, issues identified, and experience with various permitting projects. Examples of startup emission rates and durations used are provided.

d. Long-Term Field Evaluation of Mercury Continuous Emission Monitors at a Coal-Fired Steam Plant

Kris Kinder, Jim Dunn, and Debbie Lander – Shaw Environmental and Infrastructure; Jim Pruett - Environmental Systems Corporation

A long-term field study of mercury continuous emission monitors (CEMs) was conducted at a coal-fired steam plant by Shaw Environmental and Infrastructure. The primary objective of the project

was to perform an inter-comparison of the operability, availability, maintainability and measurement performance of commercial mercury CEMs. Three commercially available mercury CEMs were evaluated in a two-phase field test in the spring and fall of 2004. Shaw personnel conducted day-to-day maintenance and operations checks, challenges by external mercury standards, and reference method comparison testing using the Ontario Hydro Method. Auxiliary CEMs for SO₂, NO_x, and O₂ measurements and data logging were supplied and maintained by Environmental Systems Corporation. Harsh environmental conditions in the flue gas matrix proved to be a stiff challenge for the mercury CEM sampling and conditioning equipment. Concentrations of SO₂ ranged between 300-600 ppm while NO_x emissions were in the range of 150-250 ppm. The flue gas also contained condensable aerosols, requiring proper handling and conditioning to avoid deposits in the sampling system. Flue gas mercury levels were in the range of 3-10 µg/dscm. This presentation discusses operational and maintenance problems that occurred with the mercury CEMs over the course of the test period and attempts at addressing those problems. Results of challenges with mercury gas standards and comparison of mercury CEM measurements with manual reference methods for determination of relative accuracy are presented.

e. Data Management Techniques for Electric Utilities

Steve Drevik – ESC; TBD – Eastman Chemical

Regulated sources must now manage a complex array of emission credits, plant performance data, and environmental limits for individual units and organizational totals. The most competitive companies are using modern data communication and data management techniques to provide decision-makers and operational leaders with real-time information to optimize production needs such as fuel purchasing and dispatch against the regulatory environment. This paper explores several existing and proposed projects to analyzer various different architectures and approaches.

f. Ammonia Monitoring on SCR's and SNCR's In Coal Fired Applications

Keith Crabbe – CEMTEK Environmental; Heather Gamble – Unisearch

This paper will discuss cross duct ammonia measurements using the tunable diode laser technology and the Fast scan approach. Discussion of technology and application with data validation on the Unisearch TDL will be presented.

C5 Emission Monitoring Tuesday; 1-3pm

Chairs: J. Ron Jernigan – Thermo Electron Corporation

Richard D. McRanie – RMB Consulting & Research

a. CEMS Networks and Asset Management Result in Cost Reduction

Bill Worthington – ABB, Inc.

Facility wide centralized networking of CEMS and other analytical assets is discussed and examples given of how this approach has resulted in both saving capital and improved operation of the equipment involved. Through centralized access to all relevant analytical data, such as analyze status, sample system status, error messages, servicing and maintenance of the system can be performed in an efficient manner that is more effective. Areas of great improvement are planned maintenance and trouble shooting and testing. This means that on-site service calls are significantly reduced. This comprehensive remote control system approach ensures safer and more reliable operation and enables advanced remote diagnosis techniques to quickly identify and solve potential problems fast. An installation in a powerplant with 41 measurements is discussed and experiences shared with emphasis on the actual areas of improvement. The most improved areas were calibration gas management, manpower costs related to calibration and functional tests of analytical equipment, and spare parts and handling of a great many different analyzers from several different vendors. The network costs themselves are not so great since this system utilizes Ethernet and the hardware normally associated with office networking of computer systems. In other words, commonly available commodity type components. The result of improved performance and reduced cost are always goals of companies, this demonstrates how this can be realized with analyzer and continuous monitoring installations.

b. Optical Monitoring, Providing Capabilities; Difficult or Impossible with Conventional CEM's?

Dr. Robert L. Spellicy and Dr. Ralph J. Brewer – Industrial Monitor & Control Corp.

Optical remote sensing for stack and process monitoring has achieved more widespread industrial acceptance as well as regulatory acceptance over the last several years. These technologies provide capabilities unavailable with many "standard" CEM sensors.

This presentation provides a brief outline of the operation of FTIR infrared sensors and presents measurements of NO_x, SO_x, SO₃, H₂SO₄, and HCL in power plant SCR outputs. A new program for SO₃ detection in power plant stacks, scheduled for initiation this year with EPRI, will also be discussed and expected advantages of the new EPRI approaches will be shown.

c. (SmartPEMST) Field Demonstration of a Cost-Effective Advanced Monitoring Solution - Deployment of a Predictive Emissions Monitoring System as a Complete Compliance Solution for a Large Cogeneration Facility in Southeastern Michigan.

Brian G. Swanson – CMC Solutions, L.L.C.

Previous papers have detailed the certification and demonstration of SmartPEMST for natural gas-fired turbine and boiler compliance under 40 CFR Part 60 and 40 CFR Part 75. A complete predictive emissions monitoring solutions was deployed and configured for NO_x compliance under 40 CFR Part 75, Subpart E and for SO₂ and CO compliance under 40 CFR Part 60. The certified SmartPEMST has allowed the plant to replace three complete CEMS on the boiler exhaust SmartPEMST resulting in a greater than 50% reduction in the ongoing operational costs of their compliance monitoring program. The focus of this paper is on the results of certification and the costs associated with the installation and ongoing operation of a SmartPEMST in lieu of a CEMS. In addition, the costs of ongoing SmartPEMST quality assurance is detailed and assessed.

d. Simultaneous Measurement of NO and NO₂ on a Single NDUV Based Analyzer

Bruce Herman – ABB

The development of a highly sensitive ultra violet photometer (UV) analyzer for the simultaneous measurement of nitric oxide (NO) and nitrogen dioxide (NO₂) in a heated package allows low response time measurement with high accuracy. This approach enables the installation of a rugged and durable analyzer with minimal requirement for complicated sample conditioning packages. The measurement is made hot and wet; stability of both NO and NO₂ are optimized for reliable precision.

e. Overview of EPA's Changes to Part 75 CEMS "Guidance on Recertification and Diagnostic Test Events"

J. Ron Jernigan, P.E., DEE – Thermo Electron Corporation

The EPA Clean Air Markets Division published on October 30, 2003, "Part 75 Emission Monitoring Policy Manual", a revised edition to the previously titled "Acid Rain Program Policy Manual". This Policy Manual includes new guidance on recertification and diagnostic testing. This guidance is located in Chapter 13, Question 13.21. The guidance on recertification and diagnostic test events provides test policy for the following CEMS types and components;

1. Dry-Extractive CEMS,
2. Dilution-Extractive CEMS,
3. In-Situ CEMS,
4. Flow Monitors,
5. Flue Gas Moisture Sensors,
6. Fuel Flow Meters, and
7. DAHS.

The revised guidance on recertification and diagnostic test events includes more examples of specific spare parts, which replacement or repair will require a diagnostic test event. Also, listed are more components that require a diagnostic test event if routine maintenance is performed. An important new addition to the revised guidance document is an addendum titled, "Alternative Diagnostic Tests". The alternative diagnostic tests include an Abbreviated Linearity Check and Alternative System Response Test.

Additionally, the guidance documents states; "EPA recognizes that this guidance cannot possibly address every situation that may arise and is not binding for situations that it does address. You

may want to contact EPA concerning your specific situation, particularly in cases where:

- (1) An event occurs that is not listed in the Tables, and you do not know which (if any) tests are required: or
- (2) An event occurs which is listed in the Tables, but for which you believe, based on sound engineering judgment or other technical considerations, that the tests listed in the Tables may be inappropriate or unnecessary.

This paper will present an overview of the revised "Guidance on Recertification and Diagnostic Test Events". Also the paper will identify those test events listed in the Tables that Thermo Electron Corporation believe based on sound engineering judgment and technical knowledge of our specific analyzers are not appropriate or necessary.

f. Hg Continuous Emissions Monitoring Significant Technical Issues Associated With The Technology

Richard D. McRanie – RMB Consulting & Research, Inc.

There are a number of Hg continuous emission measurement issues raised by the Environmental Protection Agency's (EPA) proposed Hg electric utility rules, and it does not matter what form the final rule takes - the issues are the same. From a Hg emissions measurements perspective it does not matter if the final rule emerges as a conventional MACT rule or as a cap and trade rule. The technical support documentation in the rule proposal dockets and information available from industry research clearly shows that mercury measurement technology is not commercially available at the level of reliability, accuracy and cost needed for either a continuous compliance or trading program. It is a simple fact that no continuous Hg monitor or carbon trap method has ever met all of the requirements of the proposed rules: Performance Specification 12A or Method 324.

EPA has initiated an extensive dual site evaluation project to define and refine the continuous Hg monitoring technology. Three different EPA groups are involved: (1) Office of Air Quality Planning and Standards (OAQPS), (2) Clean Air Markets Division (CAMD), and (3) Office of Research and Development (ORD). This paper contains a summary of the major technical issues associated with Hg continuous emissions monitoring technology, discusses why the issues are important and also provides suggestions for addressing those major issues during the EPA evaluation project. It is critical that these EPA projects not only resolve the major technical issues associated with Hg CEMS but also demonstrate the reliable continuous operation of Hg CEMS.

The major technology issues associated with Hg monitoring include:

- The precision, accuracy and time lag associated with the Ontario Hydro wet chemical reference test method
- Availability and demonstration of an instrumental reference method for Hg
- Availability and demonstration of continuous Hg monitor calibration techniques for elemental Hg
- Availability and demonstration of continuous Hg monitor calibration techniques for oxidized Hg
- Demonstration of oxidized Hg converter performance
- Demonstration of calibration drift and linearity of the continuous Hg monitor
- Quantification of lower measurement limit for continuous Hg monitors
- Reliability and operability of Hg monitoring systems
- Performance of Hg carbon traps (Method 324) relative to other measurement methods

All of these issues are very important if there are to be reliable continuous Hg measurements. If we take the issue of the Ontario Hydro Reference Method as an example, it is immediately clear that this is not an appropriate reference method for a CEMS program. The Ontario Hydro method requires meticulous operation, is subject to considerable error and has a long laboratory turnaround (weeks). It is probable, that from the time a Relative Accuracy Test Audit (RATA) is started until the results are known, 6-8 weeks could pass. Having such a long time lag, where it is not known whether the Hg CEMS has passed the RATA, is untenable.

Another example is the determination of calibration, drift tests and linearity techniques. It should be noted that many of the Hg monitors on the market do not even have zero and span controls. While this would not be acceptable in any other CEMS program, we assume that technical approaches can be developed to circumvent this problem.

A complete discussion of these major technical issues will be included in this paper. In addition, technical approaches that might be used to develop solutions to these issues will be offered.

C6 Permitting Tuesday; 3:30-6pm

Chairs: Lauren Freeman – Hunton & Williams
David Gaige – Burns & McDonnell

a. Defining Compliance In and Out of Your Title V Permit: What Your CEM and Parametric Monitoring is Really Telling You as a Matter of Law.

Mike Born and Lou Tosi – Shumaker, Loop & Kendrick

Title V permits have become increasing complex in their monitoring requirements, especially for pollutants which are not subject to the watchful eye of a continuous monitor. The presentation provides an overview of the usefulness, accuracy, and danger of typical parametric monitoring approaches, along with the concerns associated with CEM data when used to determine or certify compliance with Title V permits. The presentation also analyzes the possible questions that can arise on your compliance status for reported data, along with possible defenses to any potential enforcement.

b. Permitting Of New Coal-Fired Generation

Debra Cline – Troutman Sanders LLP

Coal is on the way back! And new source review "requirements" are more confusing than ever. The BACT analysis is fast becoming an in-depth exercise in designing coal-fired generation. Projects to burn local, higher-sulfur Eastern coal are told to consider lower-sulfur Western coal. A company wishing to add a new pulverized-coal boiler must instead consider its future generation coming from either integrated gasification combined cycle or fluidized-bed equipment. By what authority can this expanded scope of BACT be required? Many have been led to believe, incorrectly, that the Supreme Court's *Alaska v. EPA* decision virtually strips the States of authority to establish BACT. In fact, Congress granted the States authority to set case-by-case BACT by weighing certain statutory factors according to local preferences -- all the while limited by the PSD increments established by EPA. The Supreme Court's decision teaches, however, that States need to follow certain administrative procedures when determining BACT in order to immunize those decisions from EPA interference. What are those procedures? How much of those federal powers did Congress entrust to federal land managers? While the statute and regulations plainly identify the limited role of those non-EPA federal entities, they nevertheless have constructed their own set of "requirements" for protecting Class I areas. Will those entities attempt to grab even more NSR "authority" from the new regional haze regulations? The delicate statutory balance of federal and State powers in the NSR program continues to exist; it just needs to be restored in practice with the help of those seeking to permit new coal-fired units. Almost two decades of gas-fired combined-cycle permitting have witnessed a substantial erosion of State inputs to NSR decisions. If coal is to get all the way back, it's time for the pendulum to swing the other way.

c. Developments under the Title V Permitting Program

Lauren Freeman – Hunton & Williams

Now 14 years after promulgation of EPA's Part 70 rules governing Title V Operating Permit Programs, only a minority of states have issued permits to all of their major sources. Environmental groups who are dissatisfied with the program have filed law suits challenging EPA and states' implementation and have threatened to move forward with challenges to the Part 70 rule that have been in abeyance for years. This year, EPA formed a task force of industry, state/local, and environmental group stakeholders to investigate the performance of the Title V program and collect information on what is and isn't working. This presentation will provide an update on the status of various lawsuits and the work of the Title V Performance Task Force.

d. What is BACT for a Coal Plant? Process Versus Add-on Controls

Carl Weilert – Burns & McDonnell Engineering; Gary Van Helvoirt – Wisconsin Public Service

A discussion of recent developments in PSD permitting, involving some states requesting an evaluation of alternative generation technologies in BACT determinations. Why alternative generation technologies are evaluated as options for a company to consider for responding to load demand, and the role less polluting alternatives have in the BACT process. Economics, technical aspects, and environmental aspects will be discussed.

e. Fast Track PSD Permitting of the BPU Nearman Creek CTG - A Lesson in Successfully Herding Cats

Brian Petermann – Sega Inc.; Curt Deitz – Board of Public Utilities

Board of Public Utilities of Kansas City, Kansas, received a final PSD Construction Permit on October 12, 2004, for a proposed GE 7EA simple cycle CTG (80 MW). The final permit was received only 19 weeks after submittal of the permit application. There were unique circumstances which impacted this schedule both positively and negatively. This presentation provides a project summary, describes the unique circumstances and how they impacted the schedule, lists the lessons learned, and recommends key features of a permitting approach to minimize schedule while not giving up major concessions for the air permit.

The CTG will be located at an existing coal fired power facility, making this a major PSD action. The required permitting schedule was unique because a final construction permit was needed prior to issuing bonds for the purchase of the unit. This was much sooner than the typical schedule for a permit issuance just prior to start of construction. Another unique element was the number of parties involved and resulting coordination required. These included the owner, the owner's engineer and permitting advisor, the air permit application consultant, the turbine supplier, the local air permitting authority, the state air permitting authority, and USEPA Region VII. Coordination, communication, and constant attention were the key features of the permitting process in order to achieve a fast track schedule while integrating with project design and developing a permit with acceptable conditions. Important lessons were learned which can be applied to future, similar projects.

f. The Coal Asset Environmental Survey - Not your Father's Due Diligence

Robert G. Fraser – ENSR International

How is this coal-fired power plant positioned for an onslaught of new environmental drivers? As the power generation industry continues to adjust, an unprecedented number of coal-fired powerplants (assets) and ownership positions will change hands over the next several years. Both prospective buyers and sellers seek to fully understand all economic risks to the financial proforma of the asset.

Caution - the term Environmental Due Diligence means different things to different people. Traditional due diligence services have focused on historical and existing conditions. In practice, few material "surprises" emerge from these reviews - the issues typically have been studied for years and are well documented. Similarly, an EHS compliance audit only documents existing management practices, unlikely to identify material issues that can not be easily corrected. The single largest risk to a coal-fired powerplant is the potential impact of new and emerging future regulatory initiatives. These issues drive the entire valuation of the asset.

The "Coal Asset Environmental Survey" is a forward looking environmental due diligence assessment, that seeks to characterize potential capital and operating cost impacts of new and emerging environmental initiatives including multi-pollutant legislation, mercury control, NSR reform, 316 (a) and (b), PM 2.5, BART and greenhouse gas regulations.

At a minimum, a given coal asset may be faced with conversion to PRB, addition of active mercury control and annual purchase of emission credits. In the extreme, some facilities may require an entire new APC train or even replacement of older, smaller boilers with a new state-of-the-art supercritical PC Unit or CFBs.

This paper will present how these future unknowns may be characterized, yielding proforma and bid development support that goes well beyond your "father's due diligence".

g. Siting Critical Electric Infrastructure: What Will it Take to Site Power Projects?

Dr. Susan Tierney – The Analysis Group

Virtually every region has some sort of looming energy infrastructure need that is being thwarted in the context of local or state siting processes. In some regions, it is as hard to site a wind farm as it is to permit a gas-fired power plant, or a conventional coal plant, or an LNG facility to provide fuel for local power generation. New power lines are as difficult to site today as they ever have been. The prospect of siting advanced coal or advanced nuclear projects - should they be economic in the future - poses almost staggering siting challenges. And yet, many regions need new infrastructure in order to affordably and reliably meet the growing energy needs of consumers in a manner that also protects the environment and enhances our national security. And

nationally - moreover, globally - we must address the challenge of reducing the electric sector's greenhouse gas emissions profile.

Siting difficulties stem from tension between an increasing unwillingness to accept the construction of energy infrastructure in local communities, and the need to add critical energy infrastructure. While large infrastructure projects can impose significant changes on neighborhoods, and these local impacts must be comprehensively reviewed and addressed, the importance of energy infrastructure must also be accurately assessed.

Dr. Susan Tierney, Managing Principal of Analysis Group Inc., will examine energy facility siting, and the policy reforms, project development attributes and siting processes that increase the odds of success. Using examples from wind projects, power plants, and fuel supply facilities, and drawing from her two decades of experience in state and federal environmental and energy regulation, in consulting to energy projects, and in serving as an expert on these topics, Dr. Tierney will identify best practices that assure the siting of critical energy infrastructure consistent with addressing regional and global environmental challenges.

Wednesday, 1/26/2005

C7 Renewable Energy Wednesday; 7:30-9:30am

Chairs: Charlie Bayless – Primary Energy

Coke Coakley – FPL

a. Recycled Energy Projects can Reduce Emissions

Charlie Bayless; Mark Hall – Primary Energy

Modern industrial facilities like steel mills and coke production facilities consume a tremendous amount of energy to turn raw materials into finished products. While much attention has been paid to efficiency improvements like motors and lighting, an array of energy resources that could otherwise be captured and used to displace purchased fuel and electricity have been left untapped. These recycled energy opportunities exist in many forms including high temperature waste heat (exhaust), pressure drop or expansion, and low-to-medium btu opportunity fuels. Recycling these energy resources has the potential to significantly reduce criteria pollutants and carbon dioxide emissions while reducing costs and improving energy security and reliability. This presentation will include an overview of what these opportunities include, where they are located and how much pollution can be reduced by implementing these projects.

b. Developing an Integrative Clean Energy Resource Plan

Richard T. Stuebi - NextWave Energy, Inc.

Back in the late 1980's and early 1990's, under the old regulatory compact before electricity deregulation came to dominate electric utility strategic agendas, the concept of least-cost integrated resource planning (LCIRP) was becoming an industry standard. In LCIRP, utilities evaluated the entire slate of all supply-side and demand-side resource options to meet future system conditions, and then selected the least-cost mix of options that could most robustly cope with a variety of risk factors, for presentation and approval by regulators. When deregulation came to the fore, a variety of forces largely shunted LCIRP to the sideline. As utilities focused most of their attention on shaping and preparing for the brave new world that they would enter post-deregulation, for the most part, since the early 1990's, utilities neither built new generation nor implemented new demand-side management (DSM) programs. Since the Enron and California debacles, the future path of electricity deregulation has slowed and become even less certain. However, the electric industry marches on. Notably, the emergence of green pricing programs and renewable portfolio standards are increasingly pressuring utilities to weigh the most economically attractive clean energy supply options. However, many utilities seem to have forgotten that the greenest and cheapest energy is the energy that's not used, and have let DSM options fall off the table.

In other words, utilities should consider dusting off LCIRP principles, and assess both renewable energy supply and energy efficiency options - using up-to-date assumptions, reflecting significant technology advancements in the past decade - to develop a least-cost integrated clean energy

resource plan. A plan of this character will help utilities meet its increasingly stringent environmental obligations at minimum cost, thereby improving their competitive position and maximizing long-term profitability prospects.

c. Accelerating and Achieving Targets for Renewable Energy Market Penetration: Options and Tools for Policy Makers

Kamala R. Jayaraman and Juanita M. Haydel – ICF Consulting

This paper describes the issues involved in increasing the market penetration of renewable energy technologies and discusses why often the policies intended to increase the renewable energy penetration fall short of their targets. This paper highlights the importance of adopting a holistic approach in developing and implementing renewable energy policies that is based on the integrated view of the wholesale and the retail power market conditions, energy market outlook, renewable energy technology (cost and performance) characteristics, market barriers, economic outlook and impacts, market failures, and applicable local, regional and national environmental and other policies, constraints, and goals. This paper describes various policy options and analytic tools that policy makers can adopt to accelerate, and achieve their targets for, the market penetration of renewable energy technologies.

d. Energy Required to Neutralize Off-Gassing from HVAC Systems Located in the Attics of Residential Houses

Charles I. Davis – Regal Air Quality

Indoor air quality is becoming an important issue as we learn more about the adverse health affects of prolonged exposure to organic vapors such as formaldehyde. In some Southwestern US houses, the production of formaldehyde from HVAC systems located in hot attics require outside ventilation air to keep the formaldehyde concentration at an acceptable level. The energy required to cool the ventilation air can exceed 20% of the total energy required to cool the house. There have been studies which show that many articles inside a residential house can generate formaldehyde and other organic gases. However, our research is the first to show that certain materials used inside HVAC air handling systems become important sources of formaldehyde when subjected to temperatures greater than 120F. Most new houses in the Southwestern US have HVAC systems in the attic where the temperature frequently exceeds 120F. Our research has identified specific materials that off-gas formaldehyde and other organic gases when attic temperatures exceed 120F. We have determined that a short term solution for reducing the formaldehyde concentration to acceptable levels is to increase the amount of outside ventilation air. Case studies of individuals who have suffered health problems because of inadequate ventilation will be discussed.

e. Recycling the Solid Waste Stream - CIRCA's Promotion of CCP Use

Doug Johnson - Manitoba Hydro, CIRCA; Anne Weir – CIRCA

The Association of Canadian Industries Recycling Coal Ash's mission is to bring together Canadian producers and marketers of coal combustion products (CCPs) to increase technically sound, environmentally responsible, and commercially competitive use of CCPs as mineral resources. The primary means to accomplish this is through education and partnerships. CIRCA has always recognised the value in working with related associations and government. Our partnerships, within Canada and beyond, strategically leverage CIRCA resources to deliver programmes to become an internationally recognised organisation responsible for the significant improvement in the use of CCPs in Canada.

f. Offshore Wind Parks - Status of U.S. Development

Louis "Coke" Coakley – FPLE; Patricia Fleischauer & Frederick Pope – ENSR

Numerous Offshore Wind Parks (OWP) have been proposed off the east coast of the United States by several developers. The interest in wind energy development has shifted offshore since larger wind turbines (up to 5MW and 500 ft in height) can be utilized, and the electricity produced can more readily be transported to metropolitan areas. The areas in which these projects would be located (near the coastline due to water depth considerations) are not developed, thus allowing for larger scale projects. Over 500 MW of offshore wind power has been installed in Europe, and speculation as to why US development is lagging behind the Europe situation will be discussed.

The regulatory permitting of an OWP continues to be controversial. Several aspects of the permitting process have been contentious including federal agency jurisdiction, authority to grant approvals, ownership / leasing of land, state and/or federal review and limits of agency jurisdiction in terms of distance offshore. In addition, some proposed OWPs have been rejected by states such as New Jersey due to environmental and other considerations. The regulatory situation and ongoing process for Cape Wind (under development for several years) and the Long Island Power Authority proposed project will be discussed along with the difficulties / uncertainties of the regulatory process to which an OWP is subject. Court decisions that have established and confirmed the jurisdictions of agencies in the permitting process will be discussed. The reasons why some proposed OWPs have failed will be presented.

Finally, ENSR has developed some exclusion, avoidance and preferred siting criteria for the placement of an OWP based on engineering, environmental and general public concerns. These criteria will be presented as guidance in the hypothetical siting of an OWP. Along with the siting of an OWP, ENSR will also discuss the potential for the federal and/or state agencies to require the collection of field data (avian, marine mammal etc) to support the permitting effort for such projects.

g. Utilization of Photovoltaics to Mitigate the Urban Heat Island Hysteresis Lag Complexity

Jay S. Golden – Arizona State University Sustainable Technology Program ?

Research was carried out during 2003-2004 to evaluate the potential of mitigating the urban heat island hysteresis lag complexity in the greater Phoenix, Arizona region.

A Photovoltaic mitigation strategy was developed in comparison to traditional urban forestry and cool pavement technologies. Incorporation of the PV for the mitigation provided new insights into the urban energy balance in regards to sky view factor and thermal convection and conduction.

The resultant findings indicates that PV can be a particularly viable mitigation alternative especially for arid regions where the water balance questions are of significance.

C8 Renewable Energy Wednesday; 10am-12pm

Chairs: Edgar Mercado – US EPA

Jerry Kotas – DOE

a. Energy Efficiency, Renewable Energy and Clean Distributed Generation

Joe Bryson, Tom Kerr, Edgar Mercado and Cindy Jacobs – US EPA

Energy efficiency, renewable energy and clean distributed generation have important roles to play in keeping our national electric system reliable, low-cost and minimal environmental impact. However, to date, electricity policymakers do not allow these resources to compete with traditional wires and generation investments during resource planning and congestion relief. A handful of regions and states, as well as the Federal Energy Regulatory Commission, have proposed policy solutions to address this problem. The country is at a variety of places in implementing these solutions. This panel will evaluate different policy responses, including demand response, non-wires RFPs, and decoupling throughput from electricity profits, among others, to determine which policies offer the best chance for true market change for EE/RE/DG. Speakers will be from key states and/or power pools and will discuss their innovative approaches.

b. EERE/Air Quality Integration Pilots: Improving Air Quality through Energy Efficiency & Renewable Energy Technologies

Jerry Kotas – U.S. Dept. of Energy, EERE

The U.S. Department of Energy (DOE), in partnership with the U.S. Environmental Protection Agency (EPA) and several state-based organizations, is sponsoring a pilot initiative to demonstrate how state energy and environment officials can work together on energy efficiency and renewable energy (EERE) technologies and policies that improve air quality while addressing energy goals. The DOE's regional offices, along with their partner organizations, will provide technical assistance to four selected state or multi-state pilot initiatives to:

- 1) Support the application and use of EERE technologies;
- 2) Evaluate state policies/programs that can achieve reduction or prevention of air emissions and determine how those policies/programs can benefit from EERE technologies; and,
- 3) Quantify or verify the resulting air quality, energy and economic benefits.

DOE anticipates that the pilot initiatives will increase collaboration between federal and state energy and air officials so that, ultimately, EERE technologies are considered routinely in air-quality planning. Each pilot will demonstrate collaborative and innovative approaches to utilizing EERE technologies to reduce or prevent air emissions, as well as quantifying avoided emissions. Successful initiatives will provide replicable tools, models and strategies that others can implement.

c. How Much Renewable Energy Is Really Produced?

Fred Mayes and Louise A. Guey-Lee - Energy Information Administration, U.S. Dept. of Energy
Renewable portfolio standards and concerns over measuring pollution reduction require complete and accurate measurements of renewable energy. This paper examines the challenges to measuring renewable energy accurately.

One of the major areas of uncertainty is non-electric energy from biomass. Renewable energy facilities are comparatively difficult to find because renewable energy plants are generally not required to file EPA permits to operate. Since non-electric energy is traded far less formally and frequently than electricity, there are few, if any, compendia of such facilities. As a result, the only way to measure such energy is by a comparatively expensive, time-consuming survey of Census manufacturing establishments. Funds limit this effort, the Manufacturing Energy Consumption Survey, to once every 4 years. Even at that, only a small sample of companies is surveyed, and only a small fraction of the sample companies use biomass for process heat.

Renewable-electric plants can often be difficult to locate, as well, especially wind plants. An example is California, where there are at least 4 different "official" lists of wind facilities. These lists differ by several hundred megawatts.

Even when renewable facilities are identified, it is often difficult to get them to begin reporting on a timely basis. By the time plants are identified, it is not uncommon for them to begin reporting a year after start-up.

Finally, official statistics are extremely uncertain for distributed energy. Seemingly beneficial efforts to encourage distributed electricity will undoubtedly decrease the reliability of comprehensive renewable energy statistics.

d. Using Supplemental Environmental Projects to Transform Renewable Energy Markets

Rick Sprott - Utah Division of Air Quality

Reduction of fossil fuel use with renewable energy (RE) can be a crucial strategy for reducing particulate matter, ozone, and regional haze. Supplemental Environmental Projects (SEPs) resulting from enforcement settlements have been used to support RE. Many of these SEPs have focused on large capital projects that are difficult and time consuming to implement for both the violator and regulatory agency. The costs involved also mean that the penalties necessary are not often available in state actions. The Utah Division of Air Quality has teamed with DOE to develop a system to build the RE market, not hardware. Providing an ongoing, stable stream of power purchases helps ensure continued investment in RE generation. The system actually takes less time to settle enforcement actions than traditional compliance activities and also allows even the smallest settlements to purchase modest amounts of RE. The new program may almost double the RE market in Utah and help avoid violations of the new ozone standard. The approach could be easily adapted in most parts of the country.

e. Landfill Gas: A Cost-competitive Renewable Energy Source

Vineet Aggarwal, Steve Fine and Josh Smith - ICF Consulting; Rachel Goldstein - U.S. EPA

Demand for renewable energy is growing rapidly and landfill gas (LFG) is considered an established, low-cost, reliable source of renewable power. LFG energy can be used to satisfy renewable portfolio standards as well as support consumer renewable power products. As a renewable resource, LFG provides both environmental as well as economic benefits. It is one of the most cost-effective forms of renewable energy on a levelized cost basis and as a baseload renewable, also provides full credit against reserve margins. Because it is one of the few renewables that reduces methane and NMOC emissions, it also has the potential to provide additional emissions credits from methane reductions at the landfill apart from the green attributes received from offset of grid electricity. Landfill gas based electricity projects have a proven track record of nearly 25 years and currently the installed capacity adds up to over 1,000 MW with

individual projects as large as 50 MW. There are several financial and regulatory incentives available for LFGE projects at the state and federal level including the Section 45 tax credits that were recently reinstated as part of the corporate tax bill. US EPA's Landfill Methane Outreach Program estimates that there are still 600 untapped landfills with an electricity generation potential of 1,500 MW.

f. Best of Class in Utility Green Pricing Programs: Tools for Future Success

Matt Clouse, Kurt Johnson and Blaine Collison – US EPA

This paper will discuss the growth in utility-sponsored green pricing programs that involve marketing to customers to pay more for renewable energy. EPA's Green Power Partnership has analyzed successful utility programs and will highlight the policies and approaches that have been successful for the "best in class" programs in the country. The paper will then turn this analysis into a lessons learned for other utilities interested in expanding their use of green power.

C9 RE Credits & Financing Alternative Energy Wednesday; 1-3pm

Chairs: Edgar Mercado – US EPA

Mark Trexler – Trexler Climate + Energy Services, Inc.

a. Renewable Energy: What Will Renewable Energy Credits be Worth?

Mark Trexler – Trexler Climate + Energy Services, Inc.

Interest in the renewable energy credit market is huge, yet it remains very difficult to get lenders to value these credits when reviewing project pro formas. Similarly, policy makers find it extremely challenging to assess the economic implications of alternative renewable energy portfolio standards and designs. What would it mean for supply and demand to include or exclude certain renewables or small scale energy efficiency measures? When developing an RPS at a multi-state level, who's going to win and lose in terms of financial flows?

This presentation will explore the supply and demand implications of a range of renewable energy policy scenarios, and explore the likely implications of such scenarios for the future value of tradeable renewable energy credits in both mandatory and voluntary markets in the United States.

b. Environmental Credits to Enhance Renewable Energy Project Value

Douglas A. McWilliams – Squire, Sanders & Dempsey, LLP with support from the SSD Renewable Energy Project Team

The demand for renewable energy is increasing dramatically and incentives are emerging that enhance project value. Douglas A. McWilliams, of the Renewable Energy Project Team from the global law firm, Squire, Sanders & Dempsey L.L.P., helps clients identify and quantify opportunities to use environmental credits to enhance the value of new development projects. For the energy sector, these environmental credits offer revenue streams independent of the value of the electricity being generated. For instance, many states are requiring utilities to meet renewable portfolio standards mandating that some portion of each utility's annual electricity sales be generated by renewable energy resources. Renewable energy credits or "green tags" are emerging as a market-based revenue stream for renewable energy projects. In some areas, emission reduction credits may also be available, particularly where the renewable energy project replaces an existing fossil fuel-fired unit. New nonattainment areas are creating new demand for emission offsets and Mr. McWilliams is working in states with evolving emissions banking and trading programs to ensure that they are structured to reward renewable energy projects. Finally, the emerging carbon trading market creates new opportunities to quantify the benefit of a renewable energy project in terms that capture the beneficial effect on greenhouse gas emissions. This session will focus on the opportunities to enhance project value by identifying, quantifying and certifying the available environmental credits.

c. Emission Allowances For Renewable Energy And Energy Efficiency Projects

Steven R. Schiller – Schiller Consulting; Edgar Mercado – US EPA; Bill Balcke – PQA

Allowance trading programs represent an opportunity for the renewable and energy-efficiency industries to capitalize on the environmental benefits associated with their projects. This paper discusses an EPA sponsored program for documenting and trading emission allowances associated with efficiency and renewable energy (EE/RE) projects. The paper also discusses a crucial element

of EE/RE project allowance trading, the monitoring and verification (M&V) of actual emission reductions.

One EPA rule, commonly known as the NOx SIP Call, requires several eastern states to submit air quality plans that address the regional transport of ground-level ozone through reductions in NOx emissions. As part of the NOx SIP Call, EPA provided guidance to states interested in developing an EE/RE set-aside. The Set-Aside is a pool of NOx allowances that are used to reward EE/RE projects that reduce electricity generation and thus NOx emissions. The EPA included an EE/RE set-aside in order to reward and recognize the benefits of renewable energy and energy efficiency programs. EE/RE Set-Aside Program background and the status of Program implementation in various states are discussed in the paper.

Unfortunately, the quantification of EE/RE emission reductions is not often a straightforward process. Thus, this paper also reviews the M&V process that has been developed for the NOx Set-Aside Program. When designing and implementing an emissions trading program, the challenge associated with evaluation is balancing the cost, effort and rigor of various approaches with the value of the allowances and the need for fungible allowances. Two mechanisms for reducing the costs and effort associated with documentation and verification, while not reducing the integrity of the results, are: (a) program level aggregation of individual project emission allowances and (b) the use of standardized M&V Quality Assurance Guidelines. These two mechanisms and other recommendations are presented in the paper.

d. Financing Incentives and Challenges for Renewable Energy Projects

Paul A. O'Hop – Squire, Sanders & Dempsey, LLP

As the demand for renewable energy continues to skyrocket, so too does the development of financial incentives to promote the supply of renewable energy. Such incentives take many forms (including special financing terms, tax incentives, grant funding) and they come from many sources (international, federal, state, private). Renewable energy projects also have new revenue streams that enhance the value of projects and can be used to attract improved commercial or financing terms, such as renewable portfolio credits and emissions reduction credits. However, renewable energy projects, particularly those based on intermittent resources such as solar and wind, carry with them certain risks not typical of power projects utilizing traditional fuel sources. Utilities, project sponsors and developers alike will want to understand such risks and their impact on the content of power purchase agreements, the availability of financing, and ultimately the prospects for long term project success.

The presentation will be made by Paul O'Hop, a Partner in the Washington, DC, office of the global law firm of Squire Sanders & Dempsey, LLP, where he is also the Chair of the Renewable Energy Group, and a member of the Project Finance team. Throughout his career, he has acted as lead counsel in the development of major power projects around the world, utilizing both traditional fuels and renewable resources.

e. Renewable Energy Credits (REC), Green Power & Emission Markets/Renewable Portfolio Standards (RPS) & RGGI

Edgar Mercado, M. Clouse, & T. Kerr, Julie Rosenberg, A. Diem, & Sara Dunn – US EPA

f. RECs v. RPS: Markets in Conflict?

David W. South – Technology & Market Solutions, LLC

RECs and RPS are two instruments being used to promote the adoption and/or accelerate the deployment of renewable energy (RE) technologies. However, the technologies that benefit from these instruments differ; for RPS it depends on which technologies are defined, for RECs it is a function of the market price. The market players will also have an impact on the success of RECs v. RPS markets, as each has a different objective. For example, states may promote RE technologies (via RPS) to reduce air emissions, generate economic benefits, etc., and as such prefer that the RE technology be sited within state boundaries and have "bundled" attributes. Alternatively, RECs reduces (or avoids) air and greenhouse gas emissions within an airshed, but may be used for compliance outside of the host state. Given market and transaction price drivers it may be preferential for RECs to be disaggregated (unbundled into transaction-based commodities) so as to maximize value. This presentation will explore use of REC and RPS instruments to promote the deployment of, and a sustainable market for, RE technologies.

g. ProForm v 4.0 - A Tool for Financial Analysis of Clean Energy Projects

Bill Golove - Lawrence Berkley National Laboratory

ProForm is a software tool designed to support a basic assessment of the environmental and financial impacts of clean energy projects. Given the necessary data, ProForm calculates basic financial indicators and avoided emissions of CO₂ and local air pollutants expected from a project. As a spreadsheet-based tool, ProForm is designed to be simple enough to be easily usable, yet sophisticated enough to provide credible results. A typical application of ProForm would be in preparation of a project proposal that the developers might submit to potential investors, financiers, or a national climate change office. ProForm allows project developers, financial institutions, and other parties to investigate how changes in basic assumptions affect the key parameters of a project.

h. Computer Weather Forecast System for Wind Energy Plants

Khanh T. Tran - AMI Environmental

Wind energy is intermittent and an accurate forecast system is needed to predict the wind and wind power ahead of time for load scheduling. AMI has developed a PC-based forecasting system based on the use of advanced mesoscale models and wind modeling technologies. The system and results of a recent testing for 12 months at a wind energy plant in Texas are presented and discussed.

i. Hybrid Solar/Wind Systems for Rural Electrification in Developing Countries

Prabhu Dayal - C Trade; Rod Robinson - SWWP

j. Distributed Generation Using Landfill Gas - Getting the Go-ahead for Pollution Prevention

Franklyn Austin - Stone & Webster Management Consultants, Inc; Sarah. J. Simon, P.E., EMCON

Many landfill owners and developers agree that a landfill's "free," waste biogas should be converted into useful energy to reduce greenhouse gas emissions and avoid fossil fuel use. However, the cost and approval process for a landfill gas (LFG) to energy project can be daunting. Based on the experience of the 250 LFG burning electric projects and other landfill gas projects in planning in the US, these relatively small, electric facilities are often riskier ventures and more marginally profitable than fossil fuel utility stations.

This presentation will describe how the quality of LFG and its contaminants pose special permitting challenges for LFG to energy projects and how project proponents have addressed Federal air permit requirements; state and local emission and toxics programs; and energy industry requirements and regulations. Examples will show how permitting challenges and grid connection costs can force these small electric projects, often 1-4 MW, into on-site use or direct use in boilers. LFG energy projects may be setting precedents for approvals of other bio-fuel efforts as well. Because gas production tax credits are unlikely to be available for LFG in the future, strong support from the green credit programs may be needed for LFG electricity production to continue to grow and contribute to the renewable energy portfolios.



EUEC SPOUSES PROGRAM-----Spouses of EUEC attendees may take advantage of the many attractions available at the Westin La Paloma and its surrounding area. Some of these attractions include the famed Elizabeth Arden Red Door Spa, and shopping at Tucson's newest shopping center, La Encantada.

The Red Door Spa welcomes you to your personal retreat...over 9,300 square feet of state-of-the-art splendor. Our world-class services are designed to nurture your body, your mind, and your spirit. Integrated elements of both science and technology with natural ingredients from the earth and the sea to bring you spa therapies from around the world. Located at the Westin La Paloma.

La Encantada is the new destination sensation of Arizona featuring the definitive in elite fashion that brings the essence of sophistication and style to Tucson. **A FREE shuttle to La Encantada is available on an hourly basis, from the Westin La Paloma.**

Track D - EHS/EMIS/Visibility

Monday, 1/24/2005

D1 EHS/Health & Risk Monday; 1-3pm

Chairs: Thomas J. Grahame – US DOE
Ron Wyzga – EPRI

a. New Concerns for Toxic Exposure and Process Safety in Air Pollution Control Reagents

William Barnes, PE – Avogadro Environmental Corporation

In the evolving world of single and multi-pollutant air pollution control for NO_x, Sox, Hg and other contaminants with high visibility to the public, there is a growing variety of reagents being utilized with increasing success at the stack. From SCR to ECO and other technologies, air pollution control scientists are increasingly relying on chemicals and their reactions to achieve changes in effluent of criteria and hazardous air pollutants. This has presented challenges and opportunities to all parties involved in deploying control technologies including: technology developers, APC equipment vendors, reagent vendors, installation site personnel, and communities surrounding them. This presentation first takes a look at the regulatory framework under EPA and OSHA to ensure processes function safely ensuring protection of employees and the community. Using several case studies, an examination of the challenges and opportunities to innovate technologies will demonstrate that these new technologies can be safely deployed to industry. Overall, innovation in EHS programs at sites employing these new technologies has occurred. Reliability and maintainability issues are minimized through strong management of change and preventative maintenance programs required under PSM and RMP rules. While using some potentially toxic reagents, reduction in risk to the environment can be achieved.

b. EHS Management Systems - Lessons Learned

Robert S. Chatham – PSEG Global

PSEG Global has been proactively involved in assessing the environmental, health and safety (EHS) practices of our domestic and international electric distribution and generation companies. In addition to these assessments, we have been proactively coaching our companies on how to implement a world-class environmental, health and safety management system. For the past several years, we have been performing EHS assessments. Each assessment requires an understanding of local customs, regulations, business practices, and risks associated with the local environment. As part of these assessments, we have been looking at what management systems are currently in place to control hazards, what data is tracked, what personal protective equipment employees use, and what work practices and procedures are currently being used. We have also sponsored EHS Summits in the United States (September 2001, December 2003, and June 2004), Brazil (April 2002), Chile (November 2002), Peru (April 2003), for our EHS counterparts to share each other's programs, work practices, and participate in EHS training courses. As stewards to PSEG's non-regulated domestic and international arm, we have worked to assess, improve, and lead two very important PSEG objectives, which is "accidents, injuries and fatalities are unacceptable anywhere we operate in the world" and "the right & obligation to stop an unsafe act". This story continues as we expand our EHS Culture to our domestic and international companies. Currently, PSEG Global has interests in 38 operating companies in the following countries: Brazil, Chile, China, India, Italy, Oman, Peru, Poland, Taiwan, United States, and Venezuela.

c. Assessing the Impact of Air Toxic Emissions Using HARP

Phyllis G. Diosey, Ph.D and Lorraine Farrell, PE – Malcolm Pirnie, Inc.

The combustion of fossil fuels at power plants and other industries leads to the emissions of a number of air contaminants, including air toxics. Many states have developed air toxic programs in order to control the risks from these and other types of air toxic sources, such as Arizona's Ambient Air Quality Guidelines (AAAQG), and Utah's Toxic Screening Levels (TSL). California's Air Toxics Hot Spots Program requires stationary sources to report the types and quantities of certain substances that their facilities routinely release into the atmosphere. The objectives of the "Hot

Spots" Act (AB2588) are to collect emission data, identify facilities having localized impacts, ascertain health risks, and to notify nearby residents of any potential significant risks. To standardize the approach to this complex air toxics program, California Air Resources Board (ARB) developed a computerized program, Hotspots Analysis and Reporting Program, or "HARP", that includes an emissions inventory database, a dispersion modeling module, and a complex risk assessment protocol. Introduced in December 2003, HARP is used by air pollution control and air quality management districts, facility operators, and other parties as part of the permitting process to evaluate emissions inventory data and the potential health impacts associated these emissions. This presentation will discuss the features of the HARP program and its application to a major electric generating station in the South Coast area of California. The presentation will discuss the development of the emissions database, the set-up of the dispersion model, the selection of appropriate receptor locations, the characterization of potential risk scenarios, the results of the analysis with respect to the permitting thresholds, and potential mitigation measures.

d. What Do the Most Recent Studies of Particulate Matter (PM) Effects on Health Tell Us? A Review of Epidemiological, Toxicological, and CAPs Studies of PM

Thomas J. Grahame – US DOE

Within the last three to five years, several new methods of analyzing the health effects of PM have been developed or more widely used. These include:

1. CAPs (Concentrated Ambient Particulates) studies test the effects of the mix of particles present at a given location over a period of days and weeks. Statistical analysis enables researchers to identify which marker elements are associated with specific health effects, and which are not. These elemental markers then may enable specific sources to either be identified, or ruled out.
2. Gradient studies enable researchers to examine the health effects of exposures to different levels of pollution from specific sources, for example comparing relative risks of cardiopulmonary disease for those living within 100 meters of a freeway, vs. those living further away, everything else equal. A variant of a gradient study would compare effects in rural areas, with rural air pollutants, vs. effects in urban areas, with urban plus rural pollutants.
3. Toxicological studies enable researchers to understand specific effects of individual types of PM in cells (in vitro studies) or in animals (in vivo studies). While such studies don't mimic the mix of ambient air pollution, they allow the observations of biological mechanisms of potential harm. In addition, new methods of utilizing traditional epidemiological methodologies have enabled researchers to gain more insight from this type of study, even when central monitor information is used (central monitor studies must implicitly assume that all people in the area are exposed to the same level of pollution, an assumption now known to be wrong). Some pivotal, older studies have also been reviewed in light of these new studies.

On the whole, these studies suggest that the emphasis on controlling secondary particles in order to protect public health may not be as effective as controlling primary emissions. A recent overview study by the Government of the Netherlands comes to the same conclusion. Therefore specific further research is recommended in order to better clarify health effects of different types of PM.

e. Health Effectiveness of Utility Air Quality Regulations

Eric G. Walther, Ph.D. and Uday Singh – TRC

The Utility Mercury Reduction Rule and Clean Air Interstate Rule are examples of regulations aimed at reducing power plant emissions of NO_x, SO_x, PM, and mercury. The expected reduction of each pollutant is related to the probable health benefit of each, and compared to the probable health benefit of diesel engine and fuel regulations as a reference. The probable reductions and potential health benefits of these three sets of rules/regulations are projected from today through 2030. It is hoped that this type of information will help the regulatory and utility communities optimize the nation's investments in emission control systems required on these major stationary and mobile source populations.

D2 EMIS Monday; 3:30-6pm

Chairs: David Drerup – DS&S

Jim Davis – ESP

a. Defining a Sustainable EMIS Solution

Dave Drerup – Data Systems & Solutions

EH&S Management Information Systems (EMIS) are increasingly being leveraged in the Electric Utility space. By embracing Operational Excellence, many companies are taking EMIS solutions to new levels. Operational Excellence is the integration of EH&S with reliability and efficiency.

This paper will focus on how to define an EMIS, some trends in the EMIS marketplace, and what other companies are doing with EMIS. This presentation will give the participants a methodology for approaching EMIS projects from defining needs to selecting appropriate solutions to implementation.

In order to justify EMIS solutions, many companies look to integration with existing business and process systems as a way to derive addition value. Some examples of real-time digital dashboards and key performance indicators will also be presented.

b. PowerQUEST: Software Tool for Stakeholder Engagement in Integrated Resource Planning

Dave Biggs - Envision Sustainability Tools Inc.; Ronald Monk – British Columbia Hydro Corporation.

PowerQUEST is a software tool that facilitates stakeholder engagement on Integrated Resource Planning (IRP). Co-designed by BC Hydro and Envision Sustainability Tools, PowerQUEST was developed to help the power utility:

1. engage stakeholders in discussions about electricity supply alternatives;
2. gather feedback on their views and preferences; and
3. develop stakeholder support for the plan.

PowerQUEST presents and compares ten alternatives for how the utility could meet electricity demands throughout the region over a 20-year timeline (2004-2023 inclusive). These alternatives are described both in terms of the resources that are being proposed to meet the demand and the implications of those resources on key issues (i.e. air quality, greenhouse gas emissions, cost, employment, rate impact,..).

As facilitators guide workshop participants through the ten portfolios individually and make comparisons, participants learn about the implications of various resource mixes and can provide feedback on any preferences and concerns they might have. PowerQUEST workshops are designed to meet the following objectives:

- o convey the range of planning options available to the utility;
- o convey the constraints and priorities that the utility is required to work within;
- o convey the strengths and weaknesses, benefits and consequences of each of the portfolios in the range;
- o convey how any of the portfolios perform under the utilities constraints and priorities;
- o allow participants to provide input regarding their priorities and issues;
- o allow participants to provide input regarding all of the portfolios in the range; and
- o be easy to understand.

This presentation will demonstrate the PowerQUEST application as it have been developed for BC Hydro and will discuss the findings of that case study. Participants will gain a better understanding the challenges and benefits of using this kind of technology to assist in their stakeholder engagement efforts.

c. Cinergy EMIS

Robert C. Schnelle, Jr. – Cinergy

The tremendous volume or regulatory reporting and compliance tracking requirements for an electric utility necessitates the need for an automated system that can help maintain, track, and verify compliance with multiple environmental program areas. Cinergy chose a flexible, web-based system that allows for customization of real-time data capture, permit/condition tracking, automated report generation, and remote administration. The system uses the GreenSuite© software, developed by a company named VerticalSuite, located in Half Moon Bay, CA. The

system is made up of seven different application areas: Title V, EDR Reporting, Environmental Audits, Water Quality, Waste Management, Fuels Reporting, and Liability Management. Each functional area has regulatory and/or permit conditions linked to data entry screens and compliance tasks. Each task requiring a specific action (i.e. inspections, data collection, reporting) is scheduled within the application, which, in turn, "rolls up" any data thus collected into report screens and functions. Interfaces with various databases throughout Cinergy allow the system to collect data automatically, at designated intervals, and auto-populate forms with data in specified formats. Associated logs and reports can be generated automatically, or completed manually, as needed, based on real-time data triggers, with appropriate company personnel receiving e-mail and/or pager notification of any impending tasks or reportable events. An E-mail and/or pager reminder function for incomplete or overdue tasks is also built into the system. Users see various form and report screens in which they can enter relevant data or text for reports, prior to printing and/or electronic submittal to regulatory agencies. With the EMIS system, supervisors, managers, and other designated administrators can see a real-time snapshot of compliance with a number of regulatory requirements in multiple program areas with just a few mouse clicks. Accessible from any PC with decent Internet access, electronic records can be printed or e-mailed directly from the system.

d. Self-Implementing an EMIS: What You Need to Know Before You Get Started

Brian D. Toth – Southern Power Company

As the volume of data and information required for compliance documentation grows, so do the risks of non-compliance for organizations large and small. In order to overcome this information overload to confidently certify compliance and mitigate risk, you need a technology foundation based on your EMS. There are many organizations who will gladly work with you to implement your EMS-based information system, but what if you choose to implement it on your own? It takes a combination of people, process and technology to get it done. Southern Power Company opted to implement an EMIS on their own, and they will share their decision process on why they elected to self-implement, how they went about it, and the lessons learned throughout.

e. Cyber Infrastructure for Effective Deployment of Environmental Management Systems

Jeremiah O'Brien – Process Data Control Corp; Andy Srinivasan – Bayer Material Sciences; Tim Aldredge – Eastman Chemicals

This paper will address the design and implementation of regulatory compliance assurance systems with an emphasis on computer system infrastructure that supports web pages and other cyber components. Many industrial facilities are under pressure to implement such systems due to the large number of monitoring, reporting and recordkeeping requirements contained in federal operating permits and other applicable regulations. Web environments are quickly becoming the standard means by which requirements are communicated to company personnel and tracked to confirm compliance, leading to extensive infrastructure needs to harness the computing resources that are needed. Cyber infrastructure is the key to success when deploying compliance assurance systems because access to the data by a broad spectrum of personnel is an absolute necessity. Web pages that enable viewing and updating data, and high performance database connections with effective security are essential to meeting this requirement. The overall objective is twofold: (1) achieving compliance with applicable rules; and (2) proving compliance to the satisfaction of company officials, regulators, and the public. To meet these goals, companies must implement systems that maintaining "compliance history," i.e., records confirming that regulatory requirements were met in accordance with approved methods and schedules.

Ultimately, the ability of a facility environmental manager to assure compliance rests squarely on the capabilities of work processes that create and maintain "compliance history," including management of change and continual improvement. This paper takes a careful look at principles of design and implementation of reliable, efficient and effective systems and the cyber infrastructure components on which they depend.

f. Compliance Survival Tactics: How to Protect Yourself From the Title V Data Explosion in the Absence of a Flak Jacket

Greg Gasperecz – Enviance

The Title V operating program resulting from 1990 amendments to the Clean Air Act requires that

many industries, including the utility industry, demonstrate, in one document, their compliance with all applicable regulations and requirements of the act. The U.S. Environmental Protection Agency (EPA) reports that, as of 2003, 95 percent of Title V permits have been issued nationwide. As such, approximately 19,000 facilities are required to submit annual certifications and semiannual deviation reports. To receive their Title V permits, power plants and other facilities dutifully outline how they monitor their processes and what controls they have in place to manage potential sources of non-compliance. Any sense of relief that ensued when the permit was issued quickly disappeared with the realization that, in fact, the issuance of a Title V permit is but the beginning of a process -- the opening of a door and not its closing. And that door hinges on the ability to demonstrate ongoing compliance with the controls outlined in the application process: the conditions of ongoing compliance.

Title V, Superfund Amendments and Reauthorization Act (SARA), the Right-To-Know Act, the Toxic Release Inventory, the Resource Conservation Recovery Act, Hazardous and Solid Waste Act and the National Pollutant Discharge Elimination System permitting program have all contributed to a compliance data explosion. While this presentation focuses on the data explosion created by Title V, the practices put in place to manage clean air compliance will support any and all corporate compliance activities, including water, waste, health and safety.

g. Beyond Compliance: The Role of Software in Environmental Management and Emissions Portfolio Management at DTE Energy

Jim Keehn – Specialist Licensing at DTE

As part of its commitment to both regulatory compliance and sustainable business practices, DTE Energy has deployed an environmental information management system (EMIS) throughout its power plants. An unusual aspect of DTE's EMIS system is that it extends beyond regulatory compliance management and helps the company also manage its emissions trading program. DTE Energy uses a combination of the opsEnvironmental software and the ecoAsset Manager software, both from ESP. When integrated, the two packages offer DTE Energy a powerful way to manage its emissions program from compliance through to trading.

The presentation will offer an overview of the history and scope of DTE Energy's EMIS system, providing examples of how the software is used to manage regulatory programs such as Title V, sustainability programs such as ISO 14001 certification, and the financial and compliance aspects of the company's emissions allowance trading program. Special attention will be placed on the ways in which the EMIS system provides information that can then be used to make business decisions (such as whether to buy or sell emissions allowances) for the company.

Tuesday, 1/25/2005

D3 Visibility Tuesday; 7:30-9:30am

Chairs: John Watson – Desert Research Institute

Robert Pearson – CH2M Hill

a. Should IMPROVE Light Extinction Reconstruction be IMPROVED?

Naresh Kumar – EPRI; Patrick A. Ryan – Sonoma Technology, Inc.; Doug Lowenthal - Desert Research Institute

The U.S. Environmental Protection Agency (EPA) published a Regional Haze Rule (RHR) designed to reduce haze in all Class I areas. The goal is to linearly reduce haze to natural background levels by 2064 from a baseline established in 2000-2004. Compliance under the rule is determined following the Interagency Monitoring of Protected Visual Environments (IMPROVE) protocol. This IMPROVE protocol predicts light extinction from aerosol chemical concentrations measured by the IMPROVE network. We have examined the IMPROVE light extinction formulation accuracy, consistency, and potential biases in the past and shown that the IMPROVE light scattering formulation systematically overestimates by 33%, on average. By evaluating assumptions integral to the IMPROVE formula, we have proposed modifications in the IMPROVE formula.

The effect of the proposed modifications is to minimize any biases in the IMPROVE formula predictions over the range of nephelometer measured visibility impairment at the IMPROVE sites.

We apply the new formula to sites in different Regional Planning Organizations (RPOs) to examine if a single formula can be used for all locations in the country or if we may need separate formulas. We also examine the effect of using the new formula on progress goal requirements under the regional haze rule at specific locations.

b. Sensitivity of CALPUFF Visibility Impacts to Meteorological Data, Emissions, and Model Inputs

George E. McVehil, Thomas R. Hormel, and Edward Addison – McVehil-Monnett Associates, Inc.

The CALMET/CALPUFF modeling system is the standard methodology for assessing impacts on visibility and air quality related values in Class I areas due to emissions from new or modified major sources. Experience in applying this methodology indicates that predicted visibility impacts can vary markedly depending upon meteorological data bases utilized for model input. Results are also dependent on the magnitude and speciation of emissions, and upon a number of model input parameters. Results from several Class I visibility analyses are presented to demonstrate the sensitivity of model results (frequency and magnitude of light extinction change) to changes in model input. Parameters analyzed include: MM5 vs RUC meteorological data fields; varying amounts of surface and upper air meteorological observations; dispersion representation in CALPUFF; background pollutant concentrations; and the relative emissions of sulfur and nitrogen compounds. The results provide additional understanding of factors most likely to result in predicted visibility impacts at Class I areas.

c. Recent Advances in Demonstrating Acceptable Visibility Impacts in Class I Areas

Robert Pearson and James Nall – CH2M Hill

Electric power production in the United States, particularly in the West, is continuing to grow with a renewed interest in coal fired power plants. Many of these proposed or potential power plants are located near enough to a Class I area (within 300 km) to require predictive modeling calculations of the potential impact to visibility and other air quality related values in the Class I area. The CALPUFF dispersion model is routinely used in the refined mode pursuant to the FLAG guidance. Full CALPUFF has been adopted by EPA as a preferred guideline air dispersion model. If the plant is located with 200 km of the class I area, it is likely that the model will show visibility impacts over 5% using the FLAG guideline approach. The FLAG procedure allows the use of method 2 in the CALPUFF postprocessor (CALPOST) to use hourly relative humidity capped at 98% to adjust the background visibility in a class I area. However, we have found that this approach does not appropriately take into account natural weather conditions such as fog or precipitation on days when elevated visibility impact is predicted by the model but in reality would not be observed due to naturally obscured background visibility. Instead we have developed an approach using IMPROVE transmissometer data for the Class I area to adjust background visibility for days with model predicted high visibility. The adjustments are made for each hour in the day where the background visibility is obscured. If transmissometer data are not available for a class I area, we then use the new CALPOST Method 7 which uses visual range measurements from nearby National Weather Service Stations. Using these approaches we have successfully demonstrated that all plants will have an impact on visibility that is acceptable to the federal land manager.

d. AirControlNET – An Emissions Inventory and Control Technology Tool

Steve Rowe and Frank Divita – E.H. Pechan & Associates, Inc.; Larry Sorrels and Tyler Fox – US EPA

AirControlNET is a new tool developed for EPA. It is used to perform analyses of air pollution regulations. The tool allows access to emission reduction and costs of air pollution control measures. The purpose of this presentation is to describe AirControlNET, a new control strategy and costing analysis tool developed for the EPA's Innovative Strategies and Economics Group. AirControlNET was designed for conducting analyses of air pollution regulations and policies, especially for NAAQS implementation for criteria air pollutants. The tool currently contains about 500 criteria pollutant control measures. AirControlNET is designed to be used by a wide range of people, including policy analysts, engineers, economists, and others interested in evaluating the efficacy and costs of air pollution control strategies. This tool allows users to easily search and review available control measures, and to obtain information regarding pollutant emission reductions and associated costs for use in SIP development, regulatory and policy evaluations, or

modeling efforts. ControlNET provides data on emission sources, potential pollution control measures and emission reductions, and the costs of implementing those controls. In essence, ControlNET is a comprehensive database of control measures and cost information for reducing the emissions of NO_x, SO₂, CO, VOC, PM₁₀, PM_{2.5}, Hg, NH₃ from point, area, and mobile sources emissions inventories supplied in EPA's National Emission Inventory (NEI) format. A new front-end to the application has been created that allows viewing and analysis of the database.

e. Topographical and Climatological Influences On Class I Impact Analysis Results

Allan R. Oestmann and James D. Hodina – Stanley Consultants, Inc.

This presentation will offer findings on the differences that site location may have on ambient air and visibility impact analysis. As part of a site selection study for a 250 MW CFB electric generating facility, four different site locations in Montana were evaluated for potential impacts using the CalPuff model in screening mode. A common set of facility characteristics was used for each site. These differences will be compared to the modeling results to better understand how various terrain and meteorological conditions may affect the results of the CalPuff model.

All the study sites were in areas designated as Class II under Prevention of Significant Deterioration (PSD) regulations. However, there are potential impacts to Class I areas. The ISCST3 model was used to assess impacts within 50 km of each site. The CalPuff model in screening mode using the Federal Land Manager Air Quality Related Values Work Group (FLAG) guidelines was used to assess potential visibility impacts and other impacts in Class I areas. PSD regulations require evaluation of ambient air and visibility impacts at Class I areas within 100 km of a proposed site. Federal Land Managers have unilaterally extended the analysis area up to 300 km using their authority under the Clean Air Act. For this study, only the closest Class I area to each site was evaluated. A 300 km study radius at one of the sites would include eleven Class I areas, each potentially requiring an impact analysis for the PSD permit.

The site located closest to a Class I area has the lowest visibility impact. It appears that this is because this site is at a higher elevation than the Class I area while the other sites are at a lower elevation relative to the nearest Class I areas.

f. Assessment of the Health Effects of Coal Combustion Emissions: Preliminary Results from the TERESA Study

Ron Wyzga and Annette Rohr, EPRI

The Toxicological Evaluation of Realistic Emissions of Source Aerosols (TERESA) study is a comprehensive effort to evaluate the formation and toxicity of secondary particulate matter (PM) derived from coal combustion. To date, the toxicity of coal combustion emissions has been examined only in terms of primary particles, but these emissions may not reflect population exposures because of atmospheric chemistry. An approach was therefore needed that would evaluate the health effects of coal combustion emissions in a realistic manner that included the simulation of various atmospheric conditions. In TERESA, power plant emissions are drawn from the stack into a mobile laboratory, where oxidants are added to convert SO₂ to sulfate, and other atmospheric constituents are added (e.g., NH₃, secondary organic aerosol [SOA]). Laboratory rats are then exposed to the resulting atmospheric mixtures, with PM present at reasonably environmentally relevant concentrations, and cardiovascular and pulmonary effects are evaluated. In each exposure scenario, 42 rats are exposed (13/day for 4 days) to the emissions atmosphere, and 42 are exposed to filtered air (control animals). Exposures are 4 hours in duration. We have recently completed fieldwork at the first TERESA study plant in the Upper Midwest. We carried out exposures to 4 scenarios: (1) primary particles only; (2) secondary particles; (3) secondary particles + SOA; and (4) neutralized secondary particles + SOA. PM_{2.5} concentrations were in the vicinity of 200-300 µg/m³. In scenario (2), strong acidity was about 50 µg/m³ H₂SO₄. Outcome parameters studied included pulmonary function and breathing pattern, bronchoalveolar lavage fluid analysis (to evaluate possible lung inflammation), heart and lung chemiluminescence (a very sensitive measure of oxidative stress in these organs), and blood analysis. Preliminary findings indicate no adverse effects from any of the exposures evaluated. There were no differences in the measured parameters between exposed and control animals. Data on lung tissue histology are still pending. We will be relocating the mobile laboratories to the next TERESA plant in the Southeast shortly. Following the power plant assessment, we will carry out the same assessment using mobile source emissions. The ultimate goal of TERESA is to compare the toxicity of secondary coal combustion and mobile source emissions to better understand the components of PM responsible

for adverse health effects. The TERESA study is the first to investigate the toxicity of actual power plant emissions using mobile laboratories, and the first to incorporate secondary atmospheric chemistry to ensure that exposures are realistic and representative of human exposures.

g. A Survey of Recent Generation Company Environmental Disclosure Practices

Franklyn Austin – Stone & Webster Management Consultants, Inc

Publicly traded electric power generation companies continue to struggle to regain investor confidence by responding to investor needs and by complying with new disclosure obligations of the Sarbanes-Oxley Act of 2002. In 2004 government studies continued to indicate under-reporting of environmentally material issues in reports to the SEC, putting SEC under increasing pressure from investors to clarify and enforce requirements for reporting. How are large publicly traded power generators responding to the increasing pressure to disclose material environmental issues? Stone & Webster Management Consultants has performed an independent study of 10K submittals to the SEC. This paper will present an updating discussion of investor, SEC and company issues on environmental disclosure, in addition to trends in reporting found by the study.

D4 BART& Regional Haze Tuesday; 10am-12pm

Chairs: John Watson – Desert Research Institute

Frank Divita – E.H. Pechan & Associates

a. Innovative Mitigation for Regional Haze Impacts: Cleaning up Smoldering Coal Refuse Piles with CFB Boilers

William Campbell, Robert Paine, and David Shea – ENSR Corporation

This paper describes one of the many beneficial aspects of circulating fluidized bed (CFB) boiler projects in Pennsylvania: Wellington's Greene Energy Resource Recovery Project. The basic fuel source for this project is coal from low-grade refuse piles (gob) left over from old mining practices. The piles usually cannot support vegetation, are eyesores, have steep and unstable slopes due to erosion, catch on fire and burn for years, and lead to abandoned mine drainage that threatens water supplies. The commercial entities that created the waste piles are no longer in operation, and it remains for the government to clean up the piles, although at a combined estimated cost of \$15 billion, according to the Pennsylvania Department of Environmental Protection's Mining and Reclamation Advisory Board. At this cost, the process of cleaning up the piles will last for decades, if not centuries. The proposed project will clean up 3000 acres of gob and save taxpayers over \$200 million of the cleanup cost.

The existing local gob piles in Greene and adjacent counties are an ongoing source of pollutant emissions caused when they sporadically smolder due to built up heat and spontaneous combustion, lightning or other natural causes. This paper describes how gob SO₂ emissions are quantified from site-specific testing, and it describes the benefits of eliminating the air pollution impacts of the burning gob piles by a CFB boiler project proposed in Greene County, PA, which more than offsets (especially over the life of the proposed project) the SO₂ pollutant emissions of the project. The local communities are very supportive of the project due to the elimination of the gob piles and their adverse environmental aspects. In addition, the Federal Land Managers should find cause to support the project as well.

b. Regional Haze and PM_{2.5} Aerosols in Minnesota, Wisconsin, Michigan, and Southern Ontario

Thomas F. Lavery – Thielsch Engineering, Inc.; Christopher M. Rogers - MACTEC Engineering & Consulting, Inc.

Measurements from eight monitoring networks (CASTNet, IMPROVE, NADP/NTN, NPS, CAPMoN, Ontario Ministry of the Environment, Environment Canada, EPA/AQS) and from several tribes and tribal organizations were merged into a database that was used to analyze regional haze in the upper Midwest and Ontario. Aerosol measurements were used to reconstruct deciview (dv) values for each 24-hour measurement. The best visibility (lowest 20th percentile deciviews) was observed along the United States - Canadian frontier and in southern Ontario. The best 20th percentile values were less than 7.0 dv for the four Class I sites located in the region. The annual distribution of deciview values for 2002 suggests occasional haze episodes but generally good visibility. The most frequent deciview values were 14, 12, and 10. 14 deciviews is roughly equivalent to a visual range of 100 km. The reconstructed deciview values show that anthropogenic pollutants contribute

significantly on the worst visibility days. Sulfate and nitrate are the principal contributors for the worst 20th percentile values. Organic carbon (OC) is a relatively minor contributor for these days. On the other hand, OC contributes significantly to the high PM_{2.5} mass measurements. Sulfate and OC are the major contributors to haze on good visibility days (best 20th percentile values). Rayleigh scattering contributes roughly 25 percent of the light extinction for the best days for most sites and about 50 percent of the extinction for the Class I sites.

c. Use of a Full-Science 3-D Photochemical Grid Model to Address the BART Visibility Modeling Requirements

Ralph Morris, Gary Wilson and Greg Yarwood – ENVIRON International Corporation; Kirk Baker and Mike Koerber – Lake Michigan Air Directors Consortium

In May 2004 EPA issued a proposed rule that addresses the Regional Haze Rule (RHR) requirements to install Best Available Retrofit Technology (BART) controls on specific sources that are shown to contribute to visibility impairment at Federally mandated Class I areas. EPA proposes that the CALPUFF modeling system be used to assess whether a potential BART-eligible source may reasonably be anticipated to cause or contribute to any visibility impairment at a Class I area and to assess the visibility improvements due to the implementation of BART controls. Visibility impairment due to emissions from potential BART-eligible sources would be primarily due to secondarily formed sulfate and nitrate fine particulate species. The CALPUFF sulfate and nitrate formation mechanism is highly simplified, neglects many important processes and was developed over two decades ago. One-atmosphere three-dimensional photochemical grid models that incorporate credible aerosol science modules have been run for annual cycles to estimate fine particulate matter (PM) concentrations across the continental US. In one such model, the Comprehensive Air-quality Model with extensions (CAMx), a PM Source Apportionment Technology (PSAT) has been implemented to efficiently and accurately provide PM source apportionment within the 3-D photochemical grid model framework. This paper shows how the CAMx/PSAT source apportionment approach can be used to address the modeling requirements of the proposed BART Rule invoking full-science photochemistry and aerosol chemistry to estimate the visibility contributions of potential BART-eligible sources at Class I areas in the Midwestern US. CAMx/PSAT is applied for a year for potential BART-eligible sources in the Midwest. The fine particulate concentrations and resultant visibility impacts at nearby Class I areas are estimated using the PM source apportionment modeling results.

d. Gazing into the Crystal Ball: Source-Specific Regional Haze BART Assessments

Robert Paine and David Heinold – ENSR Corporation

EPA re-proposed the regional haze BART guidelines on April 15, 2004, requiring older individual stationary sources in 26 industrial categories to be evaluated for installation of Best Available Retrofit Technology, known as BART. Affected sources will only have to the end of 2006 to influence their fate, some using sophisticated and controversial EPA and Federal Land Manager methods for long-range atmospheric dispersion and transport modeling. Any source that is "reasonably anticipated to cause or contribute" to regional haze in any of the 156 PSD Class I areas in 36 states and territories will be subject to BART, which must be installed and operating in the 2014-2015 time frame. Many states will allow individual sources to perform their own BART eligibility review in the 2005-2006m time frame, which could require CALPUFFatmospheric dispersion modeling to determine contributions to regional haze. These studies will need to be performed between mid 2005 and early 2006. The paper reviews various aspects of the proposed rule as it pertains to source-specific regional haze assessments. For a sample coal-fired boiler, the authors present the results of applying several alternative assessment methods, including those with special refined methods. They also discuss the use of CALPUFF modeling to determine the relative benefits of various BART choices, so as to demonstrate the viability of a less expensive application of BART. In this case, the burden is on the source operator to demonstrate that the proposed choice of BART is not appreciably different in reducing regional haze than alternative, more expensive choices for BART.

e. EPA's Ongoing Efforts To Implement Regional Haze Rules – Are They Becoming Any Clearer?

Paul M. Seby – Friedlob Sanderson Paulson & Tourtillott, LLC

Congress first addressed the problem of visibility impairment at the nation's 156 mandatory Class I areas (certain national parks and wilderness areas) in 1977, in amendments to the federal Clean Air Act (CAA). In addition to the broad set of tools a state can employ to implement a long-term "reasonable progress" visibility strategy, Congress required states to specifically address possible visibility impairment caused by certain large stationary sources. That CAA provision is known as "Best Available Retrofit Technology" (BART). With respect to regional haze/visibility regulatory initiatives, Mr. Seby's presentation will focus on the following elements:

A. U. S. Court of Appeals Decision Invalidating Major Elements of EPA's 1999 RHR in the 2002 American Corn Growers Decision:

- Court rejected EPA's "Collective Contribution" requirements for states to determine whether a BART source is "reasonably anticipated to cause or contribute" to regional haze.
- Court rejected EPA's "bifurcation" requirement that states must assess relevant costs separate from the degree of visibility improvement associated with BART controls.
- "Under EPA's take on the statute, it is therefore entirely possible that a [BART] source may be forced to spend millions of dollars for new technology that will have no appreciable effect on the haze in any Class I area."

B. CEED v EPA – Pending U.S. Court of Appeals Review of RHR "Better than BART" Cap and Trade Program

- Was EPA's ANNEX Rule developed using the same Group-BART approach invalidated by American Corn Growers?
- Does EPA properly think BART is "Optional" and that it can do "Group BART" as a "reasonable progress" requirement instead?

C. EPA's Currently Proposed Clean Air Interstate Rule (CAIR) For Mid-West and Eastern States

- Relation to CAA Visibility Requirements?

D. EPA's Currently Re-proposed Haze Rule/BART Guidelines

1. New RHR SIP Submittal deadline would be January 31, 2008
2. EPA's proposed BART process: a. EPA's three "options" for states to identify "source subject to BART"
 - New ideas or more of the same?b. Proposed BART determination process (a/k/a "How EPA wants states to use the five (5) BART factors"):
 - Isn't this a "Visibility Protection" program?
 - Why does EPA want "presumptive" BART levels before the visibility improvement factor is ever considered?
3. Has EPA made an unrepentant response to D.C. Circuit's American Corn Growers remand?

f. The Contribution of Electricity Generating Units to Regional Haze Modeling Inventories

Frank Divita, Stephen Roe, Randy Strait - E.H. Pechan & Associates, Inc.

E.H. Pechan & Associates Inc. (Pechan) was the lead contractor in the development of the regional haze modeling inventories for the Mid-Atlantic - Northeast Visibility Union (MANE-VU) and Central Regional Air Planning Association (CENRAP). These inventories are currently being used to conduct regional haze modeling in these regions and will likely serve as the starting point for modeling fine particulate matter (PM) formation within these areas. Pechan and its subcontractor, the Carolina Environmental Program (CEP, developed these inventories for the 2002 base year. The inventories include emissions from all sectors: point, area, nonroad, and onroad. Emissions for the following criteria pollutants and precursors are included: volatile organic compounds (VOC), oxides of nitrogen (NOx), PM less than 10 microns (PM10), PM less than 2.5 microns (PM2.5), sulfur dioxide (SO2), carbon monoxide (CO), and ammonia. This paper explores the contributions of electricity generating units (EGUs) to regional inventories of the important regional haze and fine PM pollutants. These pollutants include SO2, NOx, PM2.5, and ammonia. In addition, information is provided on the EGU contributions of organic carbon and elemental carbon. Areas for inventory improvement will also be covered.

D5 Emerging Issues/EMIS & Water Tuesday; 1-3pm

Chair: Richard Cogen – Nixon Peabody, LLP

a. Negotiating Clean Water Act Section 316(b) Conditions in SPDES Permits for Phase II Existing Facilities

Richard Cogen – Nixon Peabody, LLP

This paper will review EPA's final regulations for cooling water intake structures for Phase II existing power generating facilities (40 CFR Part 125, Subpart J), which were promulgated on July 9, 2004. Those regulations will become applicable to hundreds of existing power generating facilities for the first time during their next SPDES permit renewal cycles, and could require significant changes in facility design and operation. This paper will provide practical suggestions for how to address those regulations during the renewal process, including suggestions on the negotiation of permit conditions to address the requirements of the regulations.

b. DOE/NETL's Water Management R&D Program - Responding to Emerging Power Plant Water Issues

Jeffrey W. Hoffmann, Thomas J. Feeley III and Barbara A. Carney – U.S. DOE-NETL

Electricity production requires a reliable and predictable source of water, a resource that is in limited supply in parts of the United States and much of the world. The process of thermoelectric generation from fossil fuels is water intensive. In fact, each kWh generated requires on average approximately 25 gallons of water to produce, primarily for cooling. Power plants are second only to agriculture as the largest domestic user of freshwater, accounting for 39% of all freshwater withdrawals in the nation. It is becoming increasingly apparent that the demand for water by the electric-utility sector will compete with demands from other sectors of the economy. While it is likely that any large new thermoelectric generating unit will employ a wet cooling system, most likely a recirculating system with significantly lower withdrawal rates than older once-through systems, the new units will need to have permitted access to adequate water supplies. Recently, the media has reported several cases of permits being denied, at least in part, because of limited water availability. Additionally, it has been reported that existing plants have had to curtail or halt generation due to adverse water availability or water quality conditions. The US Department of Energy's National Energy Technology Laboratory (DOE/NETL) has initiated a research and development (R&D) effort directed at technologies and approaches to better manage how power plants and other energy-related projects use and affect freshwater resources. This paper will discuss the status of several DOE/NETL projects focused on the potential use of impaired waters from the production of fossil fuels - coal, oil, and natural gas - as a source of cooling water for power plants and on the recovery and reuse of water from the flue gas of coal-fired electric utility boilers.

c. Optimizing Investments in Sustainable Technologies: Incorporating Co and Dis-Benefits into Decision-Making - Bruce Dudley – The Delphi Group

Environmental technologies are touted as an increasingly important component of global efforts to address numerous environmental issues such as climate change and air quality to name but a few. Investment in the development, commercialization and implementation of these technologies is a key component of National strategies to develop environmental industries for domestic and international markets. In light of this it is important now, more than ever to take a multi-pollutant perspective on technology evaluation and verification as a means of making investment decisions in research & development, commercialization and purchasing. Co and dis-benefits refer to the other impacts of a technology or policy that may result from use or implementation. The Delphi Group has been working with the Federal government in Canada to develop a process that more fully considers the implications of these impacts associated with technologies to reduce greenhouse gas (GHG) technologies however the concept has a much broader implication for improved decision making. This approach, over the long term will provide another piece of the puzzle in the effort to contribute to the long-term sustainability of environmental technology investment.

d. Choosing the Right EMIS: Maximizing Value While Minimizing IT Risk

Keith Modesitt, CCSE - Perillon Software, Inc.

With the increasing demand to manage EH&S compliance data, industry has several choices for purchasing commercial EMIS solutions to meet this demand. As the number of EMIS choices grows annually, the confusion as to which EMIS solution meets the needs of the users and the requirements of the IT department also grows. This presentation covers the most important aspects of selecting a commercial EMIS or expanding your homegrown EMIS. Factors such as dynamic EH&S compliance requirements, database integration, internationalization, data security, and return on investment are but some of the topics covered.

e. Integrating Handheld Visible Emissions Tool with an Environmental Management Information System (EMIS). A Case Study: Westar Energy

Khal Rabadi, Nicolas Johnson - Trinity Consultants; Dan Wilkus, Craig Swartzendruber - Westar Energy

As more Title V permits are being issued for power plants across the nation, power plant environmental staff face the potentially daunting task of testing and recording visible emissions from various sources in order to demonstrate compliance. A power plant environmental department must be able to track ongoing permit compliance as well as have supporting documentation to aid the facility's responsible official in completing annual compliance certifications with a reasonable level of assurance. This paper will discuss a case study of integrating a handheld visible emissions tool with an Environmental Management Information System (EMIS) at Westar Energy. This integration provides employees at the company's corporate location the ability to monitor visible emissions inspections on a real-time basis, as well as generate reports to help demonstrate compliance. The paper will provide brief descriptions of the handheld visible emissions tool and the EMIS application, an overview of the integration process, a discussion of the technological issues, and focus on specific implementation hurdles. Successes and lessons learned from this project will be summarized in this paper through a discussion of the integration process from inception through the completion of the visible emissions reports for the power plants.

f. Beginning-of-Pipe EIS: How Proactive Utilities Are Reducing Their Toxic Footprint

Mark Wysong - Dolphin Software, Inc

Since adoption of the Pollution Prevention Act of 1990, much has been done in the U.S. to foster so-called "pollution prevention" (P2). In the 21st century, the most forward-looking utilities are now finding new ways to leverage their EIS/EMIS motions to drive further "toxics use reduction." Effectively reducing the toxic chemical count stored globally throughout each utility enterprise entails implementing a broad ranging, intentionally proactive chemical management strategy. Elements of such an EIS-related total chemical management program include accurately gauging chemical inventories (what is truly on the shelves), controlling site-specific purchases through the EIS database, implementing material request and approval checks and balances, recognition of environmental "watch-lists" and disallowed materials, and other information-driven "best practices." This presentation gives a simple-to-understand overview of effective principals now being implemented to reduce the toxic footprint among environmentally conscious U.S. utilities in the field today.

D6 Multi-Pollutant Control Technology Tuesday; 3:30-6pm

Chairs: Cathy Summers – DOE

Larry Swanson – GE Energy

a. Integrated Pollutant Removal: Modeling and Experimentation

T.L. Ochs, D.B. Oryshchyn, and C.A. Summers, US DOE - Albany Research Center

Experimental and computational work at the Albany Research Center, USDOE is investigating an integrated pollutant removal (IPR) process which removes all pollutants from flue gas, including SOX, NOX, particulates, CO₂, and Hg. In combination with flue-gas recirculation, heat recovery, and oxy-fuel combustion, the process produces solid, gas, and liquid waste streams. The gas exhaust stream comprises O₂ and N₂. Liquid streams contain H₂O, SOX, NOX, and CO₂. Computer modeling and low to moderate-pressure experimentation are defining system chemistry

with respect to SOX and H2O as well as heat and mass transfer for the IPR process.

b. VOC/HAP Mitigation Using a Combustion Turbine

William Partanen, P.E. – Neill and Gunter, Incorporated

The AMANI System: A Turbine Based Pollution Control Device That Provides a Return on Investment. Using gas turbines to destroy VOC/HAPs is an innovative technology and is based upon a system that has been in continuous operations at a chemical plant in Holland since 1999. Because gas turbines consume very large quantities of air, they are particularly well suited for consuming low concentrations of VOC/HAP emissions provided the turbine has the right time, temperature and turbulence relationship. Because this system can provide the host facility with both thermal and electrical energy, it can provide a very attractive Return-on-Investment for the host facility. This paper discusses the Amani System; testing done on a broad range of VOC/HAP's and mixtures; provides destruction efficiency curves for each of these materials tested and compares the economics of the Amani System as compared to conventional VOC/HAP destruction technologies.

c. Use of Ammonia Flue Gas Conditioning to Control SO3 Emissions and Stack Plume

Jeffery M. Russell and Jeffrey S. Gratz – MPR Associates, Inc.; Shawn E. Smith and Kevin P. Panzino – Reliant Energy, Cheswick Station

Cheswick Station (605 Mw) experienced significant load limitations following the installation of an SCR due to the impact of excessive SO3 emissions. The SO3 emissions affected both the operation of the electrostatic precipitator and resulting in unacceptable stack emissions. In addition, ammonia bisulfate deposits on the induced draft fans extended several forced outages. Based on detailed flue gas testing at several locations, including the stack, unit performance was restored through treatment of the flue gas using the existing ammonia flue gas conditioning system. The distribution of the ammonia injection was modified to off-set the effect of flue gas temperature distribution existing the Ljungstrom air preheaters. The factors affecting ammonia bisulfate formation are discussed based on their impact on the development of effective ammonia flue gas conditioning to mitigate the adverse impact of excessive SO3.

d. Performance of the Indigo Bi-Polar Agglomerator at Plant Watson

Robert R. Crynack – Indigo Technologies, LLC

The Indigo Bi-Polar Agglomerator is a unique particulate control device. Installed ahead of an existing ESP, it charges half the particles positively and half the particles negatively. When mixed together, electrostatic, diffusion, van der Waal forces bring the particles together and hold them together, resulting in a significant agglomeration of the finer particles with the coarser ones. A full scale demonstration Agglomerator has been installed at Mississippi Power's Plant Watson for almost two years on the 250 MW Unit #4. This paper presents the results of mass emissions, particle size, and opacity measurements under various operating conditions while burning various coals. The concentration of particles less than 5 micron in diameter out of the Agglomerator is reduced by at least one half the original inlet concentration. Some particle sizes are reduced by as much as seven fold. In addition to agglomerating the particles and making them easier for the ESP to collect, the reduced concentration of the finer particles reduces the corona quenching effect in the ESP inlet fields. This results in further improvements in the ESP corona power, and ultimately, ESP efficiency and stack opacity. Test results include data showing a 40% reduction in mass emissions and a 70% reduction in opacity.

e. Magnesium Enhanced Lime FGD and SO3, Hg, and CO2 Emissions

Kevin Smith, Lew Benson and Michael Schrock – Carmeuse North America

Magnesium enhanced lime (MEL) flue gas desulfurization is well known for economical and high removal of SO2 while producing byproduct gypsum and magnesium hydroxide. While byproduct gypsum produced in the MEL process is used in production of gypsum wallboard just like limestone gypsum, byproduct magnesium hydroxide has been demonstrated to be very useful to mitigate SO3 and mercury emissions while at the same time holding the potential to improve station heat rate. Additionally an analysis comparing overall CO2 emissions between MEL and LSFO FGD systems indicate MEL FGD can help a power station emit significantly lower CO2 emissions than

LSFO even when taking lime production into consideration. This paper will discuss the overall economic impact that the MEL FGD process and use of byproduct magnesium hydroxide recovery has on a station's overall flue gas treatment costs.

f. Emissions Control Technologies for Steam Turbine Upgrades: A Value Story

Larry Swanson, David Moyeda, and Randy Seeker – GE Energy

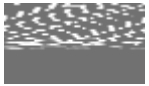
Integrating emissions control technologies with a steam turbine upgrade can be a viable strategy for increasing electricity revenue while holding emissions within specified control limits. The increase in power revenue can fully compensate for the capital cost associated with emissions control upgrades, often yielding payback times within two years. This presentation focuses on evaluating the net present value and associated payback time for a typical steam turbine upgrade integrated with emissions control upgrades. The cost impact of operating with and without emissions credits is also examined. Using a 250 MW baseload utility, an overall value story is presented for several combinations of steam turbine upgrade operating conditions and emission control scenarios.

FREE PRE-CONFERENCE WORKSHOPS

Sunday January 23, 2005*

All Workshops are FREE for EUEC Registered Attendees EXCEPT Workshop 3.

Workshop Number	Workshop Title	Offered By	Date & Time	Location
<u>1</u>	<u>Fundamentals of Green Trading</u>		Sunday 1/23/2005 9 AM - 12 Noon	Acacia Room
<u>2</u>	<u>Permitting and Compliance Strategies for Electric Utilities</u>	Jorden Bischoff McGuire Rose & Hiser, P.L.C. Eric Hiser	Sunday 1/23/2005 12 - 5 PM	Aster Room
<u>3</u>	<u>Negotiating Permit Conditions</u>	 Gary McCutchen, RTP	Sunday (\$50 cost) 1/23/2005 9AM - 5 PM	Verbena Room
<u>4</u>	<u>Risk Management for Utilities</u>		Sunday 1/23/2005 9 AM - 12 Noon	Indigo Room
<u>5</u>	<u>GHG Tracking Workshop</u>	 Russell Bailey	Sunday 1/23/2005 1 PM - 5 PM	Indigo Room
<u>6</u>	<u>BACT Determination for Utilities</u>		Sunday 1/23/2005 9 AM - 12 Noon	Primrose Room
<u>7</u>	<u>Regional Haze BART - Guidelines and Strategies for</u>		Sunday 1/23/2005 9 AM - 12 Noon	Lantana Room

	<u>Compliance</u>			
*8	<u>Utility Mercury Tutorial</u>		Monday 1/24/2005 7 PM - 9 PM	Grand Ballroom 1
*9	<u>Financing and Value Enhancements for Renewable Energy Projects</u>	 Douglas A. McWilliams	Tuesday 1/25/2005 7 PM - 9 PM	Grand Ballroom 1
10	<u>Section 316(b) of the Clean Water Act - Phase II Compliance Strategies</u>		Sunday 1/23/2005 1PM - 5 PM	Lantana Room

1 Fundamentals of Green Trading

Presented By: Global Change Associates, Trexler Climate Services, and DNV Certification
Sunday 9am to 12 Noon (Acacia Room)

Objective: Learn how the new Commodity Markets for Greenhouse Gases, RECs, and energy efficiency place financial value on environmental benefits.

Participant Benefits: With Kyoto ratification on February 16, 2005, with 28 states considering greenhouse gas reductions and with 19 states implementing Renewable Portfolio Standards, it is imperative that decision makers and operations personnel be up to speed on the emerging environmental financial markets. Learn new business strategies, develop collaborations, and cultivate new relationships with individuals and companies in the capital markets. Learn how to set up credible emissions reduction projects, which are verifiable, and potentially transferable into the capital markets

Workshop Description: The triple convergence of new commodity markets for carbon (greenhouse gases), renewable energy credits, and energy efficiency are increasingly being integrated with the capital markets for emissions trading. New products are being developed that can place financial value on environmental benefits. The ½ day workshop will provide specific training and introductory background information which will assist the participants in the mastery of market-oriented emissions trading. The workshop will demonstrate how these new mechanisms, especially those related to greenhouse gases, can lead to substantial increases in income.

The workshop outline includes topics on:

- (1) Why Environmental Markets Work,
- (2) What are the Emerging Environmental and Energy Markets,
- (3) Risk Management,
- (4) Development of tools for forward price curves for carbon dioxide and renewable energy credits
- (5) Carbon Measurement, Verification, and Certification, and
- (6) Project data control and baseline auditing.

ABOUT THE INSTRUCTORS

PETER FUSARO has 30 years experience in the energy industry and is a world expert on environmental trading and energy risk management. He is Chairman and Founder of Global Change Associates, an energy and environmental consulting firm based in New York City. He is a frequent speaker at worldwide energy and environmental conferences and is the author of eleven books and many papers, including Green Trading: The Next Financial Market and the New York Times paperback bestseller What Went Wrong at Enron. Mr. Fusaro has a BA from Carnegie-Mellon University and an MA in International Relations from Tufts University. To reach his firm's website, visit www.global-change.com.

DR. MARK C. TREXLER is president of TC+ES and has more than 20 years of energy and environmental experience. Prior to TC+ES, Dr. Trexler was part of the Climate, Energy, and Pollution Program of the WRI in Washington, DC

where he managed technical analysis for the first large-scale corporate climate change mitigation project. Dr. Trexler is a frequent speaker on climate change policy and has published extensively on climate change mitigation. He has served as a lead author for the Intergovernmental Panel on Climate Change (IPCC) and is a member of the Scientific and Technical Advisory Panel of the Global Environmental Facility and has worked for the United Nations Development Programme in 15 countries. Dr. Trexler holds Ph.D. and M.P.P. degrees in Public Policy from the University of California at Berkeley and a B.A. in Biology from Antioch College in Yellow Springs, Ohio.

RUSSELL THORNTON is Managing Director, Climate Change and Corporate Social Responsibility Services for Det Norske Veritas Certification, Inc. He is lead greenhouse gas verifier, lead ISO 14001 assessor, and safety auditor. Mr. Thornton has over 15 years of experience in environmental and risk management consulting, training, and auditing. He has published numerous articles and papers on environmental risk and management systems. Russell V. Thornton (Russ) Managing Director, Climate Change and CSR Services
www.dnvcert.com or www.dnv.com/certification/climatechange

2 Permitting and Compliance Strategies for Electric Utilities

Presented by Eric Hiser
Sunday 12 Noon to 5 PM (Aster Room)

Jorden Bischoff McGuire Rose & Hiser, P.L.C.
7272 East Indian School Road, Suite 205
Scottsdale, AZ 8525
Phone: (480) 505-3929
Fax: (480) 505-3901

This seminar will provide participants with critical information on new developments in clean air regulation, technology, permitting requirements, review of regulatory & statutory provisions, regulatory guidance documents essential for cost-effective compliance and operational flexibility, and the status of electric utilities as a continuing "enforcement priority" for the EPA.

- 12:00 NAAQS and SIP Regulation:** Overview of the national ambient air quality standards (NAAQS) and the regulation of criteria pollutants under the Clean Air Act. It will cover recent initiatives in the regulatory and legislative arenas specifically affecting nitrogen oxides and sulfur dioxide. This section will also address the recent uncertainty regarding the status of particulate matter and ozone regulation.
- 1:00 New Source Review (NSR), NSPS and PSD** A review of the challenges presented by the NSR and PSD programs and the triggers and permitting scheme. It will present the regulatory regime and potential reforms that may affect the electric utilities.
- 1:45 Regional Haze and Visibility:** This section will identify the consequences of the recent regional haze rule on state implementation plans and electric utilities as well as a treatment of the implementation plan submitted to the EPA by the Western Regional Air Partnership.
- 2:00 Title IV: Acid Rain:** Discusses the principles of the acid rain scheme, the trading program, and the permitting requirements for the acid rain as they affect electric utilities, including trends and recent developments.
- 2:30 Title V: Operating Permits:** Reviews fundamental concepts of permitting under the operating permit. Explores issues such as potential-to-emit and what regulatory flexibility exists as these permits apply to electric utilities.
- 3:15 Permitting Compliance Strategies:** Examines options in permits through strategic initiatives that allow for optimal performance and compliance.
- 4:00 Enforcement Initiatives and Environmental Management Strategies:** Explore the recent trends of enforcement and the EPA's priorities for enforcement. This section will examine proactive solutions such as environmental management systems.
- 4:30 Adjourn**

3 Negotiating Permit Conditions - How Good Companies End Up With Bad Permits and What They Can Do About It

COST: \$50

Presented by Gary McCutchen, RTP Environmental Consultants, and
Richard M. Cogen & Scott M. Turner; Nixon Peabody, LLP
Sunday 9AM to 5PM (Verbena Room)

Name at least 3 likely concerns a permittee should have with the following condition:

Emissions of PM-10 from the boiler shall not exceed 106 lb/hour.
(You'll learn about this and other problem permit terms at the workshop.)

Unauthorized and unnecessary permit terms and conditions, most carried forward from New Source Review (NSR) construction permits into Title V operating permits, can easily have direct costs of several hundreds of thousands of dollars per year. The potential liability of penalties for exceeding these unneeded limits, of course, is in the millions of dollars, yet few facilities realize the extent of these possible costs or how to address the limits. This workshop, using real permit examples, will show you how to recognize the types of limits you have, whether the limits are authorized, what your legal rights are, and how to go about getting unnecessary conditions removed.

AGENDA:

1. Welcome / Introductions;
2. Air Permit Workshop Overview
3. **Permittee Legal Rights and Recourse**
 - a. **New Source Review (NSR) permits**
 - i. During processing; ii. Administrative Appeals; iii. Judicial Appeals; iv. Right to accept permit and challenge later (dealing with delays)
 - b. **Title V permits**
 - i. Initial permit; ii. Revisions and renewals; iii. Effect on NSR permits
 - c. Steps to take to protect your ability to challenge terms and conditions
4. **Recognizing dangerous permit terms--RTP**
 - a. Unauthorized terms; b. Unnecessary terms (redundant, etc.); c. Too stringent emission limits
 - i. Numerical limit; ii. Short averaging time
5. **Recent enforcement and court actions: a summary**
 - a. **Types of alleged violations: what they mean to you**
 - i. Civil ; ii. Criminal; iii. Section 114 letters;
 - iv. **The "we think you're guilty, so come in and tell us what you've done" letter**
 - b. Parties involved (agency, source)
 - c. Type of limit at issue
 - d. Who won and implications for others
 - e. Agency versus agency
 - i. Alaska BACT-Supreme Court decision; ii. EPA objection letters
6. **Ideal Air Permits**
 - a. Sustainable emission limits
 - b. No production, operating hour, or raw material/fuel limits unless voluntary surrogates for emissions
 - c. Minimum necessary number of terms and conditions
 - i. Voluntary limits; ii. Regulatory limits; iii. No unauthorized limits
 - d. Clear and concise
7. **Using EPA policy effectively**
 - a. General: i. White Papers; ii. Other policy documents
 - b. Specific: i. Incorporating / Citing Applicable Rules
8. **Analyzing and Dealing with Existing Permit Terms**
 - a. The three basic types of permit limits
 - i. Purpose of limit; ii. Appropriate averaging time
 - b. Establishing priorities: i. Can't get everything; ii. How to establish priorities on permit revisions
 - c. Arguing against: i. Redundant permit conditions; ii. Unnecessary permit conditions; iii. Too-short averaging times
 - d. Specifying federal- and state-only enforceability
9. **Setting (or revising) emission limits: an objective approach using limited data**
 - a. Safety margins are acceptable to EPA ; b. Objective approach to setting limits with safety margins
 - i. Removing outliers; ii. Establishing the limit and averaging time
10. **Monitoring requirements: hidden costs, double jeopardy**

- a. What's required/court decisions
- b. Compliance Assurance Monitoring
- c. Periodic Monitoring/gap filling
- i. Credible Evidence Issues; ii. Use of Surrogate Parameters
- d. Recordkeeping & Reporting
- e. Compliance Certifications

11. Permit Revision Process

12. Permit Revisions and Renewals - Keeping What You Won

13. Overview: When you need an attorney

- a. What are the warning signs that indicate possible legal problems ahead?
- b. What role does an attorney play in getting you better permit terms?
- c. Do you need an attorney in the administrative appeal process?
- d. Should an attorney be at meetings where you discuss the permit terms that concern you with the agency?
- e. When do documents/communications need to be attorney-client privileged?
- f. Do I need a record retention policy?

Nixon Peabody LLP
Clinton Square, Suite 1300
P.O. Box 31051 Rochester, NY 14603-1051

4 Risk Management for Electric Utilities

Presented By RW Beck
Sunday 9AM to 12 Noon (Indigo Room)

Management consulting and engineering firm, R. W. Beck combines its environmental knowledge and enterprise risk management expertise to provide a half-day seminar for plant managers, utility operators and others in the power industry. This workshop will provide attendees with an understanding of future environmental regulations, potential retrofit costs, allowance price formation, and environmental risk management decision tools. The benefit to those who attend the workshop will be a better understanding of the process involved in making compliance decisions. Additionally, this process allows utilities to understand future environmental costs and the risk around those decisions.

The workshop will start with a thorough review of the regulatory environment presented by **Bill Stark, Senior Environmental Engineer of R. W. Beck**, topics will include the following:

- Pending and Proposed Regulations
- Emission Control Retrofits and Expected Costs
- Additional Compliance Considerations and Alternatives

Jean Agras, PhD, Senior Consultant with R. W. Beck, will present a state of the art fundamental model which includes the latest in environmental regulations affecting market mechanics. Topics will include:

- Regional marginal cost of reducing emissions
- Price setting mechanism for allowances
- Effect of new regulations on allowance price
- Role of allowance trading in a dispatch model

Jay Lindgren, PhD, Head Quantitative Analyst at R. W. Beck, will discuss the role of risk management in determining project decisions affected by changes in the regulatory environment. One thing remains certain about the future - it will be different in ways we can not anticipate. This presentation will cover how uncertainty can be included in decision making:

- Uncertain environmental regulations
- Uncertain retrofit costs
- Volatile energy prices and loads
- Estimating your EVaR (Environmental Value at Risk)
- Managing your risk

Finally, R. W. Beck's Consultant come together to take participants through an example that will incorporate volatility to look at a range of outcomes and tools to evaluate the potential changes.

5 Greenhouse Gas Tracking Workshop

Presented By Katherine Blue, Managing Consultant , Trinity Consultants
Sunday 1PM to 5 PM (Indigo Room)

Many companies are beginning to address greenhouse gas (GHG) emissions as part of a proactive environmental management strategy. In addition, consistent gathering and processing of GHG emissions data can be challenging. Effective inventory strategies and data management systems allow companies to streamline the annual data collection process, store valuable emissions and emissions reduction data, track trends and changes in estimation methodology, compare the effects of adopting differing quantification protocols, and create reports. Attend our information-packed workshop to learn how to manage GHG emissions and leverage available tools to manage the data collection and analysis burden. Topics include:

- Updates on regulatory developments, nationally and internationally
 - Review of voluntary programs and initiatives
 - Best practices and requirements for planning and executing a GHG inventory for your company
 - Effective GHG data gathering, processing, and analysis
 - Overview of specific software packages that are used to manage GHG data
-

6 BACT Determination for Utilities

Presented by Burns & McDonnell
Sunday 9 AM to 12 PM (Primrose Room)

Topics:

- " Overview/history of BACT
- " Review of definition and intent of BACT requirement in 40 CFR 52.21
- " Status of NSR court case
- " Discussion of BACT interpretations and precedent
- " Netting Emissions - Avoiding PSD Review
- " Effect of coal sulfur content on BACT
- " Recent BACT Trends (NO_x, SO₂, PM₁₀) - Limits and Technologies
- " Permit limits vs. emission limits achievable in practice and their relation to BACT
- " Discussion of the case-by-case nature of BACT
- " PC vs CFB vs IGCC
- " Case Studies
- " Permitting Pitfalls - Negotiating Permit Conditions
- " Making sure you can live with your permit

Who should attend: Anyone planning to build or modify an electric generating facility. Environmental managers, Utility planners, anyone involved with BACT determinations.

Details: This workshop will start with a review of the definition of BACT and significant policy interpretations that have affected the BACT process. Procedures for netting emissions will be reviewed to identify ways to avoid BACT review.

The scope of this workshop will include a review of the Top Down process, and how this is applied to each pollutant being considered. The role of the permitting authority, EPA, the National Park Service, the public, and other interested agencies and environmental groups, will be discussed and key factors in developing a permitting strategy will be identified. Since BACT is a case-by-case determination, inherent in the process is education of the permitting authority and others with key roles in the permitting process. Key questions will be discussed including "Can the BACT emission limit drive the combustion technology or fuel source selection, or is IGCC BACT?"

Recent BACT determinations will be reviewed and trends will be identified. This will include lessons learned regarding the identification of the pool of units to be used for the BACT determination, including Freedom of Information Act

(FOIA) requests and how to compare with international data. The definition of "achievable" technology will be discussed. For example, does a unit that has not yet started operation represent "achievable" technology? The lowest emitting units for each pollutant that are operating and the lowest emission limits proposed in submitted applications will be identified.

Factors involved in the case-by-case determination including the economic analysis will be presented. Factors that are important in negotiating emission limits will be identified, including vendor guarantees, compliance demonstration, averaging periods, variability of fuel quality, start-up/shutdown, low load operation, and fuel blending.

Instructors:

Robynn Andracssek, Burns & McDonnell, Senior Environmental Engineer
Karen Burchardt, Burns & McDonnell, Staff Environmental Engineer
David Gaige, Burns & McDonnell, Environmental Project Manager
Carl Weilert, Burns & McDonnell, Environmental Systems

7 Regional Haze BART - Guidelines and Strategies for Compliance

Presented By ENSR
Sunday 9 AM to 12 PM (Lantana Room)

The regional haze rule requires older power plants to be evaluated for installation of Best Available Retrofit Technology, known as BART. The new EPA BART guidelines provide an opportunity for affected sources to influence their compliance requirements through the application of sophisticated and controversial EPA and DOI methods for long-range atmospheric dispersion and transport modeling.

This workshop will cover the following topics:

- Key provisions of the BART guidelines.
- Modeling procedures for evaluating exemption from BART requirements.
- The features and characteristics of the required modeling applications.
- Strategies for incorporating model results into BART determinations.
- Evaluating the effectiveness of control alternatives or emissions trading options.
- Other initiatives for emission reductions that interact with BART
- The various State approaches to implementing the guidelines.

The workshop is intended for environmental and plant managers with compliance responsibility for regional haze BART determinations.

Lead Instructor: Mr. Robert Paine, CCM. ENSR International (bpaine@ensr.com), 978 589-3164. Mr. Paine has 30 years of experience in atmospheric dispersion modeling and has been instrumental in the evaluation of power plant regional haze impacts in more than 50 modeling studies for more than 30 PSD Class I areas across the United States, applying the CALPUFF model under the DOI FLAG guidance. Mr. Paine has also reviewed specific retrofit alternatives and their effectiveness on visibility improvement for individual Class I areas.

8 Utility Mercury Tutorial

Presented By Sorbent Technologies
Monday, 1/24/2005 7pm - 9pm (Grand Ball Room 1)

Sid Nelson Jr., President, Sorbent Technologies

Scott Renninger, Mercury Control Specialist, Babcock & Wilcox, (formerly of DOE NETL)

This workshop will be a general tutorial on utility mercury emissions and their control. Both sorbent injection technology options and FGD-related mercury control will be covered in detail. Emphases will be on the results of past full-scale control demonstrations and the associated control costs expected. Additional topics to be covered include mercury in coal purchasing, mercury measurement, and related fly ash disposal issues.

9 Show Me the Money: Financing, Incentives and Revenue Streams for Renewable Energy Projects

Presented By: Douglas A. McWilliams, Squire, Sanders & Dempsey L.L.P.

Tuesday, 1/25/2005 7pm - 9pm (Grand Ball Room 1)

Companies seeking to finance power projects utilizing renewable resources face both special opportunities and challenges. For example, tax and other incentives continue to evolve at the federal, state and municipal levels. Renewable portfolio credits and emissions reduction credits have resulted in new revenue streams that enhance the value of projects and can be used to attract improved commercial or financing terms. However, renewable energy projects, particularly those based on intermittent resources such as solar and wind, carry with them certain risks not typical of power projects utilizing traditional fuel sources. Utilities, project sponsors and developers alike will want to understand better such risks and their impact on the content of power purchase agreements, the availability of financing, and ultimately the prospects for long term project success.

The following Presenters from the Squire Sanders' Renewable Energy Project team bring together relevant expertise in energy, project finance, tax incentives, emission trading, and environmental siting issues. Their collaborative presentation will focus on the opportunities for maximizing the economic value of renewable energy projects based on the firm's experience with some of the largest wind, solar, and ethanol projects in the world. The Presenters include:

Paul O'Hop is an expert in structuring and finance options for energy projects.

Mitch Thompson is an expert in tax incentives and other supplemental funding sources for renewable energy projects.

Douglas McWilliams is an expert in environmental credits and permitting issues.

Karen Peters is an expert in environmental siting issues relating to energy projects.

Squire, Sanders & Dempsey L.L.P.

4900 Key Tower, 127 Public Square, Cleveland, OH 44114-1304

Phone: (216) 479-8332

Fax: (216) 479-8776

dmcwilliams@ssd.com

10 Section 316(b) of the Clean Water Act - Phase II Compliance Strategies

Presented By ENSR

Sunday 1 PM to 5 PM (Lantana Room)

The 316(b) Phase II rule affects over 500 facilities and changes the way that the impingement and entertainment impacts of cooling water intake structures (CWIS) are assessed. While the rule defines specific thresholds and procedures, it also provides for considerable flexibility. This workshop will cover the following topics:

- Key provisions of the rule.
- The nature of the various studies and reports called for by the rule including their goals and the information necessary to include in them.
- A general strategy applying the rule within the context of the site-specific data.
- The compliance options in the rule including strategies for selecting among them.
- Two case studies and a compliance strategy mapped out for each one.
- Information developed during the rule-making as well as experience in rule application during 2004.

The workshop is intended for environmental and plant managers with compliance responsibility at Phase II stations. Those with responsibility for Phase III stations will also find it useful given the likely similarity between the two rules.

Lead Instructor: Mark Gerath. ENSR International (mgerath@ensr.com; 978/589-3189). Mr. Gerath is a senior specialist with 20 years experience in the water resources permitting for the power industry in 30 states and internationally. He is currently involved in five 316(b) Phase II projects for major power companies.

EXIBITING COMPANIES

Booth No	Logo	EUEC 2005 Exhibiting Companies	Contact Info
1		<u>Met One Instruments</u> is a world leader in the design and manufacture of meteorological, particulate and hydro-met monitoring instruments and systems .	1600 Washington Blvd Grant Pass, OR 97526 Ph: 541-471-7111 Fax: 541-471-7116
2		<u>Universal Analyzers</u> Inc. specializes in the manufacture of sample conditioning components for continuous, online process gas analyzers and continuous emissions monitoring systems.	1701 S. Sutro Terrace Carson City, NV 89706 Ph: 775-883-2500 Fax: 775-883-3688
3		<u>Environmental Quality Management, Inc.</u> (EQ) is an environmental engineering and remediation company headquartered in Cincinnati, Ohio.	1800 Carillon Blvd Cincinnati, OH 45240 Ph: 513-825-7500 Fax: 513-825-7495
4		<u>Terra Environmental Technologies</u> Terra, has formed strategic partnerships with a number of engineering companies, who specialise in SCR technology, in order to develop the engineering and product supply principles that ensure that NOX generating installations use the Best Available Techniques.	161 Bickfordline Courtright, Ontario, CANADA Ph: 519-867-2739 Fax: 519-867-3128
5		<u>Climatronics</u> is recognized worldwide as a leading manufacturer of high quality, dependable meteorological instrumentation and systems for accurate and reliable climate monitoring and recording as well as environmental data acquisition.	140 Wilbur Place Bohemia, NY 11716 Ph: 631-567-7300 x10 Fax: 631-567-7585
6		<u>Air Hygiene</u> International, Inc. serves as the quality standard for the stack emission testing industry, providing expert services that consistently meet and exceed our clients' expectations!	27210 Doverborrk Huffman, TX 77336 Ph: 281-324-7345 Fax: 281-324-7346
7		<u>P.S. Analytical</u> Founded in 1983, P S Analytical specialises in the determination of mercury, arsenic, selenium, antimony, tellurium and bismuth for a wide and ever-increasing range of applications.	Orpington, Kent BR5 Ph: 01689 891211 Fax: 01689 896009
8		<u>Custom Instrumentation Services Corp</u> provides complete high quality CEMS and Data Acquisition and Handling Systems (DAHS) to monitor process gases, flow, and opacity for EPA regulatory compliance and process control.	7325 S. Revere Parkway Centennial, CO 80112 Ph: 303-790-1000 Fax: 303-790-7292
9		<u>Air Sampling Associates</u> , Inc. performs stack testing for Part 75 RATA's, as well as testing for mercury using both the Ontario Hydro Method and the proposed EPA Method 324. ASAI is a company that is large enough to serve industries needs yet small enough to provide personal service.	PO Box 1175 Lewisville, TX 75067 Ph: 972-492-1400 Fax: 972-492-1402
10		<u>Scott Specialty Gases</u> is an international producer and supplier of specialty gas products and equipment.	6141 Easton Rd. Plumsteadville, PA Ph: 215-766-8867 Fax: 215-766-2476
11		<u>RTP Environmental Associates, Inc.</u> provides professional environmental consulting services to meet client needs for today and for the future. Develop timely and cost effective approaches for permit application preparation, training, modeling analyses, ambient monitoring needs, and testing and analytical services to satisfy regulatory requirements.	2031 Broadway Suite 2 Boulder, CO 80304 Ph: 303-444-6046 Fax: 303-444-8281

12	 RMB Consulting & Research, Inc. <i>Providing Environmental Consulting Services to Industry</i>	<u>RMB Consulting & Research, Inc.</u> specializes in providing consulting services to industrial clients and associated organizations.	5104 Bur Oak Circle Raleigh, NC 27612 Ph: 919-791-3120 Fax: 919-510-5104
13		<u>Burns & McDonnell's</u> more than 1,600 employee-owners represent many technical disciplines.	9400 Ward Parkway Kansas City, MO 64114 Ph: 816-333-9400 Fax: 816-333-3690
14		<u>VIM Technologies</u> was founded in February 1992 by engineers with over twenty (20) years of software development experience for programmable logic controls and host computers.	95 York Road Canton, MA 02021 Ph: 781-821-2376 Fax: 781-821-3495
15		<u>McVehil-Monnett Associates, Inc. (MMA)</u> is an experienced consulting firm of atmospheric scientists, engineers and environmental specialists providing air quality and environmental management system (EMS) services worldwide.	44 Inverness Drive East Building C Englewood, CO 80112 Ph: 303-790-1332 Fax: 303-790-7820
16		<u>Shaw Environmental</u> The Shaw Group, founded in 1987, specializes in the power generation and process industries along with the environmental and infrastructure sectors.	400 College Blvd. Overland Park, KS 66211 Ph: 913-451-1224 Fax: 913-451-2005
17		<u>DNV</u> Established in 1864, DNV is an independent foundation with the objective of safeguarding life, property and the environment and is a leading international provider of services for managing risk.	191 Johnson Road Suwanee, GA 30024 Ph: 281-721-6767 Fax: 281-721-6967
18		<u>Data Systems & Solutions</u> supplies world-class decision support systems and services that ensure the safe and efficient operation of your high value assets.	1900 W. Loop South Houston, TX 77027 Ph: 713-346-4210 Fax: 713-346-4201
19		<u>ENSR</u> Environmental consulting in 100 countries, in 40 languages, from 70 worldwide offices.	1500 2 nd Ave St. Petersburg, FL Ph: 978-589-3136
20		<u>Shell Engineering & Associates, Inc.</u> , celebrates more than 25 years as worldwide environmental management consultants with industrial and institutional facilities.	2403 West Ash Columbia, MO 65203 Ph: 573-445-0106 Fax: 573-445-0137
21		<u>TRC Companies, Inc.</u> is a customer-focused company that creates and implements sophisticated and innovative solutions to the challenges facing America's energy, transportation, environment, infrastructure, and infrastructure security markets.	Boott Mills South Lowell, MA 01852 Ph: 978-656-3668 Fax: 978-453-4215
22		<u>Opsis</u> is a global company that develops, manufactures and markets state-of-the-art, innovative systems for gas analysis and process control.	1165 Linda Vista Drive San Marcos, CA 92069 Ph: 760-752-3005 Fax: 760-752-3007
23		<u>Tetra Tech, Inc.</u> is a leading provider of consulting, engineering and technical services. With more than 8,000 associates located in the United States and internationally, the Company supports commercial and government clients in the areas of resource management and infrastructure.	1325 Airmotive Way # 200 Reno, NV 89502 Ph: 775-333-8459 Fax: 775-322-3987
24		<u>Metco Environmental</u> is the largest company in the U.S. specializing in source emissions testing.	P.O. Box 598 Addison, TX 75001 Ph: 979-553-4339 Fax: 979-553-4398
25		<u>First Environment</u> provides strategic environmental management and engineering services in the United States and abroad.	91 Fulton St. Boonton, NJ 07005 Ph: 973-334-0005 Fax: 973-334-0928

26/27		<u>Enviance</u> provides leading systems and services to industry and government for environmental data management.	2386 Faraday Ave Carlsbad, CA 92008 Ph: 760-496-0200 Fax: 760-496-0202
28		<u>Baldwin Environmental</u> is the leading manufacturer and service provider of gas sample conditioning equipment for industrial environmental monitoring and process applications.	895 E. Patriot Blvd. Reno, NV 89511 Ph: 775-850-1800 Fax: 775-850-1818
29/30		<u>Teledyne- Monitor Labs, Inc.</u> is a leading supplier of environmental monitoring instrumentation, systems and software.	Inverness Drive East Englewood, CO Ph: 800-422-1499 FAX: 303-799-4853
31		<u>California Analytical Instruments Inc</u> has been a premier provider of quality gas analyzers and systems for use in industrial, environmental and automotive emissions measurement applications for over 15 years.	1238 W. Grove Ave Orange, CA 92865 Ph: 714-974-5560 Fax: 714-921-2531
32		<u>Spectrum Systems</u> We at Spectrum Systems are proud of our reputation as a leader in providing Continuous Emissions Monitoring Services. Our company is built on an unyielding commitment to quality and service.	3410 W. Nine Mile Road Pensacola, FL 32526 Ph: 850-944-3392 Fax: 850-944-3397
33/34		<u>Thermo Environmental Instruments</u> A world leader in high-tech instruments, Thermo Electron Corporation helps life science, laboratory and industrial customers with instruments, scientific equipment, and integrated software solutions.	27 Forge Parkway Franklin, MA 02038 Ph: 508-553-6851 Fax: 508-520-1460
35		<u>Perillon</u> enables leading global industrial corporations to proactively manage their environmental risks and liabilities. These companies have improved their performance by securing corporate visibility and plant control through Perillon's technology leadership.	22 Kane Industrial Dr Hudson, MA 01749 Ph: 978-562-1418 Fax: 978-562-7086
37/38		<u>GE Power Systems</u> is a leading supplier to the energy industry. Providing a comprehensive range of solutions for oil and gas, power generation and energy management we are uniquely prepared to fulfill world demand for reliable, clean and efficient energy.	4200 Wildwood Parkway Atlanta, GA 30339 Ph: 678-844-6551 Fax: 770-859-6941
39		<u>Teledyne-Advanced Pollution Instrumentation</u> is dedicated to being the market leader in air quality products.	6565 Nancy Ridge Drive San Diego, CA 92121 Ph: 858-657-9800 Fax: 858-657-9816
40		<u>ADA-ES</u> Provides air pollution control systems, specialty chemicals, and consulting services to utility and industrial customers.	8100 South Parkway, Unit B Littleton, CO 80120 Ph: 303-734-1727 Fax: 303-734-0330
41		<u>Cemtek Systems Inc.</u> is a Continuous Emissions Monitoring System and service provider. Cemtek has a highly skilled field service department with extensive CEMS experience.	2121 S. Yale St. Santa Anna, CA 92704 Ph: 714-437-7100 Fax: 714-437-7177
42		<u>Epsilon Associates, Inc.</u> is an employee-owned engineering and environmental consulting firm based in Maynard, Massachusetts. Environmental Engineering, Modeling and Permitting Services for Generating, Transmission, Gas Pipelines, and LNG Terminals to Ongoing CEMs Support for Operating Facilities.	150 Main Street Maynard, MA 17540 Ph: 978-461-6222 Fax: 978-897-0099
43		<u>Spectra Gases Inc</u> is a manufacturer of specialty gases for high technology markets.	3434 Rt. 22 West Branchburg, NJ 08876 Ph: 908-252-9300 Fax: 908-252-0811

44		<u>Lakes Environmental</u> is committed to supply robust and easy-to-use air dispersion modeling software to consulting companies, industries, governmental agencies and academia.	450 Phillips St. Waterloo, CA Ph: 519-746-5993 Fax: 519-746-0793
45		RETEC The RETEC Group, Inc. leads the new generation of professional service firms by providing strategic environmental management services that are focused on meeting your specific business objectives.	4076 Old Town Road Shawsville, CA 92069 Ph: 540-268-1212 Fax: 540-268-1551
46		Envimetrics Formerly EEI, is committed to providing instrumentation based upon plasma technology to measure, monitor and control air pollutant emissions from a variety of industrial sources.	P.O. Box 6 Pluckmin, NJ 07978 Ph: 908-256-5033 Fax: 908-781-1607
47		Ohio Lumex is manufacturer of Continuous Emission Mercury Monitors for field "point source testing" and permanent installations. We are also proud to present our Method 324, an "on-site" analyzer for "direct" testing of sorbent tubes.	9263 Ravenna Rd Unit A-3 Twinsburg, OH Ph: 330-405-0837 Fax: 330-405-0847
48		CO2 Solution Inc is a high-tech firm involved in recycling carbon dioxide (CO2), the most important greenhouse gas. The technology it has perfected allows it to transform CO2, through biological means, into an environmental friendly material.	2750 Einstein Suite 360 Sainte-Foy QC GOA SWO Ph: 418-650-1913 Fax: 418-650-6489
49	<u>Augusta Systems</u>	<u>Augusta Systems</u> provides energy and environmental solutions to public and private sector clients, with strategic focuses on greenhouse gas (GHG) emissions management, energy assurance and security, and specialized technology applications.	3606 Collins Ferry Rd. Suite 202 Morgantown, WV 26505 Ph: 304-599-3200 Fax: 304-599-3480
50		FORNEY Corporation manufactures front-end combustion components serving the electric utilities, chemical processing, pulp/paper and cement industries. Since its inception in 1927, Forney has expanded its product line to include igniters, burners, burner management systems, flame detectors, duct burners and CEMS.	3405 Wiley Post Rd Carrollton, TX 75006 Ph: 972-458-6100 Fax: 972-458-6159
51		<u>Compliance Strategies & Solutions, Inc.</u> is an innovative company that specializes in providing compliance services and creating compliance products having superior quality for regulated facilities. CS2 Inc. works closely with customers to develop strategies and innovative solutions for environmental requirements and problems on a site-specific basis.	1301 Regents Park Dr Suite # 100 Houston, TX 77058 Ph: 281-286-1861 Fax: 281-286-0325
52		<u>Tekran Inc.®</u> is a manufacturer of a variety of ultra-trace environmental instrumentation, with particular emphasis on the measurement of mercury. The company is committed to the production of leading edge environmental monitoring equipment.	330 Nantucket Blvd Toronto, Ontario CANADA Ph: 416-449-3084 Fax: 416-449-9298
53		<u>Liston Scientific</u> Enviromax Gas Analyzers from Liston Scientific draw from a truly unique perspective. They are the products of over 50 years experience in infrared instrumentation.	18900 Teller Ave Irvine, CA 92612 Ph: 949-756-1632 Fax: 949-883-6388
54		<u>Enercon</u> is an engineering, environmental, technical and management services firm providing a broad range of professional services to private and government sector clients throughout the United States.	5100 E. Skelly Dr., Ste 450 Tulsa, OK 74135 Ph: 918-665-7693 Fax: 918-665-7232

55		<u>ESRI</u> is about improving our world and the use of our resources through better information management.	One International Court Bloomfield, CO 80021 Ph: 303-449-7779 Fax: 303-449-8830
56		<u>Environmental Software Providers</u> ESP provides enterprise software solutions for integrated environmental and compliance management and for management of emissions allowance portfolios.	444 Castor St., Suite 800 Mountain View, CA Ph: 650-968-9000 x232 Fax: 650-691-6984
57		<u>Indigo Technologies, LLC</u> Our Technology division is currently commercialising and promoting its world leading environmental technology for air pollution control.	8980 Perry Highway, Ste 205 Pittsburg, PA 15237 Ph: 412-358-0171 Fax: 412-358-0174
58		<u>Custom Stack Analysis, LLC</u> has capabilities for performing Stack Testing, Analytical Services, Burner Combustion Efficiency, Indoor Air Quality and Industrial Hygiene sampling.	P.O. Box 3750 Alliance, OH 44601 Ph: 330-525-5119 Fax: 330-525-7908
59		<u>Sorbent Technologies</u> - for commercially-available low-cost utility mercury control.	1664 E. Highland Twinsburg, OH Ph: 330-425-2354
60		<u>MSI / Mechanical Systems, Inc.</u> , is a manufacturer of Continuous Emissions Monitoring Systems (CEMS). At MSI, we take pride in our ability to help clients improve their processes to meet federal, state and local monitoring regulations which, in turn, helps improve our environment.	480 Progress Way Sun Prairie, WI 53590 Ph: 608-825-2055 Fax: 608-825-2295
61		<u>SGS</u> is the world's leading inspection, verification, testing and certification company. SGS is recognized as the global benchmark for quality and integrity. With 37,000 employees, SGS operates a network of about 1,000 offices and laboratories around the world.	2058 Fell St San Francisco, CA 94117 Ph: 415-751-2013 Fax: 415-265-2130
62		<u>NSF International Strategic Registrations, Ltd.</u> is a world leader in management systems registrations. With more than 57 years of experience in the certification business and extensive experience providing registration services to organizations in a wide range of industries, NSF-ISR is poised to provide the highest quality services available.	789 N. Dixboro Rd. Ann Arbor, MI 48105 Ph: 734-913-5755 Fax: 734-827-7768
63		<u>Bibb and Associates</u> is a multidisciplinary engineering firm uniquely positioned to provide the highest level of quality and integrity of service in the power and industrial industries. Our distinctive competitive edge is attributed to several factors.	8455 Lenexa Dr Lenexa, KS 66214 Ph: 913-928-7000 Fax: 913-928-7500
64		<u>United Sciences Testing</u> USTI is a wholly owned subsidiary of American Electric Power. We offer flow RATA services to manufacturers and other utilities as well as AEP facilities where these tests are required.	1 Riverside Plaza Columbus, OH 43215 Ph: 614-716-6875 Fax: 614-716-6494
65-67		<u>Alstom Power</u> has been reorganized into 3 new Sectors: Power Turbo-Systems; Power Service; and Power Environment.	1409 Centerpoint Blvd. Knoxville, TN 37932 Ph: 865-670-4453 Fax: 865-694-5201
68		<u>HDR</u> is a nationally recognized employee-owned architectural, engineering and consulting firm. Established in 1917, the company employs over 3,200 professionals across the U.S. and abroad.	6190 Golden Mills Drive Minneapolis, MN 55416 Ph: 763-591-5400 Fax: 763-591-5413

69		<u>Rupperecht & Patashnick</u> seeks to deliver high quality particle-related environmental information to its customers through the design, marketing and support of technologically-advanced measurement instrumentation.	25 Corporate Circle Albany, NY 12203 Ph: 518-452-0065 Fax: 518-452-0067
70-72		<u>Clean Air Engineering</u> is a company built around a principle-- environmental responsibility and economic prosperity go hand in hand.	500 West Wood St. Palatine, IL 60067 Ph: 847-991-3300 Fax: 847-934-8260
73		<u>Weston Solutions</u> is a leading environment and redevelopment firm, delivering comprehensive solutions to complex problems for industry and government worldwide.	1625 Humphrey Ave Auburn, AL 36832 Ph: 334-887-0618 Fax: 334-887-0611
74		<u>Environmental Energy Services EES</u> is an innovative combustion engineering, services and marketing company, serving utilities and industries worldwide.	8 West Kenosia Ave Danbury, CT 06810 Ph: 203-798-7428 Fax: 203-798-8219
75/76		<u>ESC Environmental Systems Corporation</u> is comprised of five divisions specializing in technology-based products and services relating to environmental monitoring, power production, and waste management.	200 Tech Center Drive Knoxville, TN 37912 Ph: 865-688-7900
77		<u>Golden Specialty, Inc.</u> provides specialized products and services in the Environmental, Safety and Industrial Hygiene fields.	931 Seaco Ct. Deer Park, TX 77536 Ph: 281-476-9898 Fax: 281-476-9876
78		<u>Parker Hannifin Corporation</u> is the world's leading diversified manufacturer of motion and control technologies, providing systematic, precision-engineered solutions for a wide variety of commercial, mobile, industrial and aerospace markets.	6085 Parland Blvd Cleveland, OH 44124 Ph: 216-896-8157 Fax: 216-896-4022
79		<u>URS Corporation</u> offers the latest technology and thinking, turning environmental liabilities into assets. With extensive expertise in pollution control, water resources development and hazardous waste and wastewater management, both communities and corporations rely on URS to help them meet their environmental challenges.	9400 Amberglen Blvd. Austin, TX 78729 Fax: 512-419-5439
80		<u>M&C Products</u> : The equipment manufactured by M&C has proven to be very reliable over a wide range of applications. For this reason the company quickly gained a leading position in the manufacture of sampling and conditioning equipment as well as systems for process environmental analysis.	1879 Portola Road Suite G Ventura, CA 93003 Ph: 805-654-6970 Fax: 805-654-6971
81		<u>Stanley Consultants, Inc.</u> A multidiscipline engineering firm established in 1913, Stanley Consultants, Inc. serves industrial, institutional, international, government, commercial, and utility clients in 50 states. Since 1957, Stanley Consultants has served international clients in 85 countries.	2658 Crosspark Rd. Suite 100 Coralville, IA 52241 Ph: 319-626-3990 Fax: 319-626-3993
82		<u>Trinity Consultants</u> Our expertise in virtually every facet of environmental performance, from regulatory permitting to strategic environmental management, can help you achieve your objectives quickly and accurately.	12801 N. Central Expressway Suite 1200 Dallas, TX 75243 Ph: 972-661-8100 Fax: 972-385-9203

83		<u>ECO PHYSICS</u> We serve the CEMs, stack testing, automotive, catalyst research, source emissions, background ambient, atmospheric research and medical detection of exhaled NO markets.	7870 Villa Park Drive Richmond, VA Ph: 734-998-1600 Fax: 734-998-1180
84		<u>Horiba Instruments</u> is a global leader in analytical and measurement technology.	17671 Armstrong Irvine, CA 92614 Ph: 949-250-4811 x212 Fax: 949-250-0924
85		<u>Dakota Software Corporation</u> is a leading resource for the industry's most powerful, versatile tools to manage and track your company's environmental, health and safety (EHS) regulatory compliance.	95 Allen Creek Rd. Building 2, Suite 302 Rochester, NY 14618 Ph: 585-244-3300 Fax: 585-244-3301
86		The Environmental Protection Agency's mission is to protect human health and the environment. Since 1970, EPA has been working for a cleaner, healthier environment for the American people.	26 W. Martin Luther King Dr Cincinnati, OH 45268 Ph: 513-569-7578 Fax: 513-569-7585
		<u>Climate Leaders</u> is a voluntary industry-government partnership that encourages companies to develop long-term comprehensive climate change strategies and set greenhouse gas (GHG) emissions reduction goals.	2200 Wilson Blvd. #400 Arlington, VA 22201 Ph: 703-841-0533 Fax: 703-841-1440
87		The Department of Energy's overarching mission is to advance the national, economic, and energy security of the US...and to ensure the environmental cleanup of the national nuclear weapons complex.	2200 Wilson Blvd. #400 Arlington, VA 22201 Ph: 703-841-0533 Fax: 703-841-1440
		<u>C Trade</u> is an international developer of Carbon Trade Credits for renewable energy projects.	5860 N. Calle Grandeza Tucson, AZ 85718 Ph: 520-615-3535 Fax: 602-296-0199
88		<u>Southwest Windpower</u>	2131 N First St Flagstaff, AZ 86001 Ph: 928-779-9463 Fax: 928-779-1485
		<u>Distributed Generation Systems, Inc. (DISGEN)</u> is a developer of electricity generation projects with special skills, from site selection through construction for wind power projects	200 Union Blvd Suite 304 Lakewood, CO 80228 Ph: 303-531-5523
89		<u>Vision Monitor Software, LLC</u> is a Software Technology company formed to provide energy companies an enterprise wide software solution for managing their compliance with various standards and environmental regulations.	11451 Katy Freeway Suite 510 Houston, TX 77079 Ph: 713-935-0500 x310 Fax: 713-935-0515
90		<u>CH2M Hill</u> People help our clients imagine, design, and build a better world. We create and operate facilities, infrastructure, and systems that bring clean water, safe transportation, efficient industry, and life-enhancing technologies and products to people everywhere.	9193 S. Jamaica St. Englewood, CO 80112 Ph: 720-286-5919 Fax: 720-286-9719
Reg		Our mission is to facilitate technical information exchange & foster cooperation between industry, government, academia, regulators and stakeholders for the protection of our environment.	5860 N. Calle Grandeza Tucson, AZ 85718 Ph: 520-615-3535 Fax: 602-296-0199
Table Top		The <u>Southern Arizona Tech Council</u> is a non-profit organization formed in August 2000 whose mission is to promote and implement high-tech industry economic development and competitiveness in Tucson and Southern Arizona.	7311 N. Sonia Way Tucson, AZ 85704 Ph: 520-742-6601

Table Top		Environmental Technology Industry Cluster ETIC Environmental Technology Industry Cluster, Arizona Department of Commerce, Southern Az Technology Cluster, City of Tucson, Pima County, GTEC.	5860 N. Calle Grandeza Tucson, AZ 85718 Ph: 520-615-3535 Fax: 602-296-0199
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LOCAL ATTRACTIONS



ARIZONA-SONORA DESERT MUSEUM

The New York Times refers to it as "the most distinctive zoo in the United States." The Desert Museum is Southern Arizona's most popular visitor attraction. Nestled in Tucson Mountain Park 14 miles west of downtown Tucson, the Desert Museum exhibits the living, outdoor world of nature found in the Sonoran Desert region. On your way to the museum, you'll drive through Saguaro National Park, which preserves the most magnificent Saguaro forest in the world. The great Sonoran Desert region is filled with natural beauty and mystery. This outing provides a unique opportunity to see a comprehensive collection of the plants, animals, and geology of this area. This is an outdoor experience that requires walking. This tour will require 5 hours.



ARIZONA STATE MUSEUM

Experience the indigenous cultures of Arizona, the Greater Southwest, and northern Mexico at Arizona State Museum (ASM). Dynamic exhibitions, engaging programs, a renowned research library, and an educational museum store engage visitors of all ages. ASM's experts and collections are among the most significant resources in the world for the study of southwestern peoples. Arizona State Museum is The oldest and largest anthropology museum in the Southwest, est. 1893, Arizona's premier research museum, A Smithsonian Institution affiliate, and home of The Pottery Project, an official project of Save America's Treasures. No backpacks, satchels, food or drinks are allowed in the exhibition galleries. All items are subject to search. Admission: \$3 per person suggested donation. Museum Business Hours: Monday to Friday 8 a.m. to 5 p.m. Closed on state and national holidays. For more information, call: 520-621-6302



BIOSPHERE 2

Biosphere 2 was privately constructed in the late 1980s to discover if eight people could sustain themselves in a sealed, energy-rich environment. The first two-year mission began in September 1991 and was followed by a second, shorter mission in 1993-1994. Following these experiments, the owners of Biosphere 2 decided to change its mission and asked scientists at Columbia University to advise them as to what might be done. Now, situated on 250 acres, amidst the beautiful Sonoran Desert, Biosphere 2 is one of the largest living laboratories of the world. A monumental feat of engineering, the glass and metal shell hosts several different land types, or biomes, where scientists use the latest technology to experiment on Earth systems on a relatively large scale.-Biosphere 2 website. Come experience the different biomes of the Bio2! Biosphere 2 opens at 8:30am. Admission Prices- Adults: \$12.95, Teenagers: 13-17- \$8.95, Children 6-12: \$6.00, and Children 5 and under are free.



COLOSSAL CAVE Discovered in 1879, Colossal Cave has since turned into a mysterious, yet civilized journey into a different world. Once a hideout for bandits in the early 1900s, the crystal-filled hollow mountain now attracts people from all walks of life. Experience the incredible wonders of nature as you explore the different cave formations such as stalactites, stalagmites, flowstone, boxwork, and helectites. After your adventure, take in the breathtaking views of the desert under a covered ramada, or browse through the unique gift shop. The tour winds throughout the cave, gradually descending six and a half stories and takes about 45-50 minutes. This tour will take between 3 and 3.5 hours. Put on your hard hat and lights to explore the mysterious side routes of Colossal Cave. Test your courage as you negotiate steep inclines, endless cliffs and narrow corridors. You will be in the cave for approximately 1.5 hours. This tour will take 3.5 to 4 hours. Located at the end of the Old Spanish Trail, Colossal Cave is always a pleasant 70° and an experience not to be missed.



FLEUR DE TUCSON

Each 1 to 1 1/2 hour journey is unique, combining low level views of the beautiful desert landscape, javelina, deer, bobcat, rabbits and red-tailed hawks, and spectacular panoramas from higher elevations. After landing, each flight is celebrated with a delicious continental brunch and champagne served in beautiful crystal flutes. You will hear about the history of hot air ballooning, receive digital pictures of your ride and a personalized flight certificate.

Due to climate conditions in Tucson, Arizona, Fleur de Tucson can safely fly only in the early morning hours. Launch time is at sunrise and varies through the seasons, typically 6am-7:30am. TUCSON MOUNTAINS - Approximately 1-1 1/2 hour ride over the beautiful Tucson Mountains and Saguaro National Park, traveling 10-18 miles. \$160 - \$175pp, AVRA VALLEY- Approximately 30-40 minutes over Avra Valley, traveling 5-8 miles. \$140 - \$150pp. For required reservations, please contact Mike and Becky Fleury at 520-529-1025.



HORSEBACK RIDING IN THE MAJESTIC CATALINA FOOTHILLS

Spanish Trail Outfitters trail rides offer a unique opportunity to view the diversity of the Sonoran Desert. Experience the cooling shade of a mesquite woodland and mix with giant saguaro cacti! Ride through an ancient Hohokam village site. Prices range from \$25.00/person (2 person minimum) for a 1 hour ride to \$50.00/person for advanced rides or "Lunch on the Trail" rides. For reservations please call 520-749-0167.



LADYSMITH BLACK MAMBAZO

Sun, January 23 (7:30 PM) UA Centennial Hall. UA Presents. Ladysmith Black Mambazo's "The Long Walk to Freedom" tells the story of Nelson Mandela's release from political imprisonment. It is a fitting program for this Grammy Award-winning ensemble that has become even more of a national treasure in post-apartheid South Africa. Nearly 18 years have passed since Ladysmith Black Mambazo earned international notoriety for their unforgettable contribution to Paul Simon's "Graceland". Today their tight vocal harmonies and signature "tip toe" dance steps serve as historical and symbolic reminders of repressed people and the healing and unifying power of music. Ticket prices range from \$18.00-\$36.00. Please call 520-621-3341 for available ticket prices, and view the website for the seating chart.



MOSCOW PHILHARMONIC ORCHESTRA

Wed, January 26 (7:30 PM) UA Centennial Hall. UA Presents. The Moscow Philharmonic Orchestra was founded in 1951 by Samuel Samosud, a distinguished conductor of the Bolshoi Opera. Since then, the ensemble has performed over 4000 concerts and made over 100 recordings, for which they have received some of music's most coveted prizes. Under the leadership of eminent Russian conductor Yuri Simonov, the orchestra plays an all-Tchaikovsky program. They are joined by the Taiwan-born, Grammy Award-winning violinist Cho-Liang Lin. Ticket prices range from \$20.00-\$62.00. Please call 520-621-3341 for available ticket prices, and view the website for the seating chart.



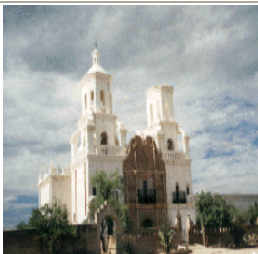
OLD TUCSON STUDIOS

"From daring cowboy stunts with fiery explosions to rip-roarin' can-can musicals and comedies, Old Tucson Studios offers some of the best old west entertainment this side of the Pecos. The experience is so authentic, you can taste it! We pride ourselves on our mesquite-grilled barbecue and authentic Mexican dishes. Knock it down with your favorite brew in the Grand Palace Saloon, and head to Main Street for some turn-of-the-century shopping. Get all decked out and gussied up in some old-fashioned duds for an old-time photo or take a horseback ride into the beautiful desert surrounding the park. And don't miss Old Tucson Studios' very own "silent" movie star, The Reno locomotive! Proudly stationed at the north end of town, The Reno has more than 100 film and television credits."-Old Tucson Studios website. Open 10am-3pm daily. Price: Adults are \$7.00, children 4-11 years old are \$5.00, and children 3 and under are free.



PIMA AIR MUSEUM

Explore aviation history at the Pima Air Museum, home of the largest privately owned collection of historical aircraft in the country. From a full-scale model of the Wright Brothers' 1903 Wright Flyer to a mock up of the world's fastest aircraft, the SR - 71 Blackbird, this museum is sure to interest everyone! More than 250 military and civilian aircraft are on display, along with engines, flight simulators, uniforms and other aviation memorabilia. Some of the aircraft at the Pima Air Museum are on loan from the Smithsonian, the Air Force Museum and the Navy. All craft are significant both in engineering and historical perspective. This tour takes approximately 3 hours.

	<u>SABINO CANYON</u> Come visit scenic Sabino Canyon! Take a 45 minute narrative shuttle bus tour through the canyon. Picnic in one of Tucson's favorite spots. Enjoy the Bike and Hiking Trails throughout the canyon. Or experience an archeology dig and tour the Sabino Canyon Ruins. Park hours are from sunrise to Sunset. Visitor Center is open from 8:00am to 4:30pm daily. Parking is \$5 for the day. The Shuttle bus is \$6.00 for adults, \$2.50 for children 3-12yrs, and children under three ride free. For more information about the archeological dig, please call 520-798-1201.
	<u>SAN XAVIER MISSION DEL BAC / WITH SHOPPING AT OLD TOWN ARTISANS</u> Begin your tour with a visit to the "White Dove of the Desert," San Xavier Mission Del Bac. Built by the Jesuits from 1783 to 1797, San Xavier was established by the "Padre on Horseback," Father Kino. San Xavier is acclaimed as the finest example of mission architecture in the country. After your visit, Old Town Artisans is next. This unique marketplace is located in the El Presidio Historic District. Housed within this 1850s restored adobe building are distinctive shops featuring contemporary and traditional works of hundreds of artists and craftsmen, including Native American tribal art and imports from Latin American cultures. This tour will require 4.5 hours.
	<u>SAVOY OPERA HOUSE</u> The Wild West is still alive and well in Trail Dust Town, home to the Savoy Opera House. Just a short twenty-minute drive from the resort brings your guests to the "thrilling days of yesteryear". Upon arrival your guests will be welcome to browse the shops along the boardwalk of Trail Dust Town. Western wear and jewelry, hats and boots are among some of the items available to visitors. As they approach the center of the town, a time forgotten is brought back to life as park benches under gas lit lamps surround the Gazebo. Here your guests can take in the beauty of the town while enjoying cocktails and hors d'oeuvres. The Opera House itself is a replica of a saloon and dance hall and tonight it is exclusively reserved for your guests. Entering the French beveled glass doors (imported from London's Savoy Hotel), you are greeted by elegant Victorian chandeliers, a true to life western bar and authentic pressed tin ceilings. A stage, draped in red velvet is the centerpiece for the band, which will entertain your guests throughout the evening. This is the true "upscale" western experience, one that will remain as a highlight of your guests' visit to Tucson.
	<u>UNIVERSITY OF ARIZONA SPORTS</u> Check out the Men's and Women's Basketball Teams! Men's Basketball - Thursday, January 27 vs Washington - 6:30pm McKale Center Women's Basketball - Saturday, January 22 vs Oregon State - 2pm McKale Center - Wednesday, January 26 vs Arizona State - 7pm McKale Center

EUEC 2005 Dining Guide within a mile from La Paloma

FREE Shuttle from The Westin La Paloma to La Encantada Shopping Center

	Incorporating the flavor of bold sauces, Chipotle peppers and Ancho chiles, Firebirds proudly features the unique taste of Colorado and the Rocky Mountains with the opening of its sixth store in Tucson, AZ. Located at the intersection of Skyline and Campbell Roads in northeast Tucson, La Encantada sits just above the Rillito and Tanque Verde Rivers in the fabulous Catalina Foothills, an affluent sub-community of Tucson.	Firebird's Rocky Mountain Grill La Encantada Shopping Center 2985 E. Skyline Drive Tucson, AZ 85718 Phone: 520-577-0747 HOURS: Sunday – Thursday: 11am-10pm Friday & Saturday: 11am-11pm
	Located in Tucson's majestic Catalina Foothills in the new La Encantada center, NoRTH in Tucson opened on November 7th, 2003 to standing room crowds! Featuring delicious modern Italian cuisine, great hospitality in a chic New York City loft interior, the fabulous bar, intimate, private dining room and great sofa seating on the patio in town are matched only by the breathtaking views of Tucson!	NoRTH La Encantada Shopping Center 2995 E. Skyline Drive Tucson, AZ 85718 Phone: 520-299-1600 HOURS: Monday – Thursday: 11am-10pm Friday & Saturday: 11am-11pm Sunday: Noon to 9pm

	Fresh seafood, prime steaks, chops, premium cocktails and spectacular views of the valley are just a few of the highlights of Bluepoint Kitchen & Bar. A sexy, "big city" atmosphere showcases a bustling open kitchen, high ceilings, custom light fixtures, unique round martini bar, mahogany walls and plasma televisions.	Bluepoint La Encantada Shopping Center 2905 E. Skyline Drive Tucson, AZ 85718 Phone: 520-577-6000
	Welcome to Janos, located on the grounds of The Westin La Paloma Resort and Spa. Janos has been Arizona's highest rated restaurant since 1983, and Chef Janos Wilder was winner of the James Beard Award for the Best Chef in the Southwest, 2000. An enchanted evening awaits you as local ingredients are refined with French cooking techniques to create extraordinary cuisine.	Janos The Westin La Paloma 3770 East Sunrise Drive Tucson, Arizona 85718 Phone: 520-615-6100 CALL TO RSVP HOURS: Monday – Saturday: Open at 5:30pm
	Beginning in 1979 with a menu of New York style pizza and pasta dishes, Larocca's has grown into a delectable Tucson favorite. We are still offering the finest food in a family owned atmosphere. Enjoy dining in our attractive, classic dinning room, or enjoy the amazing views from our new lounge. Our staff will make sure you feel welcome, and your meal is perfect.	Larocca's 5689 N. Swan Rd. Tucson, AZ 85718 Phone: 520-299-4301 HOURS: Monday – Sunday: 5:30-10pm
	Chef/owner Donna Nordin is considered one of the pioneers of modern Southwestern cooking, and her restaurant is considered a must-dine when visiting Tucson. With its two dining sections decorated in desert-tones, two patios affording spectacular views of the Santa Catalina Mountains, and a collection of art by some distinguished Southwestern artists, it is an icon of contemporary Santa Fe style.	Terra Cotta 3500 E. Sunrise Drive Tucson, AZ 85718 Phone: 520-577-8100 HOURS: Sunday – Thursday: 11:30am-9:30pm Friday – Saturday: 11:30am-10:30pm
	Stylish, contemporary dining with exceptional food & wine, Fleming's Prime Steakhouse - Tucson features the finest in Prime Beef, quality chops, fish, chicken, generous salads, inventive side orders & indulgent desserts. The wine list offers some of the finest wines from around the world with all 100 available by the glass.	Fleming's 6360 N. Campbell Avenue, Suite #180 Tucson, AZ 85718 Phone: 520-529-5017 HOURS: Sunday – Thursday: 5-10pm Friday – Saturday: 5-10:30pm
	This is the place that Tucsonans flock to for special occasions—with the spectacular views and award-winning cuisine and wines any visit is a memorable experience. Called an "architectural jewel" by many, this fine dining room is sophisticated without being snooty. True to its name, the views of the surrounding mountains and the cityscape to the south are the visual focus of the restaurant. An underground wine cellar houses more than 25,000 bottles with more than 1,400 individual selections.	Anthony's 6440 N. Campbell Ave Tucson, AZ 85718 Phone: 520-299-1771 HOURS: Monday – Friday: 11:30am-10pm Saturday & Sunday: 5-10pm
	Perched high atop Skyline Drive in the new El Cortijo art annex, this restaurant opens its doors to the sun with fabulous views of the Santa Catalina Mountains and the city of Tucson sprawling below. Each Mediterranean dish is crafted from fresh ingredients, many of which are organic, and the menu changes often to keep even the most creative pallets intrigued.	Soleil 3001 E. Skyline Drive Tucson, AZ 85718 Phone: 520-299-3345 HOURS: Tuesday – Sunday: 11am-9pm
	For more than a quarter of a century, Cosmos and Anna Ali and their children have been tempting Tucsonans with their flavorful, freshly prepared "cucina Italiana." This Santa Catalina foothills cafe is done in style, with a full range of classic dishes in a sophisticated setting. Soaring columns, high ceilings and flowing fabrics give the dining room an opulent feel. Pizzas and calzones come hot from a wood-fired oven; pastas and risottos "del giorno" are superb, as are the handmade gnocchi.	Trattoria Pina 5541 N. Swan Road Tucson, AZ 85718 Phone: 520-577-6992 HOURS: Monday – Friday: 11:30am-10pm Saturday: 4:30-10pm
Ra Sushi Bar	A large selection of sushi and a full menu of Pacific Rim dishes in a hip environment	Ra Sushi Bar La Encantada Shopping Center 2905 E. Skyline Drive, Tucson, AZ 85718 Phone: 520-615-3970 Monday – Sunday: 11am-11pm

ATTENDEE LIST

#	First Name	Last Name	Title	Company	Address	City	ST	ZIP
1	Michael	Abbott	Env. Sci.	Idaho National Laboratory	PO Box 1625	Idaho Falls	ID	83415
2	Richard	Abrams	Dir.-Bus. Dvlp	Babcock Power, Inc.	5 Neponset Street	Worcester	MA	1606
3	**Brad	Adams		Reaction Engineering Internatio				
4	Rich	Adelt		Teledyne Monitor	76 Inverness Drive East	Englewood	CO	80112
5	Yoseph	Admekom	Prog. Mgr.	UNDP	PO box 5366, 5 Warsai St.	Asmara	OT	99999
6	**Vineet	Aggarwal	Asc.	ICF Consulting				
7	Douglas	Aitkin	Trade Spec.	Arizona Department of Comme	3800 N. Central Ave.	Phoenix	AZ	85012
8	Vince	Albanese	SR.VP	FuelTech Environmental	512 Kingsland	Batavia	IL	60510
9	Bruce	Alexander	Strategy Mgr.	Exelon Corporation	2301 Market Street, S21-2	Philadelphia	PA	19101
10	Kenneth	Alexander	VP	Old Dominion Electric Co	4201 Dominion Boulevard	Richmond	VA	23060
11	Frank	Alix	CEO	Powerspan Corp.	P.O. Box 219	New Durham	NH	3855
12	Kris	Allen	Proj. Eng.	Kleinfelder	4815 List Drive	Colorado Spring	CO	80919
13	Ibraheem	Al-Mofeez	Dr.	King Faisal University	Dept. of Building Science and	Dhahran, Saudi	OT	31942
14	Amer	Al-Sharif	Cons.	Saudi Aramco	P.O Box 9386	Dhahran, Saudi	OT	31311
15	Deanna	Altenhoff	Exec. Dir.	CLEAN AIR Force of Centra	2512 S. IH 35	Austin	TX	78704
16	Amina	Amadu		Sampa General		B/A GHANA---	OT	233
17	**Roger	Anderson		Clean Energy Systems, Inc.				
18	**Darcy	Anderson	Env. Eng.	Matrix Consulting Group, Inc				
19	Robynn	Andracsek		Burns & McDonnell	9400 Ward Parkway	Kansas City	MO	64114
20	Block	Andrews	Dir.-Env. He	Aquilla	20 W. 9th Street	Kansas City	MO	64105
21	Ralph	Anhold		ESRI Denver	One International Court	Broomfield	CO	80021-320
22	Mary	Archer	Prin. Envir. Spe	Florida Power & Light	700 Universe Blvd [JES/JB]	Juno Beach	FL	33408
23	Dennis	Arfmann	Atty.	Hogan & Hartson, LLP	1470 Walnut St.,Ste 200	Boulder	CO	80302
24	John	Arnold	VP	MSI/Mechanical Systems, I	480 Progress Way	Sun Prairie	WI	53590
25	**Ted	Atwood		Xenon Specialty Gas				
26	Frank	Austin	Sr. Env. Cons.	The Shaw Group	One Main St	Cambridge	MA	02142-151
27	Mollie	Averyt	Asc.	ICF Consulting	1725 Eye Street, NW	Washington	DC	20006
28	Jeom-In	Baek	Sr. Res.	Korea EPRI	103-16, Munji-dong, Yusung-g	Taejeon, Korea	OT	305-380
29	Mitchell	Baer	Sr. Reg. Ana.	DOE	5404 Landmark Pl	Fairfax	VA	22032-312
30	Bill	Baggenstoss		Maricopa County Air Quali	1001 N. Central Ave	Phoenix	AZ	85004
31	Wurra	Bah	Mr	Student	C/o Sarjo Sowe, General Post	Banjul, The Gam	OT	220
32	Marcia	Baldwin		Baldwin Environmental	895 E. Patriot Blvd. # 107	Reno	NV	89511
33	Tom	Baldwin		Baldwin Environmental	895 E. Patriot Blvd. # 107	Reno	NV	89511
34	**Howard	Balentine	Sr. Prog. Mgr.	ENSR Corporation				
35	Lewis	Ballard	Res. Dir.	Environmental Supply Co.	2142 E. Geer Street	Durham	NC	27704
36	Piyush	Banafar	Technical Mgr.	GE Energy	8800 E.63rd St	Kansas City	MT	64133
37	Jonathan	Banks	Deputy Dir.	National Environmental Tr	1200 18th St. NW 5th Floor	Washington	DC	20036
38	Matt	Banks	Prog. Officer	World Wildlife Fund	1250 24th Street, NW	Washington	DC	20037
39	William	Barnes	Mgr. of Consult	Avogadro Environmental Co	1350 Sullivan Trail, Suite A	Easton	PA	18040
40	Michael	Barnham		McVehil-Monnet Associates	44 Inverness Drive East,Bldg	Englewood	CO	80112
41	Jon	Barr		ADA-ES,Inc	8100 South Parkway,Unit B	Littleton	CO	80120
42	Robert	Battenhouse	Bus. Develop	CH2M HILL	9189 South Jamaica Street	Englewood,	CO	80112
43	Thomas	Batts	Env. Spec.	DTE Energy	4901 Pointe Dr	East China Twp	MI	48072
44	Charles	Bayless	Board of Dir.s	Primary Energy	7300 N. Sunset Canyon Dr	Tucson	AZ	85718
45	Jon	Bebbington	Sr. Eng.	EARTH TECH, INC.	1452 Corporate Pointe	Warner Robins	GA	31088
46	Ethan	Begg		Shaw Environmental and In	3500 College Blvd. Ste # 350	Overland Park	KS	66211
47	Victor	Belba	Prin.	Belba and Associates	P. O. Box 11315	Boulder	CO	80301
48	Peter	Belmonte	Dir., Env. Eng.	Tractebel Power Inc.	1990 Post Oak Blvd	Houston	TX	77027
49	Jeff	Beneke	Waste Red. Sp	IWRC- U of N.Iowa	1005 Technology Pkwy	Cedar Falls	IA	53613
50	Teshome	Berhane	Prof. Asst.	Ministry of Energy and Mi	PO Box5285	Asmara	OT	99999
51	Russell B	Bery	Proj. Mgr.	RMB Consulting	5104 Bur Oak Circle	Raleigh	NC	27612
52	Bob	Bertik		Uninversal Analyzers	1701 South Sutro Terrace	Carson City	NV	89706
53	Rick	Beusse	Dir. of Air Prog	EPA Office of Inspector G	MD: N-283-01	Research Trian	NC	27711
54	Quinn	Bierman	Pres.	Air Hygiene International	5634 S. 122nd E.Ave Ste F	Tulsa	OK	74146
55	Swanson	Bierman	VP	Air Hygiene International	5634 S. 122nd E.Ave Ste F	Tulsa	OK	74146
56	Joseph	Biermann	Dr	CDEM Holland BV	P.O. Box 3	Eerbeek	OT	NL 6960 A
57	**Dave	Biggs	Co-Founder	Envision Sustainability Tools				
58	John	Bins	Sr. Dir. of Air P	Waste Management	1001 Fannin	Houston	TX	77002
59	Eric	Birch	Atty.	Birch & Becker, LLP	7000 N. MoPac Expressway	Austin	TX	78731
60	Bob	Bisha		Dominion Energy	5000 Dominion Blvd	Glen Allen	VA	23060
61	Sean	Black	Mktg. Mgr.	ALSTOM ECS	1409 Centerpoint Blvd	Knoxville	TN	37932
62	Alan	Bland	Dr.	Western Research Institut	365 North 9th Street	Laramie	WY	82072
63	Bill	Blankenship	Chem. Eng.	Los Alamos Natl. Laborato	P O Box 1663 MSJ 978	Los Alamos	NM	87545

64	Katherine	Blue	Mgng. Cons.	Trinity Consultants	1100 Johnson Ferry Road	Atlanta	GA	30342
65	Joel	Bluestein	Pres.	Energy & Environmental Analy	1655 N. Fort Myer Dr. Suite 60	Arlington	VA	22207
66	Jason	Boeckel	Sr Env. Sci.	Montana-Dakota Utilities	400 North Fourth Street	Bismarck	ND	58501
67	Blake	Bolt	EHS Sprv.	Rathdrum Power LLC	PO Box 995	Rathdrum	ID	83858
68	Michelle	Bongo		M and C Products	1879 Portola Rd, Ste G	Ventura	CA	93003
69	Larry	Bool	Sr. Dev. Asc.	Praxair	Praxair Inc.	Tonawanda	NY	14151-004
70	Kevin	Booth	Env Coord.	Avista Corp	1411 East Mission	Spokane	WA	99220-372
71	**Richard	Boren	Dir.	EnviroScrub Technologies Cor				
72	Michael	Born		Shumaker Loop & Kendrick	41 S. High St., Suite 2210	Columbus	OH	43215
73	Rob	Bott	Sr. Dir. of Sale	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112
74	Kyle	Boudreaux	Sr Env Spec.	FPL Group	700 Universe Blvd	Juno Beach	FL	33408
75	David P	Bour	Mr.	Niksa Energy Associates	21434 Shannon Court	Cupertino	CA	95014
76	**Ken	Boyd		Southern Company				
77	Scott	Boyden	Tech. Mgr.	Alstom Power	1409 Centerpoint Blvd.	Knoxville	TN	37922
78	Shari	Brabham	Proj.s/Office M	Eventus LOI, Inc.	1870 W. Prince Road, Suite 11	Tucson	AZ	85705
79	Gail E.	Braden	Env. Cons.	Dixon Environmental	3 Hampton Court	Flanders	NJ	7836
80	David	Branecky	Mgr. Air Qual.	OGE Energy	P.O. Box 321	Oklahoma City	OK	73101
81	Richard	Bratcher	Dir., Env.	EPRI	3412 Hillview Avenue	Palo Alto	CA	94303-081
82	Bob	Breeze, PE	Air Prog. Coor	Austin Energy	721 Barton Springs Rd	Austin	TX	78704
83	Richard	Brewer	Mgr., Environ.	Cinergy Corp	PO Box 960	Cincinnati	OH	45201
84	Lynn	Brickett	Physical Sci.	U.S. Department of Energy	P.O. Box 10940	Pittsburgh	PA	15236
85	Brenda	Brickhouse	Dir.	Progress Energy	410 S. Wilmington Street	Raleigh	NC	27601
86	**Gifford	Broderick	Pres.	Combustion Components Asso				
87	Gary	Brown	Proj. Eng.	CH2M HILL	9189 South Jamaica Street	Englewood	CO	80112
88	Chuck C.	Brown	Asst. Sec.	La. Department of Environ	P.O. Box 4313	Baton Rouge	LA	70821-431
89	Merritt	Brown	Plant Mgr.	Mesquite Power LLC	P O Box 508	Tonopah	AZ	85354
90	J. Michael	Brown	Gen. Mgr.	AEP	5475 William Flynn Highway	Gibsonia	PA	15044
91	Michael	Brumbach	Grad Stud.	University of Arizona	1303 E. University Blvd. #205	Tucson	AZ	85719
92	**Joe	Bryson		EPA				
93	John	Bunyak	Env.Spec.	National Park Service- Ai	P O Box 25287	Denver	CO	80225
94	Larry	Burbach	Sales Mgr.	Scott Specialty Gases	2600 Cajon Blvd.	San Bernardino	CA	92411
95	Greg	Burch	Mgr.,Emiss. Te	Golden Speciality Consult	931 Seaco Ct.	Deer Park	TX	77536
96	Karen	Burchardt	Env. Eng.	Burns & McDonnell	9400 Ward Parkway	Kansas City	MO	64114
97	Jeff	Burgess	Env. Mgr.	Lignite Energy Council	1016 E. Owens Ave	Bismarck	ND	58502
98	Peter	Burlage	VP	Peerless Mfg. Co.	2819 Walnut Hill Lane	Dallas	TX	75229
99	Mike	Burnett	Exec. Dir.	The Climate Trust	516 SE Morrison Street	Portland	OR	97214-234
100	Thomas A.	Burnett	Spec., Pol'n. R	TVA	1101 Market Street	Chattanooga	TN	37402
101	Nicholas	Burwell		Lansing Board of Water	PO Box 13007	Lansing	MI	48901-300
102	Wendi	Busch		Stanley Consultants	2658 Cross Park Rd,ste #100	Coralville	IN	52241
103	Oliver	Bussler	Port. Ana.	EPCOR Utilities	505 - 2nd Street SW	Calgary	OT	T2P 1N8
104	Jean	Bustard	Exec. VP	ADA-ES	8100 SouthPark Way, B-2	Littleton	CO	80120
105	Andy C.	Byers	Sr. Permitting	Black & Veatch	11401 Lamar Ave.	Overland Park	KS	66211
106	Carlos	Cadena	EHS Ana.	PSEG	80 Park Plaza	Newark	NJ	7102
107	Stephen	Cain	Snr. Env. Engr	Arkansas Electric Coop Co	P.O. Box 194208	Little Rock	AR	72219-420
108	Matthew	Caldwell	Pres.	VIM Technologies	7464 New Ridge Road, Suite 2	Hanover	MD	21076
109	Frank	Call	West. Reg'l. Sa	Environmental Systems Cor	4002 W Mohawk Lane	GLENDALE	AZ	85308
110	Robyn	Camp	Prog. Dir.	California Climate Action	515 S. Flower St.	Los Angeles	CA	90071
111	William	Campbell	Sr. Reg'l. Prog.	ENSR International	4600 Park Road	Charlotte	NC	28209
112	Colin	Campbell	Proj. Mgr.	RTP Environmental Associa	304-A West Millbrook Rd.	Raleigh	NC	27609
113	Michael	Canterbury	VP of Risk Mg	ESP (Environmental Softwa	444 Castro St., Suite 800	Mountain View	CA	94041
114	Adam	Capage	Dir.	Platts	3333 Walnut St.	Boulder	CO	80211
115	Fred	Carl	Dir. Environ/Sa	Black Hills Corporation	625 Ninth Street	Rapid City	SD	57709
116	William	Carr		CSQ Environmental Technol	202-5752 176th St.	Surrey, British C	OT	V3S4C8
117	Marie	Casanova	Mgr Env. Serv.	North American Energy Ser	1 Collins Drive	Carneys Point	NJ	8069
118	Michael	Cashin	Sr. Eng.	Minnesota Power (Allete)	30 West Superior Street	Duluth	MN	55802
119	Dan	Casiraro	Mgr., Env. Com	SRP	PO Box 52025	Phoenix	AZ	85072
120	Mike	Cassidy	Env. Spec.	Kohler Co.	444 Highland Drive	Kohler	WI	53044
121	Patrick	Cassidy	Dir., Env.	Kansas City Board of Public	300 N. 65th Street	Kansas City	KS	66102
122	Tom	Castor	Mgr., Bus. Dev	AEP	1 Riverside Plaza	Columbus	OH	43215
123	Pietro	Catizone	Prin. Meteorolo	TRC	5 Waterside Crossing	Windsor	CT	6095
124	J.J	Cavender		Air Hygiene International	5634 S. 122nd E.Ave, Ste F	Tulsa	OK	74146
125	**Melissa	Chan		NETL				
126	Larry	Chandler	Elec. Eng.	Tennessee Valley Authorit	1101 Market Street, LP 2G	Chattanooga	TN	37402-288
127	Mark	Chapman		Parker Hannifin	3215 Country Walk Dr	Parker Springs	GA	30127
128	ROBERT	CHATHAM	Dir. EHS	PSEG GLOBAL	80 PARK PLAZA, T-20	NEWARK	NJ	7102
129	Lokesh	Chaturvedi	Cons.	EUEC	5401 Vista Lejana NE	Albuquerque	NM	87111
130	li-Ting (Bobb	Chen		Western Kentucky Universi	2355 Nashville Rd	Bowling Green	KY	42101

131	Harry S.	Chen	Client Prog. Ma	The Shaw Group	1430 Enclave Parkway	Houston	TX	77077
132	Judith	Chow	Res. Prof.	Desert Research Institute	2215 Raggio Pkwy	Reno	NV	89512
133	Jamie	Christopher	Air Qual. Prog.	ReTEC	2409 Research Blvd., Suite 10	Fort Collins	CO	80526
134	Betty	Chu	Env. Spec.	Calpine	104 Woodmere Rd.	Folsom	CA	95630
135	Paul	Chu	Proj. Mgr.	EPRI	3412 Hillview Avenue	Palo Alto	CA	94303
136	Craig	Clapsaddle	Sales Mgr.	MIS	9013 Deerland Grove Dr.	Raleigh	NC	27615
137	Nathan	Clark	Economist	Chicago Climate Exchange	190 S. LaSalle St.	Chicago	IL	60603
138	John	Cline	Atty. at Law	Troutman Sanders LLP	1111 East Main Street	Richmond	VA	23218-112
139	**Matt ⁽¹³⁾	Clouse	Prog. Dir.	EPA				
140	Louis	Coakley	Prin. Env Spec.	FPL	700 Universe Blvd	Juno Beach	FL	33408
141	Greg	Coffman	Sr. Proj. Mgr.	The Shaw Group	4400 College Blvd	Overland Park	KS	66211
142	Richard	Cogen	Ptnr.	Nixon Peabody, LLP	30 South Pearl Street	Albany	NY	12207
143	**Nate ⁽¹⁴⁾	Collamer	Prin.	ICF Consulting				
144	Leslie	Cook		RETEC	4076 Oldtown Rd., Ste 200	Shawsville	VA	24162
145	D. G.	Cook, Jr	Dir., Asset Plng	Duke Energy	526 South Church St	Charlotte	NC	28202
146	John	Corn	Dir., E and IS	Enercon Services, Inc	5180 E. Skelly Dr	Tulsa	OK	74135
147	Terry	Coughlin	Mgr. Air Qual.	We Energies	333 W. Everett	Milwaukee	WI	53290
148	Colleen	Coyle Mathis	Dir.	GTEC	33 N. Stone Ave., Suite 800	Tucson	AZ	85701
149	Keith	Crabbe		CEMTEK Environmental	2121 South Yale Street	Sana Ana	CA	92704
150	David	Crabtree	VP and Gen. C	Desert Power	10714 S. Jordan Gateway, St	South Jordan	UT	84095
151	Richard	Crawford	Plant Mgr. Stan	Texas Independent Energy	2200 E I-20nService Rd. South	Odessa	TX	79766
152	Marc	Cremer	Mgr., Eng.ing A	Reaction Engineering Inte	77 West 200 South, Suite 210	Salt Lake City	UT	84101
153	Cody	Cress	Gen. Mgr.	Apex Instruments, Inc	125 Quantum Street	Holly Springs	NC	27540
154	Ted	Cromwell	Mgng. Dir., Env	ACC	1300 Wilson Blvd.	Arlington	VA	22209
155	Jeff	Crone	Mktg.-Reg'l. Ma	EPRI	3412 Hillview Ave.	Palo Alto	CA	94304
156	Brent	Croom	Prin. Air Spec.	CLECO	P.O. Box 5000	Pineville	LA	71361-500
157	Jeff	Crowe	Reg'l. Mgr. - En	EPRI	3412 Hillview Ave.	Palo Alto	CA	94304
158	Bob	Crynack	Pres.	Indigo Technologies, LLC	304 South Magnolia Drive	Glenshaw	PA	15116
159	Kevin	Culligan	Acting Branch	USEPA - Clean Air Markets	6204 J, USEPA Headquarters,	Washington	DC	20460
160	Joe	Curreri	VP	ENSR	2 Technology Park Drive	Westford	MA	1886
161	Mike	Cybulski		Metco Env	P.O Box 598	Addison	TX	75001
162	Peter	Czepiel	Life Cycle Mgr.	Xenon Specialty Gas	89 Exeter Road	South Hampton	NH	3827
163	Jack	Dallal		Maricopa County Air Quali	1001 N. Central Ave	Phoenix	AZ	85004
164	**Gregory ⁽¹⁵⁾	Daneke	Prof.	ASU				
165	Rob	Daniel		Universal Analyzers Inc	1701 South Sutro Terrace	Carson City	NV	89706
166	Arlene	Davidson		Dakota Software Corporati	95 Allen Creek Rd. Bldg 2, Ste	Rochester	NY	14618
167	Stacey	Davis	Sr. Policy Ana.	Center for Clean Air Poli	750 First Street, NE	Washington	DC	20002
168	Jim	Davis	Reg'l. Dir., Sale	ESP (Environmental Softwa	444 Castro St., Suite 800	Mountain View	CA	94041
169	Petie	Davis		NSF-ISR	789 N. Dixboro Rd.	Ann Arbor	MI	48105
170	Rachel	Davis		Puget Sound Energy	PO Box 97034, PSE-09S	Bellevue	WA	98009
171	Charles	Davis	Dr.	Regal Air Quality, Inc.	4732 E. Carob Dr.	Gilbert	AZ	85297
172	Peter	Davis	Instrumentation	Solar Turbines Inc.	2200 Pacific Hwy.	San Diego	CA	92101
173	Robert	Davis	Env. Mkt Mgr	Scott Specialty Gases	6141 Easton Road	Plumsteadville	PA	18949
174	Prabhu	Dayal	Pres.	CTrade	sdg	GSD	MO	dg4366
175	Kim	Deatherage		EQM, Inc	1800 Carillon Blvd	Cincinnati	OH	45240
176	Randall	Decker	CEO	Earth Savers Energy Servi	P.O. Box 32834	Tucson	AZ	85751
177	Dennis	Delmastro	Prod. Line Mgr.	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112
178	Patrick	Dennis	Sr. Env. Engr.	Archer Daniels Midland Co	1001 Brush College Road	Decatur	IL	62521
179	William	Depriest	Dir. Env.Serv.	Sargent Lundy	55 E Manor Street	Chicago	IL	60603
180	Dr. Vasanti	Deshpande	Env. Prog. Spe	AZ Dept. of Environmental	1110 W. Washington St., 3415	Phoenix	AZ	85007
181	Jim	Dewey	Prog. Dir.	Earth Tech	3033 Campus Dr., # 290	Plymouth	MN	55441
182	Adam	Diamant	Mgr., Econ. An	EPRI	1805 Arlington Blvd	El Cerrito	CA	94530
183	Craig	Diamond	Prod. Line Lea	EPRI	3412 Hillview Ave.	Palo Alto	CA	94303
184	Mary	Dieltz	Env. Ana.	Xcel Energy	Sherburne County Generating	Becker	MN	55362
185	**Phyllis ⁽¹⁶⁾	Diosey	Asc., Air Qual.	Malcolm Pirnie, Inc.				
186	Frank	Divita	VP	HE Pechan	5528 Heampstead Way	Springfield	VA	22151
187	fidelis	djebredafe	mr	national electric power a	p.m.b 1020	Jagos	OT	23401
188	Dan	Dobbin	Bus. Dev.	Air Liquide America	432 No 44th St	Phoenix	AZ	85008
189	Sharon	Dodson	Dir. Env.Serv.	LGand E Energy	220 W.Main Street	Louisville	KY	40232
190	Katherine	Dombrowski	Eng.	URS Corporation	9400 Amberglenn Boulevard	Austin	TX	78729
191	Ellen	Donnelly	Mktg. Mgr.	EPRI	3412 Hillview Avenue	Palo Alto	CA	94304
192	Prakash	Doraiswami	Res.Assoc	University of Tennesse	70 Perkins Hall, Dept of Civil/En	Knoxville	TN	37996- 201
193	Brent	Dorsey	Dir., Corp. Env.	Entergy	639 Loyola Avenue	New Orleans	LA	7.01E+08
194	Brennan	Downes	Proj. Eng.	Primary Energy	2000 York rd	Oak Brook	IL	60523
195	Kara	Downey	Mgr. of ES and	Sierra Southwest Cooperat	PO Box 2165	Benson	AZ	85602
196	Jim	Downey	VP of Environ	Horiba	17671 Armstrong	Irvine	CA	92614
197	Jerry	Drake		Compliance Strategies and	1301 Regents Park Dr., Ste # 1	Houston	TX	77058

198	Chris	Drechsel	Mngng. Cons.	Trinity Consultants	20819 72nd Ave South	Kent	WA	98032
199	Chris	Drechsel	Mngng. Cons.	Trinity Consultants	20819 72nd Avenue South	Kent	WA	98032
200	Wilma	Dreessen	Sr. Prog. Mgr.	ENSR International	1420 Harbor Bay Parkway, S	Alameda	CA	94502-705
201	**Dave ^{un}	Drerup	Mgr. Bus. Dev.	DS&S				
202	Steve	Drevik	Dir.	ESC	200 Tech Center Drive	Knoxville	TN	37912
203	RONALD	DREWNOWS	Dir.	PSEG	80 PARK PLAZA - 17B	NEWARK	NJ	7102
204	Camille	Drouin	Env. Sci.	Lakes Environmental Softw	419 Phillips St. Unit 3	Waterloo	OT	N2L 3X2
205	Frank	Duckett	Prod. Mgr.	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
206	Bruce	Dudley	Sr. VP	The Delphi Group	428 Gilmour St	Ottawa	OT	K2P 0R8
207	John	Duffer	Eng.ing Coord.	Zachry Construction	1409 Centerpoint Blvd.	Knoxville	TN	37932
208	Ghassan	Dughaish	Sr. Env. Eng.	Alcan Primary Products Co	P.O. Box 44	Henderson	KY	42419-004
209	Julia	Dulan	Mngng. Atty.	Southern Company	270 Peachtree Street	Atlanta	GA	30303
210	Jim	Dunn	Qual. Mgr.	Shaw Environmental and In	PO Box 4699	Oak Ridge	TN	37831-734
211	Lenny	Dupuis	Mgr, Env. Polic	Dominion	5000 Dominion Blvd.	Glen Allen	VA	23060
212	Mick	Durham	Proj. Prin.	Stanley Consulting	2658 Crosspark Rd.	Coralville	IA	52241
213	Michael	Durham	Pres.	ADA-ES	8100 SouthPark Way, B-2	Littleton	CO	80120
214	Bill	Eastman	Dir., Env. Serv.	Westar Energy	818 Kansas Ave.	Topeka	KS	66612
215	Lee	Eberley	Mgr. Air Qual.	Xcel Energy	414 Nicollet Mall	Minneapolis	MN	55401
216	Craig	Eckberg		Texas Genco	12301 Kurland	Houston	TX	77034
217	Howard	Edelson		Consumers Energy	One Energy Plaza	Jackson	MI	49201
218	Stacey	Edwards	Eng.	Cornell University	Humphreys Service Building	Ithaca	NY	14853
219	Philip	Efthimion	Dirctor of R an	Ohio Lumex Company, Inc	P.O. Box 6	Pluckmin	NJ	7978
220	Greg	Eirschele		RTP Environmental Associa	2031 Broadway	Boulder	CO	80304
221	David	Elkins	VP, Power Sys	Alstom Power	1409 Centerpoint Blvd.	Knoxville	TN	37754
222	Michael	Elliot		Southwest Wind Power	2131 N. First St	Flagstaff	AZ	86001
223	Fred	Ellis	Prin. Res. Engr.	Southern Company	600 N 18th St/14N-8195	Birmingham	AL	35291-819
224	Howard	Ellis	Pres.	Enviroplan	81 Two Bridges Road	Fairfield	NJ	7004
225	Randy	Eminger	VP South Regi	CEED	5600 South Bell St	Amarillo	TX	79109
226	Mike	Engelman	Exec. Dir.	Progress Energy	410 S. Wilmington Street	Raleigh	NC	27601
227	Joshua	Epel	Gen. Counsel	Duke Energy Field Service	370 17th Street	Denver	CO	80202
228	Michell V	Esposito		Augusta Systems,Inc.	3606 Collins Ferry Rd.,Ste 202	Morgantown	WV	26505
229	Patrick R	Esposito		Augusta Systems,Inc.	3606 Collins Ferry Rd.,Ste 202	Morgantown	WV	26505
230	Bob	Estes	Practice Leade	URS Corp	E.Wetmore Rd #611	Tucson	AZ	85705
231	**Scott ^{un}	Evans	VP Reg. Affair	CleanAir Engineering				
232	Raymond L	Evans		FirstEnergy Corp.	76 S.Main St	Akron	OH	44308
233	Victoria	Evans	Mgr., Energy S	Tetra Tech EM Inc.	135 Main Street, Suite 1800	San Francisco	CA	94105
234	George	Everett	VP Env. Policy	Duke Power	526 S. Church Street	Charlotte	NC	28201
235	Thomas	Fair	Dir., Env. Affai	Nevada Power Company	6226 W. Sahara Ave. MS#30	Las Vegas	NV	89146
236	Zig	Fang	Air Qual. Permi	Arizona Department of Env	1110 W. Washington St.	Phoenix	AZ	85007
237	Keith	Faretra	Env. Sci.	Puget Sound Energy	6905 S. 228th St. SKC-WMF	Kent	WA	98032
238	Beau	Farmer	CTO	TSI Incorporated	500 Cardigan Rd	Shoreview	MN	55042
239	Lorraine	Farrell	Proj. Eng.	Malcolm Pirnie, Inc.	104 Corporate Park Drive	White Plains	NY	10602
240	Hap	Fauth	Chairman	Churchill	333 So. 7th St. Suite 31000	Minneapolis	MN	55402
241	Dale	Fennell	CEMS Prod. Lin	GE Energy	2849 Sterling Dr	Hatfield	PA	19440
242	Dr. Carmo	Fernandez	Dir.	Environ-Tech Group	1018 E. Carson Drive	Tempe	AZ	85282
243	Steven	Fine	Dir.	ICF	9300 Lee Highway	Fairfax	VA	20850
244	ABE	FINKELSTEIN	CHIEF	Environment Canada	351 ST-JOSEPH BLVD, 19TH	GATINEAU, QUE	OT	K1A 0H3
245	Steve	Finley		Colorado Energy Managemen	1500 South Clayton Street	Brush	CO	80723
246	Randy	Fisher	Supt., IL Gener	Continental Coop Services	P.O. Box 10	Pearl	IL	62361
247	Diane	Fitzgerald		American Electric Power	8523 Livingston Hills Lane	Bridgman	MI	49106
248	Kent	Fletcher	Env. Spec.	WFEC	P.O. Box 429	Anadarko	OK	73005
249	Jillian	Flett	Section Head	Alberta Environment	7th Floor, 9915-108 Street So	Edmonton, alber	OT	T5K 2G8
250	steven	flowers	Env. Spec.	michigan south central po	720 herring rd.	litchfield	MI	49252
251	Jim	Folds		Parker Hannifin	1300 N. Freedom St	Ravenwa	OH	44266
252	Steven G.	Folk	Pres.	SGF Consulting Svcs.Inc	881 Hex Hwy	Hamburg	PA	19526
253	Perry	Fontana	VP	URS Corporation	8181 East Tufts Avenue	Denver	CO	80237
254	**Dirk	Forrister		Natsource				
255	Eric	Fournier	VP Sales and	Forney Corporation	3405 Wiley Post Road	Carrollton	TX	75006
256	Randy	Fox	Env. Eng.	Black Hills Energy	350 Indiana Street, Suite 400	Golden	CO	80401
257	Dave	Fraley	Mgr.-Env. Com	City Utilities of Springf	301 E. Central	Springfield	MO	65802
258	Dave	Fraley	Mgr.-Env. Com	City Utilities of Springf	301 E. Central	Springfield	MO	65802
259	Blake	Francis	Spvsr, Water	Minnesota Power / Allete	30 West Superior St.	Duluth	MN	55802
260	Michael	Frankel	VP	Perillon Software, Inc.	30 Porter Road	Littleton	MA	1460
261	Bob	Fraser	Sr. Prog. Mgr.	ENSR	2 Technology Park Drive	Westfrod	MA	1886
262	Lauren	Freeman	Ptnr.	Hunton & Williams	1900 K Street, NW Suite 1200	Washington	DC	20006
263	Wes	Fritz		Weston Solutions,Inc.	1625 pumphrey Ave	Auburn	AL	36832
264	Dan	Froelich	VP	Burns & McDonnell	9400 Ward Parkway	Kansas City	MO	64114

265	Chuck	Fryxell	Air Pol'n. Contr		14306 Park Ave.	Victorville	CA	92392
266	Michael L.	Fuhrman			3780 E. 44th Street	Tucson	AZ	85713
267	Derek	Furstenwerth	Mgr. Air Res.s	Reliant Energy	1000 Main Street 16	Houston	TX	77002
268	Derek	Furstenwerth	Mgr., Air Res.s	Reliant Energy, Inc.	P. O. Box 148	Houston	TX	77001-014
269	Peter	Fusaro	Chairman	Global Change Associates	2565 Broadway PMB Box #38	New York	NY	10025
270	David	Gaige	Proj. Mgr.	Burns - McDonnell	9785 Maroon Circle, Suite 400	Centennial	CO	80112
271	Christina	Garaas	Env. Eng.	Arizona Electric Power Co	1000 S. Hwy 80	Benson	AZ	85602
272	Nicole	Garcia	Coord.	EUEC, C Trade, AZ ETIC	blank	Tucson	AZ	85711
273	Tony	Garcia	Team Leader	Nevada Power Company	6226 W Sahara Ave.,MS # 30	Las Vegas	NV	89146
274	Tony D.	Garcia	Team Leader,	Nevada Power Company	6226 W. Sahara Ave. MS#30	Las Vegas	NV	89146
275	Jill	Garrity	AQI Mktg. Spe	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
276	Greg	Gasperecz	VP EHS	Enviance, Inc.	2386 Faraday Ave.	Carlsbad	CA	92008
277	Karen	Gautreaux	Deputy Sec.	LA Department of Environm	Post Office Box 4301	Baton Rouge	LA	70821-430
278	Robert	Gehri	Climate Issue	Southern Company	P.O. Box 2641 14n-8195	Birmingham	AL	35291-819
279	Janet	Gellici	Exec. Dir.	American Coal Council	2980 E.Northern Ave., Ste B4	Phoenix	AZ	85028
280	Emma Lou	George		US EPA-NRNL	26 W. Martin Luther King Dr.	Cincinnati	OH	45268
281	Mark	Gerath	Sr. Prog. Mgr.	ENSR International	2 Technology Park Dr.	Westford	MA	1886
282	Brad	Gerber	Account Exec.	Dakota Software	23230 Chagrin Blvd.	Cleveland	OH	44122
283	Brad	Gerber	Account Exec.	Dakota Software Corporati	95 Allens Creek Road	Rochester	NY	14618
284	Michael	Gerbis	Pres.	The Delphi Group	428 Gilmour St.	Ottawa	OT	K2P 0R8
285	Debesai	Ghebrehwet	Dir. energ Res.	Ministry of Energy And Mi	P.o.Box 4364, Asmara Eritrea	Asmara	OT	291-1
286	Abiy	Ghebremedhi	Proj. Mgr.	Ministry of Energy and Mi	PO Box 5285	Asmara	OT	99999
287	Don	Giel	Sales Rep.	Teledyne	76 Inverness Drive East	Englewood	CO	80112
288	Byron	Gies		Metco Env	20910 Oak Forest	Damon	TX	77430
289	Carl	Gilbert	Exec. VP	Graymont Inc.	4039 Rosemonte Drive	Allison Park	PA	15101
290	Peter	Glaser	Ptnr.	Troutman Sanders, LLP	401 9th St., N.W., Suite 1000	Washington	DC	2004
291	David	Gloski	Exec. VP	ESP	444 Castro St., Suite 800	Mountain View	CA	94041
292	Karol	Gluth	Support Serv.	Rochester Public Utilitie	4000 E. River Road NE	Rochester	MN	55906
293	**Jay ^[19]	Golden	Prof.	ASU				
294	Howard	Gollay	Mgr., Env. Po	SCE	2244 Walnut Grove Ave. Qua	Rosemead	CA	91770
295	William (Bill)	Golove	Sci.	Lawrence Berkeley Nationa	MS 90-4000	Berkeley	CA	94720
296	Daniel	Goodwin	Sr. Env. Engi	Gei Consultants, Inc.	243 Lindbergh Boulevard	St. Louis	MO	63141
297	giri	gopal	test	test	112234	none	ID	45444
298	Bart	Gossett	CEMS Sales M	Forney Corporation	3405 Wiley Post Road	Carrollton	TX	75006
299	Eric	Gottung	Group Leader	United Technologies	411 Silver Lane	E. Hartford	CT	6108
300	Kathlene	Graf		Maricopa County Air Quali	1001 N. Central Ave	Phoenix	AZ	85004
301	Thomas	Grahame	Sr. Policy Ana.	DOE	1000 Independence Ave., SW	Washington	DC	20585
302	William	Grant	Assoc. Exec.	Izaak Walton League	1619 Dayton Avenue, Ste. 20	St. Paul	MN	55104
303	Mike	Grant	Tech Serv. Mgr	Tessenderlo Davison Chemi	6406 Threeflower Lane	Kingwood	TX	77345
304	Suzanne	Graver		APS	P.O. Box 53999, MS 8376	Phoenix	AZ	85072-399
305	John	Graves	Env. Mgr.	Minnkota Power	P.O. Box 13200	Grand Forks	ND	58208
306	James	Gray	Owner	Custom Stack	P.O. Box 3750	Alliance	OT	44601
307	Benjamin	Greene	Proposal Devel	Alstom Power Inc.	2000 Day Hill road	Windsor	CT	6095
308	Andrew	Greene	Asc. Dir.	Navigant Consulting, Inc.	77 South Bedford Street	Burlington	MA	1803
309	**Lorna ^[20]	Greening	Cons.	Energy and the Environment				
310	Carolyn	Greenwood		Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
311	Monette	Greer	Chem./Env. En	Tucson Electric Power Com	PO Box 711, Mailstop UE204	Tucson	AZ	85702
312	Mike	Gregory		Bibb and Associates,Inc	8455 Lenexa Drive	Lenexa	KS	66214
313	Brian	Griffin	Pres.	Clean Energy Systems, Inc	11330 Sunco Drive Suite A	Rancho Cordov	CA	95742
314	Grant	Grothen	Client Coord.	Burns & McDonnell	9400 ward pkwy	Kansas City	MT	64114
315	Krista	Gunther		Lakes Environmental Softw	450 Phillips,Ste 2	Waterloo	OT	N2L 5J2
316	Mae	Gustin	Asc. Prof.	University of Nevada	Department of Nat.Resources	Reno	NV	89557
317	Dan	Haas	Sr.Env. Special	Great Plains Energy	P O Box 418679	Kansas City	MO	64141
318	Chris	Haas	Sr Prog. Mgr.	ReTEC	413 Wacouta Street, Suite 400	St Paul	MN	55101
319	**Kamal ^[21]	Hadad						
320	Tim	Hagley	Sprv., Air Qual.	ALLETE Inc.	30 West Superior Street	Duluth	MN	55802
321	**Mark ^[22]	Hall	Sr. VP	Primary Energy				
322	Rachael A.	Hamilton	Sr. Asc.	Frost Brown Todd LLC	400 W. Main Street	Louisville	KY	40202
323	Roy	Hamme	Prin.	Catawba Strategy Group	193 Barber Loop	Mooreville	NC	28117
324	Robert	Hammer	Air Qual. Spec.	Tetra Tech EM Inc.	4940 Pearl East Circle, Suite 1	Boulder	CO	80501
325	Joe	Hammond	Proj. Mgr.	CH2M HILL	9193 South Jamaica Street	Englewood	CO	80112
326	John	Hampp	Sr. Env. Spec.	FPL	700 Universe Blvd	Juno Beach	FL	33408
327	John	Hanisch	Ntnl. Air Qual.	Arcadis	175 Cabot Street	Lowell	MA	1864
328	Kurt	Hansen	Sr.Air Qual. En	Amec Earth and Environmen	221 18th St SE	Calgary	OT	T2E 6J5
329	Scott	Harrison		Teledyne Monitor	76 Inverness Dr East	Englewood	CO	80112
330	Craig S.	Harrison	Atty.	Hunton & Williams	1900 K St. N.W.	Washington	DC	20006-110
331	Bob	Hart	Reg'l. Sales Re	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112

332	Bob	Hart	Sales Rep.	Teledyne Monitor	76 Inverness Drive East	Englewood	CO	80112
333	Doug	Haugen		Teledyne API	6565 Nancy Ridge Dr.	San Diego	CA	92025
334	Christine	Havermann	Sec.	National Park Service	P.O. Box 25287	Denver	CO	80225
335	Ronald	Hawks	Pres.	EQ Engineering	3700 179th Street	Hammond	IN	46323
336	Sara	Head	Dept. Mgr.	ENSR	1220 Avenida Acaso	Camarillo	CA	93012
337	Daniel	Hedrick	Env. Spec.	Associated Electric Coope	P.O. Box 754	Springfield	MO	65801-075
338	Bill	Hefley		Air Sampling Associates	P O Box 1175	Lowisville	TX	75067
339	Christopher	Heintz	Env. Sci. IV	Nevada Power Company	6226 W. Sahara Ave. MS #30	Las Vegas	NV	89146
340	Gary	Helm	Env. Cons.	Conectiv	P.O. Box 6066	Newark	DE	19714
341	Tim	Hemig	Env. Dir.	NRG Energy, Inc.	4600 Carlsbad Blvd.	Carlsbad	CA	92008
342	David	Hendricks	Pres.	Environmental Supply Co.	2142 E. Geer Street	Durham	NC	27704
343	Joseph	Hensel	Dir. Field Serv.	Rochester Public Utilitie	4000 E.River Rd.NE	Rochester	MN	55906
344	Bruce	Herman	Tech Sales Su		433 Northpark Central, Suite 1	Houston	TX	77073
345	Greg	Herrema	Pres., EID	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
346	Danny	Herrin	Mgr., Env. Stra	Southern Company	P.O. Box 2641/14N-8195	Birmingham	AL	35291-819
347	Jennifer	Hickman	Hydrologist II	Arizona Dept. of Environm	1110 West Washington	Phoenix	AZ	85007
348	Alan	Higgins	Mgr., Market D	Anadarko Petroleum Corpor	1200 Timberloch Place	The Woodlands	TX	77380
349	Brian	Higgins	VP of Tech.	Mobotec USA	3468 Mount Diablo Blvd, Suite	Lafayette	CA	94549
350	Bob	Hilton		Alstom Power	1409 Centerpoint Blvd.	Knoxville	TN	37932
351	Michele	Hincks	VP	Enviance	2386 Faraday Ave., # 220	Carlsbad	CA	92008
352	Lewis	Hinman		Pratt and Whitney	628 Hebron Ave. Ste 222	Glastonbury	CT	6033
353	Eric	Hiser	Attorney	Jorden Bischoff	7272 E.Indian School Rd., Ste	Scottsdale	AZ	85251
354	James	Hodina	Chief, Env. Ser	Stanley Consultants, Inc.	2658 Crosspark Road	Coralville	IA	52241
355	Edward	Hoefs	Proj. Mgr.	Wenck	360 North Robert Street	St. Paul	MN	55101
356	Jeffrey	Hoffman	Gen. Eng.	U.S. Department of Energy-NE	P.O. Box 10940	Pittsburgh	PA	15236
357	Terry	Hogan	ViP Power Ind	KERAMIDA Environmental In	330 North College Avenue	Indianapolis	IN	46202
358	Jim	Hoke		Parker Hannifin Corp	6035 Parland Blvd	Cleveland	OH	44124
359	Eric	Holdsworth	Dir., Climate Pr	Edison Electric Institute	701 Pennsylvania Avenue, N	Washington	DC	20004
360	Andrew	Homer	Account Exec.	Enviance, Inc.	2386 Faraday Ave.	Carlsbad	CA	92008
361	Christopher	Horan	Prog. Mgr.	Iowa Waste Reduction Cent	1005 Technology Parkway	Cedar Falls, Iowa	IA	50613
362	Thomas	Hormel		McVehil-Monnett Associat	44 Inverness Drive East,Bldg	Englewood	CO	80112
363	Rich	Hovan		Forney Corporation	3405 Wiley Post road	Carrollton	TX	75006
364	Ching-Hsun	Huang	Dr.	Stephen F. Austin State U	Box 6109	Nacogdoches	TX	75962
365	Joe	Huber	Prin. Eng.	NIPSCO	2755 Raystone Drive	Valparaiso	IN	46383
366	Michael	Hucks	Ntnl. Account	Dolphin Software	9 Monroe Pkwy, Suite 150	Lake Oswego	OR	97035
367	Bob	Hughes	Mgr. Env. Affai	East Kentucky Power Coop.	P O Box 707	Winchester	KY	40392-604
368	Jerald	Hunter	Sr. Ana.	SRP	PO BOX 52025	Phoenix	AZ	85072-202
369	Bill	Irwin	Reg'l. Sales Mg	General Electric	8703 Wentworth Court	Lone Tree	CO	80124
370	Pamela	Jackson	Sr Env Spec	San Diego Gas and Electri	8315 Century Park Court	San Diego	CA	92124
371	Robert	Jacques	P.E.	ECubed, Inc	2603 Toulouse Dr.	Austin	TX	78748-605
372	Natalie	Jalil	Env. Sci.	Alabama Department of Env	1400 Coliseum Blvd	Montgomery	AL	36110-205
373	Jeff	James	Client Coord.	Burns and McDonnell	9400 Ward Parkway	Kansas City	MO	64114
374	Bob	James	Reg'l. Sales Re	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112
375	Bob	James	Reg'l. Sales Re	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112
376	Bob	James	Reg'l. Sales Mg	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112
377	Tom	James	Bus. Dev.	Zachry Construction	1864 Flowers Road	Mathews	AL	36052
378	Chris	Janick	Sr. Sci. / Engin	SRP	P.O. Box 52025, PAB352	Phoenix	AZ	85072
379	John	Jansen		Parker Hannifin Corp	6035 Parland Blvd	Cleveland	OH	44124
380	John	Jansen	Prin. Sci.	Southern Company	P.O. Box 2641	Birmingham	AL	35291-819
381	**Kamala [23]	Jayaraman		ICF				
382	Beth	Jenkins	Bus. Dev. Mgr.	Air Products and Chemical	12600 Northborough, Suite 19	Houston	TX	77401
383	Susan	Jenkins	Env. Eng.	Georgia Department of Nat	4244 International Parkway S	Atlanta	GA	30354
384	Angela	Jenkins		Hunton and Williams LLP	951 East Byrd Street	Richmond	VA	23219
385	J. Ron	Jernigan	Reg. Mgr.	Thermo Electron Corporati	113 Spring Hollow Lane	Cary	NC	27511
386	Jessica	Jewell	Env. Eng.	Ga. Dept. of Natural Reso	4244 International Parkway	Atlanta	GA	30354
387	Jessica	Jewell	Env. Eng. I	Georgia Department of Nat	4244 International Parkway	Atlanta	GA	30354
388	Fernando	Jimenez	InterNtnl. Trade	Arizona Department of Com	1700 West Washington, suite	Phoenix	AZ	85007
389	Arbslkfj	ijklk	ijklkl	j	sdadd street Suite 560	Washington	DC	20013
390	Ronald	Jochum	VP Power Sup	VECTREN	20 N W Fourth Street	Evansville	IN	47741
391	Vic	Johnson	Mktg. Mgr.	CISCO	7325 S. Revere Parkway	Centennial	CO	80112
392	Rick N	Johnson	Mgr., Corp. En	Entergy	639 Loyola Avenue	New Orleans	LA	7.01E+08
393	Rich	Johnson		Spectrum Systems, Inc.	3410 West Nine Mile Road	Pensacola	FL	32526
394	Douglas	Johnson	Sr. Env. Spec.		PO Box 815	Winnipeg	OT	R3C-2P4
395	Les	Johnston	Dir.,ESD	EPCOR Utilities Inc.	10065 Jasper Ave	Edmonton	OT	T5J 3BI
396	Jimmy	Johnston	Prog. Mgr.	Georgia EPD - Air Branch	4244 International Parkway	Atlanta	GA	30354
397	Gordon	Jones		Spectrum Systems, Inc.	3410 West Nine Mile Road	Pensacola	FL	32526
398	**Don	Jones		COPEC	none	none	AZ	none

399	Dave	Joseffer	Sales Rep.	Teledyne Monitor	76 Inverness Drive East	Englewood	CO	800112
400	Mike	Joseph		CLECO	2030 Donahue Ferry Rd	Pineville	LA	71360
401	Dinkar	Joshi	Env. Journalist	Environment Cycle Radio(F	Environmental Library,Bade G	Kathmandu	OT	12135
402	*John	Kadyszewski	Team Advisor	Winrock International	1621 North Kent St., Ste. 1200	Arlington	VA	22209
403	Kohichi	Kajiura		Yamatake Sensing Control,	3323 Kifer Road	Santa Clara	CA	95051
404	Cynthia	Karlic	Reg'l. Mgr., Air	NRG Energy, Inc.	P.O. Box 1001	Middletown	CT	6457
405	Martin	Karpiscak	Res. Sci.	University of Arizona	1955 E 6th Street	Tucson	AZ	85719
406	**Gary ^[24]	Kaster		AEP				
407	David	Katz	Reg'l. Sales Mg	Climatronics Corporation	140 Wilbur Place	Bohemia	NY	11716
408	**Jim ^[25]	Keehn	Spec.	DTE Energy				
409	Kevin	Kelly	Prog. Mgr.	Georgia Environmental Fac	100 Peachtree Street, NW	Atlanta	GA	30303
410	Raymond	Kelly	Mr	Sempra Energy Resources	101 Ash Street	San Diego	CA	92101
411	Dick	Kempka	Dir. of Energy	Ducks Unlimited	One Waterfowl Way	Memphis	TN	38120
412	Norman	Kettenbauer	Advanced Tec	The Babcock and Wilcox Co	20 S Van Buren Ave	Barberton	OH	44203-035
413	Cindy	Khalaf	Mgr Power Pl	Argillon	1345 Ridgeland Pkwy, Ste 116	Alpharetta,	GA	30004
414	Sikander	Khan	Env. Eng.	EPA	1200 Pennsylvania Ave., NW	Washington	DC	20460
415	Hyung	Kim	Prof.	Ajou University, Dept. of	210 Energy Center	Suwon, Korea	OT	442-749
416	**Hyo-Sun ^[26]	Kim	Sr. Economist	Korea Gas Corporation				
417	Mark	Kimball	Mngr, Technic	Northeast Generation Serv	301 Hammer Mill Rd	Rocky Hill	CT	6067
418	Kris	Kinder	Env.Sci.	Shaw Environmental	312 Directors Dr	Knoxville	TN	37923
419	Robert	Kinsella	Reg'l. Sales Mg	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
420	**John ^[27]	Kinsman		EEL				
421	Edward	Kirk	Mktg. Dir.	Clean Air Action	708 Childs Point Road	Annapolis	MD	21401
422	Dieter	Kita	R and D Dir.	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
423	Christopher	Kjellmark	Env. Spec. Sr.	Iowa DNR	7900 Hickman Rd., Suite 1	Urbandale	IA	50322
424	**Dan ^[28]	Klein		Twenty-First Strategies				
425	Dr. Jonas	Klingspor		URS Corporation	9400 Amberglen Blvd	Austin	TX	78729
426	Dennis R	Knisley	Env. Mgr.	Franklin Engineering Grou	381 Riverside Drive, Suite 200	Franklin	TN	37064
427	Jon	Knodel	Env. Eng.	EPA Region 7 (Kansas City	901 North 5th Street	Kansas City	KS	66101
428	Kris	Knudsen	Sr. Technical C	Duke Energy	PO Box 1006	Charlotte	NC	28201-100
429	Neil	Kolwey	Res. Mgr.	Platts/E Source	3333 Walnut St.	Boulder	CO	80301
430	Chuck	Komadina	Dir., Corporate	Tucson Electric Power	Mail Stop UE204	Tucson	AZ	85702
431	Josh	Korth	Certification Sp	Teledyne Monitor Labs	35 Inverness Drive East	Englewood	CO	80112
432	Dennis	Korycinski	Eng.	US AF	10471 20th St. Ste 302	Elmendorf	AK	99506
433	Jerry	Kotas	Sr. Environ. Sc	DOE	1617 Cole Blvd, M.S. 1521	Golden	CO	80401
434	Carrie Atiye	Kowalski	Env/Legislative	KFX Inc.	55 Madison Street	Denver	CO	80206
435	Lee Ann	Kozak		Southern Company	C/O 193 Barber Loop	Mooreville	NC	28117
436	Ursula	Kramer	Dir.	Pima County Department of	150 W. Congress	Tucson	AZ	85701-133
437	**Gary ^[29]	Kronrad	Prof.	Arthur Temple College of Fore				
438	Eric	Kuhn		Cinergy Corp.	P.O. Box 960	Cincinnati	OH	45201
439	Naresh	Kumar	Dr.	EPRI	3412 Hillview Ave	Palo Alto	CA	94304
440	Greg	Kunkel	Dir. of Env. Aff	Tenaska	1044 N 115 St. Ste.400	Omaha	NE	68154
441	Luther	Kvernen	VP - Gen.	Minnkota Power	1822 Mill Road	Grand Forks	ND	58201
442	Lauren	Laabs		CH2M HILL	8501 West Higgins Road	Chicago	IL	60631
443	Yan	Lachowicz	New Prod. Dev	Alstom Power	2000 Day Hill Rd.	Windsor	CT	6095
444	Randall N.	Lack	Pres.	Element Markets, Inc.	1403 Hyde Park	Houston	TX	77006
445	**John ^[30]	Lague		URS				
446	Duane	Lampman	I C Spec.	Xcel Energy	13999 Industrial Blvd.	Becker	MN	55308
447	Dr. Ronald R	Landreth	VP - Proj.s	Sorbent Technologies	1664 E. Highland Rd. #10	Twinsburg	OH	44087
448	Joe	Lanoe		CO2 Solution Inc.,	2570 rue Einstein,Ste 360	Sainte-Foy,Que	OT	GOA 3WO
449	Mike	Lanzieri	Sales rep	Scott Specialty Gases	2600 Cajon Blvd	San Bernardo	CA	92411
450	Terry	Larbes	Mgr.	Electric energy, Inc.	P O Box 165	Joppa	IL	62953
451	Doug	Lavarnway	Env. Cons.	Arizona Public Service	P.O. Box 188	Joseph City	AZ	86032
452	Thomas F.	Lavery	VP	Thielsch Engineering,Inc	195 Frances Ave	Cranston	RI	2905
453	Dale	Lebsack	Comp. Mgr.	Sempra Texas Services, LP	2705 Bee Caves Rd	Austin	TX	78746
454	Angela	Ledford	Dir.	National Environmental Tr	1200 18th St. NW 5th Floor	Washington	DC	20036
455	Jeffrey	Lee	Plant Mgr.	Arizona Public Service Co	P.O.Box 53933, Mail Station 4	Phoenix	AZ	85072-393
456	David	Leflar	Dir.	ENMAX Corporation	141 - 50 Ave SE	Calgary	OT	T2G 4S7
457	Lynne	L'Esperance	Asc.	Malcolm Pirnie, Inc.	4646 E. Van Buren St. #400	Phoenix	AZ	85008
458	Dr. Leonard	Levin	Prog. Mgr.	EPRI	3412 Hillview Ave.	Palo Alto	CA	94303
459	Joe	Lierow	Proj. Eng.	Bison Engineering, Inc.	30 South Ewing	Helena	MT	59601
460	Tom	Lillestolen	Dir., Global Tec	ALSTOM Power	1409 Centerpoint Blvd	Knoxville	TN	37932
461	Mike	Lima		TA CAID	2275 E.Ganley Rd	Tucson	AZ	85706
462	leif	lindau	Dr	Alstom Power	PO Box	Vaxjo SWEDEN	OT	35112
463	Katie	Lindblom	Prod. Line Lea		2849 Sterling Drive	Hatfield	PA	19440
464	Peter	Lindenhoff	Tech. Mgr.	Haldor Topsoe, Inc.	17629 El Camino Real	Houston	TX	77058
465	Jerry	Liner	Mgr., Bus. Dev	Tennessee Valley Authorit	1101 Market Street	Chattanooga	TN	37402

466	Vitali	Lissianski	Proj. Mgr.		18 Mason	Irvine	CA	92618
467	Xin	Liu	Sr. Env. Engr	Sorbent Technologies	1664 E. Highland Rd. #10	Twinsburg	OH	44087
468	C. David	Livengood	Proj. Mgr.	Argonne National Laborato	9700 S. Cass Ave.	Argonne	IL	60439
469	Barbara	Lockwood	Mgr. Env./Safet	APS	PO Box 53999,MS 8376	Phoenix	AZ	85072-399
470	Steven	Lomax	Mgr., Air Qual.	EEL	701 Pennsylvania Avenue, N	Washington	DC	20004
471	Barry	Lonsdale	President	Terra Environmental Techn	Box 1900 161 Bickford Line	Courtright	OT	NON IHO
472	Monica	Lopes	Sr. Env Spec.	North American Energy Ser	1 Collins Dr., Ste 100	Carneys Pt.	NJ	8069
473	Arnold D.	Luther	Env. Sci.	Nevada Power Company	North Valmy Generation Statio	Valmy	NV	89438
474	James	Lynch	Prof.	Penn State University	311 Forest Resources Lab	University Park	PA	16802
475	Scott	Macadam	Lead Eng.	Western Research Institut	365 N. 9th Street	Laramie	WY	82072
476	Chris	MacCracken	Mgr.	ICF Consulting	9300 Lee Highway	Fairfax	VA	22031
477	Bruce	Macdonald	Sr. Prog. Mgr.	ENSR International	1601 Prospect Parkway	Fort Collins	CO	80525
478	Gerald	MacDonald	Sr. Env. Spec.	Owens Corning	2790 Columbus Rd.	Granville	OH	43023
479	BILL	MACHAJ	CONSTRUCTIO	INDIGO TECHNOLOGIES, LLC	304 S. MAGNOLIA DRIVE	GLENSHAW	PA	15116
480	Segun	Majaro	Dr		P.O Box 35567 Agodi Gate	Ibadan	OT	234
481	**Yaacov ⁹²	Mamane	Prof.	Technion				
482	Steve	Mandel		Spectra Gas	3434 Rt. 22 West	Branchburg	NJ	8876
483	Aaron	Mann	Dir. Energy Ser	Tetra Tech EM Inc.	1325 Airmotive Way	Reno	NV	89502
484	Torgeir	Mantor	Chairman	VisionMonitor Software, L	11451 Katy Freeway	Houston	TX	77079
485	Terry	Marsh	Dir. of Sales	Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
486	Cameron	Martin	Dir. of Eng.ing	ADA-ES, Inc.	8100 SouthPark Way	Littleton	CO	80120
487	Tim	Martin	Env. Sci.	Arizona Department of Env	1110 W. Washington Street	Phoenix	AZ	85007
488	Mike	Martin	Proj. Mgr.	TRC	Boott Mills South	Lowell	MA	1852
489	Gretchen	Martz	AE	Enviance	2386 Faraday Ave., #220	Carlsbad	CA	92008
490	Gretchen	Martz	Account Exec.	Enviance, Inc.	2386 Faraday Ave.	Carlsbad	CA	92008
491	Jesse	Massengill	Bus. Dev.	Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
492	Vineet	Masuraha		Trinity Consultants	12801 North Central Express	Dallas	TX	75243
493	**Fred ⁹²	Mayes	Chief, Renewa	Energy Information Administrat				
494	John	Maziuk	Manger Trona	Solvay	3333 Richmond Avenue	Houston	TX	77345
495	Richard	McAllister	Bus. Mgr.	Air Products and Chemical	7201 Hamilton Blvd.	Allentown	PA	18195
496	Ann	McCabe	Ptnr.	Policy Solutions Ltd.	111 W. Washington St.	Chicago	IL	60602
497	Mike	McClure		Vision Monitor	11451 Katy Freeway, Suite 5	Houston	TX	77079
498	Bob	McCullough		EQM, Inc	1800 Carillon Blvd	Cincinati	OH	45240
499	Gary	McCutchen	Prin.	RTP Environmental Associa	304-A West Millbrook Road	Raleigh	NC	27609
500	Mike	McDaniel	Sec.	LA Dept of Environmental	P. O. Box 4301	Baton Rouge	LA	70821-430
501	Chris	McDonald	Sales West. R	Spectra Gas	1701 Bimini	Seabrook	TX	77586
502	Peter	McGarth		Scott Speciality Gases	6141 Easton Rd.,Bldg 1	Plumsteadville	PA	18949
503	Marilyn	McIlvaine	Mgng. Editor	McIlvaine Company	191 Waukegan Rd	Northfield	IL	60093
504	Tom	McKarns		ECO Physics,Inc	3915 Research Park Dr, Ste A	AnnArbor	MI	48108
505	Brian	McLean	OAP Office Dir.	Environmental Protection	1200 Pennsylvania Avenue N	Washington	DC	20460
506	Ed	McMurren	Gas Turbine T	Mesquite Power LLC	P O Box 508	Tonopah	AZ	85354
507	Richard	McRanie		RMB Consulting	5104 Bur Oak Circle	Raleigh	NC	27612
508	George	McVehil		McVehil-Monnet Associates	44 Inverness Drive East,Bldg	Englewood	CO	80112
509	George	McVehil	VP	not attending 2003	44 Inverness Drive East, Buildi	Englewood	CO	80112
510	Douglas	McWilliams	Atty.	Squire, Sanders and Demps	4900 Key Tower	Cleveland	OH	44114
511	*Charles	Means	Sr. Reg. Policy	Associated Electric Coope	PO Box 754	Springfield	MO	65801
512	Edgar	Mercado		EPA	1200 Pennsylvania Avenue, N	Washington	DC	20460
513	Dean	Metcalf	Dir., Air/Water	Xcel Energy	4653 Table Mountain Drive	Golden	CO	80403
514	John	Meyers	Mgr.	Tennessee Valley Authorit	1101 Market St.	Chattanooga	TN	37402
515	Joseph	Miakisz	Sr. Cons.	MJ Bradley	47 Junction Square Drive	Concord	MA	1742
516	Don	Michael	Mgr.	Earth Tech	196 Baker Ave	Concord	MA	1742
517	Cris	Miller	Env. Coord.	Basin Electric Power Coop	1717 Interstate Avenue	Bismarck	ND	58503
518	Michael	Miller	Dir. Env.	EPRI	P O Box 10412	Palo Alto	CA	94303
519	Jon	Miller	Sr. Mechanical	Sorbent Technologies	1664 E. Highland Rd. #10	Twinsburg	OH	44087
520	Jim	Miller	Mgr., Env. Ser	Basin Electric Power Coop	1717 East Interstate Ave	Bismarck	ND	58503
521	Paul D.	Miller	Dir., Env. Serv.	CLECO	P.O. Box 5000	Pineville	LA	71361-500
522	Jack	Missimer	Pres.	Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
523	Clarence	Mitchell	Sr. VP, Op	Oglethorpe Power Corporat	2100 East Exchange Place	Tucker	GA	30084
524	Keith	Modesitt	Chief Tech.	Perillon Software	30 Porter Rd	Littleton	MA	1460
525	Donald	Mohning	Sr. Env. Coord.	MidAmerican Energy Co.	P.O. 778 Sioux City	Sioux Ctiy	IA	51102
526	Ron	Monk	Mgr., Sustaina	BC Hydro	9th Floor	Vancouver	OT	V6B 5R3
527	Margery	Moore	Alliance Mgr.,	BNA	1231 25th Street. NW	Washington	DC	20037
528	Margery	Moore	Alliance Mgr.,	BNA	1231 25th Street. NW	Washington	DC	20037
529	Keith	Moore	Pres.	Phenix Limited, LLC	3031 W 5th Street, Suite D	Oxnard	CA	93030
530	Ralph	Morris	Prin.	ENVIRON	101 Rowland Way	Novato	CA	94945
531	Rudi	Muenster	Prod. Mgr.	VIM Technologies	7464 New Ridge Road, Suite 2	Hanover	MD	21076
532	Bill	Mullins		Air Sampling Associates	P O Box 1175	Louisville	TX	75067

533	Blake	Mullins		Air Sampling Associates	P O Box 1175	Lowisville	TX	75067
534	Michael	Murray		Sempra Energy	101 Ash Street	101 Ash Street	CA	92101
535	Jim	Mutch	Dir - Env Audit	Xcel Energy	4653 Table Mountain Dr	Golden	CO	80403
536	Dick	Myers	Sr. Dir. Res.	Teledyne Monitor Labs	5310 N. Pioneer Road	Gibsonia	PA	15044
537	John W.	Myers	Prog. Mgr., Air	Tennessee Valley Authorit	1101 Market St.	Chattanooga	TN	37402
538	Tom	Naber	Sys Plan./Anal	Dynegy	3890 North Illinois Street	Swansea	IL	62226
539	Kara	Nagle	Env. Proj.s Mgr	Headwaters Inc.,	10653 So. Riverfront Parkway	So Jordan	UT	84075
540	Bob	Naidu		EUEC				
541	BARRY	NAKAMOTO	Prin. ENV Sci.	HAWAIIAN ELECTRIC COMPA	PO BOX 2750	HONOLULU	HI	96840
542	Steve	NaManny	Industrial Sales	Terra Environmental Techn	600 Fourth Street	Sioux City	IA	51101
543	Sam	Napolitano	Division Dir.	Environmental Protection	1200 Pennsylvania Avenue, N	Washington	DC	20005
544	Mughis	Naqvi	Mgr.	Lechler USA Inc	445 Kantz Rd	St. Clarks	IL	60174
545	Christine	Neely	Dir.- Fossil Env	PSEG Power LLC	Fossil Environmental Affairs	Newark	NJ	7102
546	Jim	Nelsen	Reg'l. Sales Mg	CEMTEK Environmental Inc.	2121 South Yale St.	Santa Ana	CA	92704
547	Debra	Nelson	Env. Eng.	Great River Energy	PO Box 800	Elk River	MN	55330-080
548	Sid	Nelson Jr.	Pres.	Sorbent Technologies	1664 East Highland Road	Twinsburg	OH	44087
549	Michael	Nemergut	Mktg. Dir.	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
550	Greg	Newman	Sr. Air Qual. E	Reliant Energy	P.O. Box 148	Houston	TX	77001-014
551	Edward N.	Newman	Dir., Env. Serv.	WPS	700 N. Adams St.	Green Bay	WI	54301
552	Dana	Nickell	Site Coord.	Chickasaw Nation Division	P.O. Box 788	Ada	OK	74821
553	Todd	Nicoll		Stanley Consultants	2658 Cross Park Rd,ste #100	Coralville	IN	52241
554	Eric	Nielsen	Mgr	approved 054857	166 W. Alameda St.	Tucson	AZ	85701
555	Stephen	Niksa	Pres.	Niksa Energy Associates	1745 Terrace Drive	Belmont	CA	94002
556	Michael	Noble	Exec. Dir.	Minnesotans for an Energy	46 E. Fourth Street	Saint Paul	MN	55101
557	Steve	Noland	Sr. Env. Sci.	LG&E Energy	PO Box 1518	Henderson	KY	42419-151
558	Stephen K.	Norfleet	Eng.	RMB Consulting	5104 Bur Oak Circle	Raleigh	NC	27612
559	Gary	Norton	Prod. Line Mgr	GE Energy	2849 Sterling Drive	Hatfield	PA	19440
560	Rick	Norton	Client Coord.	Burns & McDonnell	9400 ward pkwy	Kansas City	MT	64114
561	Richard	Nowak	Pres.	Environmental Energy Serv	8 West Kenosia Avenue	Danbury	CT	6810
562	Jim	Nylander	Sr. Eng.	Duke Energy	990 Bay Blvd	Chula Vista	CA	91911-165
563	**Paul ³³¹	O'Hop		Squires, Sanders & Dempsey				
564	Mike	OBrien	Env.Spec.	Platte River Power Author	2000 E. Horsetooth Rd	Fort Collins	CO	80525
565	Mike	OBrien	Env.Spec.	Platte River Power Author	2000 E. Horsetooth Rd	Fort Collins	CO	80525
566	Jerry	OBrien	Pres.	Process Data Control Corp	903 D Medical Center Dr	Arlington	TX	76012
567	Thomas	Ochs	Gen. Eng.	US DoE - ARC	1450 Queen Ave. SW	Albany	OR	97321
568	Tom	OConnor	Env.Spec.	City of Grand Island Util	P O Box 1968	Grand Island	NE	68801
569	Allan	Oestmann	Prin. Air Qual.	Stanley Consultants, Inc	2658 Crosspark Road, Suite 1	Coralville	IA	52241-321
570	George	Offen	Tech Exec Air	EPRI	P.O. Box 10412	Palo Alto	CA	94303
571	Cindy	Oliver		Teledyne API	6565 Nancy Ridge Dr.	San Diego	CA	92025
572	Reginald	Olsen	Permitting Bran		P O Box 144820	Salt Lake City	UT	84114
573	Brian	ONeal	Air Qual. Sci.	Black and Veatch	11401 Lamar Ave	Overland Park	KS	66211
574	Dale	Osborn	Pres.	Distributed Generation Sy	200 Union Blvd., Ste 304	Lakewood	CO	80228
575	Susan	Owen	Atty. at Law	Strasburger and Price	600 Congress Ave., Ste 1600	Austin	TX	78701
576	David	Ozawa	Customer Sup	GE Energy	888 Industrial Drive	Elmhurst	IL	60126
577	Robert	Paine	Technical Dir.	ENSR	2 Technology Park Drive	Westford	MA	1886
578	Johnny	Pappas	Eng.	PacifiCorp	2 Miles south Hwy 10,P O Box	Castle Dale	UT	84513
579	Robert	Parent		Forney Corporation	3405 Wiley Post road	Carrollton	TX	75006
580	Darrell	Parson		Liston Scientific	18900 Teller Ave.	Irvine	CA	92612
581	William	Partanen	Branch Mgr.	Neill and Gunter, Incorpo	706 Giddings Ave	Annapolis	MD	21401
582	Rob	Patterson	Pres.	METCO	3226 Commander Drive	Carrollton	TX	75006
583	Rick	Patzman	Sr. Envir. Sci.	Centennial Energy Resourc	400 North Fourth Street	Bismarck	ND	58501
584	Tracy	Peace	Env. Eng. II	Alabama Department of Env	1400 Coliseum Blvd	Montgomery	AL	36110-2015
585	Robert	Pearson	VP	CH2M Hill	9193 South Jamaica St.	Englewood	CO	80112
586	Craig	Pearson	Asc. Eng.	SCANA	6248 Bush River Road	Columbia	SC	29212
587	David	Peightal	Env.Ops.Mgr.	Basin Electric Power Coop	420 County Road 26	Beulah	ND	58523
588	Wayne	Penrod	Sr Mgr., Env.	Sunflower Electric	2075 West St, John Street	Garden City	KS	67846
589	William	Pepper	Sr. VP	ICF Consulting	9300 Lee Highway	Fairfax	VA	22031
590	Luis	Perez	Env. Eng.	El Paso Electric	P.O. Box 982 - loc 246	El Paso	TX	79960
591	Brian	Petermann	Env. Mgr.	Sega	16041 Foster	Stillwell	KS	66085
592	Scott	Phillips	VP	Earth Tech / Tyco Interna	7870 Villa Park Drive	Richmond	VA	23229
593	Stephen	Piche	Dir. of Dev.	Pegasus Technologies	4002 Ave C	Austin	TX	78751
594	Paul	Pike	Env. Sci.	Ameren	P.O. Box 66149	St. Louis	MO	63166
595	Rich	Piper	Env. Mgr.	FPL Energy	P.O. Box 14000	Juno Beach	FL	33408
596	Jeff	Pittman		Custom Stack Analysis,LLC	P O Box 3750	Alliance	OH	94601
597	Mark	Podrez		RTP Environmental Associa	2031 Broadway	Boulder	CO	80304
598	Fenna	Poelzer	Proj. Leader	Luscar Ltd.	1600 Oxford Tower	Edmonton,AB	OT	T5J 3G1
599	Clara	Poffenberger	Atty.	Baker Botts LLP	1299 Pennsylvania Ave, N.W.	Washington	DC	20004

600	Peter	Pomponi	Sales Eng.	Met One Instruments, Inc	1600 Washington Blvd	Grants Pass	OR	97526
601	**F B (a)	Pope III	Sr Reg'l. Prog.	ENSR International				
602	Dan	Poteet	Sr. Prog. Dir.	Earth Tech	7870 Villa Park Drive	Richmond	VA	23228
603	Doug	Pottratz	Env Coord.	Avista Corp	1411 East Mission	Spokane	WA	99220-372
604	Dayal	Prabhu	Pres.	EUEC	5860 N Calle Grandeza	Tucson	AZ	85718
605	Frank	Princiotta	Dir./APPCD	EPA	109 T.W. Alexander Drive	Research Trian	NC	27711
606	Stephanie	Procopis	Dir. of Mktg.	Powerspan Corp.	P.O. Box 219	New Durham	NH	3855
607	Connie	Prostko-Bell	Ntnl. Account	Dolphin Software	9 Monroe Pkwy, Suite 150	Lake Oswego	OR	97035
608	Jack	Provda	Dir.	Earth Tech	300 Oceangate	Long Beach	CA	92610
609	Jim	Pruett		Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
610	Robert (Bob)	Pryor	InterNtnl. Proj.s	Tennessee Valley Authorit	400 W. Summit Hill Dr.	Knoxville	TN	37902
611	Theresa	Pugh	Env. Mgr.	American Public Power Ass	2301 M St NW	Washington	DC	20037
612	Amy	Pulsifer	Env. Coord.	Tucson Electric Power	Springerville Generating Statio	Springerville	AZ	85938
613	Jeffrey	Quick	Geologist	Utah Geological Survey	1594 W. North Temple, Suite 3	Salt Lake City	UT	84116
614	Mary	Quillian	Sr. Mgr., Env.a	Nuclear Energy Institute	1776 I Street, NW, Suite 400	Washington	DC	20006-370
615	John	Quinn	Lead Eng.	Constellation Energy	P.O. BOX 1475	Baltimore	MD	21203
616	Khal	Rabadi	Proj. Mgr.	Trinity Consultants/T3	12801 North Central Express	Dallas	TX	75243
617	Dale	Raczynski	Prin.	Epsilon Associates	150 Main Street	Maynard	MA	1754
618	Matthew	Radigan	Ntnl. Sales Mgr	VIM Technologies	7464 New Ridge Road, Suite 2	Hanover	MD	21076
619	Manu	Raju	Staff Writer	Inside EPA	1225 S. Clark St., Suite 1400	Arlington	VA	22202
620	John	Ralston	Pres.	Ralston International Tra	P O Box 3442	Kingsport	TN	37664
621	Joanne	Randall	CEM Spec.	CEMTEK	2121 S. Yale Street	Santa Ana	CA	92704
622	Dennis	Recla	Systems Eng.	Met One Instruments, Inc	1600 Washington Blvd	Grants Pass	OR	97526
623	Will	Reed	Reg'l. Account	ESS	1620 W Fountainhead Pkwy,	Tempe	AZ	85282
624	Steve	Rees	VP Bus. Dev.	Clean Air Engineering	500 West Wood St.	Palatine	IL	60067
625	Martin	Rehm	Sr.Env. Planner	Tri-State	1100 W.116th Ave	Westminster	CO	80234
626	Jim	Reichle	VP	CH2M HILL	3 Hutton Centre Drive	Santa Ana	CA	92707
627	Garry	Renwick		CSQ Environmental Technol	202-5752 167th Street	Surrey, British C	OT	V3S 4C8
628	Angila	Retherford	Dir.	VECTREN	20 N W Fourth Street	Evansville	IN	47702-020
629	Bill	Reynolds		SGS North America Inc.	2058 Fell Street	San Francisco	CA	94117
630	Bill	Reynolds		SGS North America Inc.	2058 Fell St.	San Francisco	CA	94117
631	George	Rhoderick	Res. Chemist	NIST	100 Bureau Dr., Mail Stop 8393	Gaithersburg	MD	20899-839
632	Mike	Ricciardi	Sr. Dir.-Safety/	Madison Gas and Electric	P O Box 1231	Madison	WI	58701-123
633	Leonard	Richter	Pres.	Custom Instrumentatin	7325 S. Revere Parkway	Centennial	CO	80112
634	Doug	Riedel	Mktg. Dir.	Burns & McDonnell	9400 Ward Parkway	Kansas City	MO	64114
635	Dan	Riedinger	Media Relation	EEL	701 Pennsylvania Ave., NW	Washington	DC	20004-269
636	Mike	Rini	Proposal Mgr.	ALSTOM Power	1409 Centerpoint Blvd.	Knoxville	TN	37932
637	Bruce	Rising	Reg. Affairs	Siemens	4400 Alfaya Trail	Orlando	FL	32765
638	Miriam	Robbins		Southwest Wind Power	2131 N. First St	Flagstaff	AZ	86001
639	Ralph L.	Roberson	Pres.	RMB Consulting	5104 Bur Oak Circle	Raleigh	NC	27612
640	Dick	Robertson	Air Qual. Mgr.	TXU	1601 Bryan	Dallas	TX	75201
641	Richard	Robinson	Env. Rep	NRECA	4301 Wilson Boulevard	Arlington	VA	22203
642	Mark	Rodriguez	Env. Sci.	El Paso Electric	P.O. Box 982 - Loc 246	El Paso	TX	79960
643	**Steve (a)	Roe	VP	E.H. Pechan & Associates				
644	Tim	Rogers	Env. Eng.	Black Hills Corporation	625 Ninth Street	Rapid City	SD	57709
645	Bill	Rogers	Technological	Detroit Edison Co	655 GO	Detroit	MI	48226
646	John	Rogers	Sr. Asc.	The Conservation Fund	P.O. Box 271	Chapel Hill	NC	27514
647	Ernesto	Rojas	Asst. Civil Eng.	Pima County Environmental	150 W. Congress	Tucson	AZ	85701
648	Laura	Rose	Sr. Prof.	Earth Tech	7870 Villa Park Drive	Richmond	VA	23228
649	Kevin	Rose	Gas Turbine T	Mesquite Power LLC	37625 W.Elliot Rd	Arlington	VA	85322
650	Peter	Rosenthal	Washington Bu	Argus Media/Air Daily	1012 14th St. NW	Washington	DC	20005
651	John	Ross	Mgr.. Permits	NiSource	801 E. 86th Ave	Merrillville	IN	46410
652	Michael	Rossler	Mgr., Env. Pr	EEL	701 Pennsylvania Ave., NW	Washington	DC	20004-269
653	Steve	Rowe-Krumb	Env. Impact Sp	Earth Tech, Inc.	4135 Technology Parkway	Sheboygan	WI	53083
654	John	Ruether	Sr. Eng.	DOE-NETL	USDOE	Pittsburgh	PA	15317
655	Volker	Rummenhohl	Mgr.	FlowTack, LLC	1003 Morrisville Parkway, Suit	Morrisville	NC	27713
656	Jon	Russell	Mgr.	North East Utilities	P.O. Box 270	Hartford	CT	06141-027
657	Jeffrey	Ryan		US EPA	109 T. W. Alexander Dr	RTP	NC	27711
658	Keith	Rylant	Mgr. Bus. Dev.	Tennessee Valley Authorit	POB 1010	Muscle Shoals	AL	35662
659	Robin	Saikin		4801 Woodway Drive	Suite 270W	Houston	TX	77056
660	Amena	Saiyid	Congressional	American Political Scienc	46805 Keswick Square	Sterling	VA	20165
661	Patrick	Salakovich		Air Sampling Associates	P O Box 1175	Lowisville	TX	75067
662	Nicole	Salengo	Mktg. Dir.	Air Toxics Ltd.	180 Blue Ravine Drive	Folsom	CA	95630
663	Mike	Salerno	VP Bus. Dev.	Alstom Power	1409 Centerpoint Blvd	Knoxville	TN	37932
664	Greg	San Martin	Climate Protecti	Pacific Gas and Electric	77 Beale Street, Mail Code B2	San Francisco	CA	94105
665	Mickey	Sarles		US EPA	109 W.Alexander Dr.	RTP	NC	27711
666	Greg	Scandrett	Dir. of Operatio	ESS	1620 W Fountainhead Pkwy	Tempe	AZ	85282

667	Frank	Schaedlich		Tekran, Inc.	330 Nantucket Blvd	Toronto, Canada	OT	MIP 2P4
668	Steven	Schiller	Prin.	Schiller Consulting	111 Hillside	Piedmont	CA	94611
669	Dan	Schneeberger		Tekran, Inc.	330 Nantucket Blvd	Toronto, Canada	OT	MIP 2P4
670	Bob	Schnelle	Coord.-EMIS Pr	Cinergy	139 East 4th Street	Cincinnati	OH	45202
671	Keith	Schofield	Dr.	University of California	Materials Research Laborator	Santa Barbara	CA	93106
672	Jim	Schott		Entergy Services	10055 Grogans Mill Rd.	The Woodlands	TX	77380
673	S. Dear	Schramm-Sat	Corp Affrs, En	Indianapolis Power and Li	One Monument Circle	Indianapolis	IN	46204
674	Bob	Schreiber	Pres.	Schrieber, Yonley and Asso	271 Wolfner Dr	Fenton	MO	63026
675	Jason	Schulz	Env. Sci.	EPCOR Utilities Inc.	10065 Jasper Ave	Edmonton	OT	T5J 3B1
676	Rod	Seagle	Prin., Sci./Eng	SRP	PO Box 52025	Phoenix	AZ	85072
677	Paul	Seby	Ptnr., Atty.	Friedlob Sanderson	1775 Sherman St. 21st. Floor	Denver	CO	80203
678	Fred	Sellers	VP	TRC	100 Root of John St. Boott Mill	Lowell	ME	1852
679	Lawrence	Selzer	Pres. and CEO	The Conservation Fund	1800 N. Kent Street, Suite 112	Arlington	VA	22209
680	Constance	Senior	Mgr., Eng.ing R	Reaction Engineering Inte	77 West 200 South, Suite #21	Salt Lake City	UT	84101
681	Leo	Serrano	Sr. Plant Eng.	Arizona Public Service Co	P.O.Box 53933, Mail Station 4	Phoenix	AZ	85072-393
682	Farzana Alt	Shah	Sr. Proj. Office	OIL and GAS DEVELOPMENT	Room No: 109, TOWER-A,	Islamabad, Pakis	OT	44900
683	Dana	Shay	Reg'l. Sales Mg	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
684	Mark	Shell	VP Operations	Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
685	Charles	Shell		Shell Engineering and Ass	2403 West Ash	Columbia	MO	65203
686	Michael	Shepard	Sr. VP	E Source/Platts	3333 Walnut St.	Boulder	CO	80301
687	John	Shideler		NSF-ISR	789 N. Dixboro Rd.	Ann Arbor	MI	48105
688	Ronald	Shiflett	Exec. Dir.	IUEP	701 Pennsylvania Ave., NW st	Washington	DC	20036
689	Jeremy	Shively	Eng.	High Technology Foundatio	2001 Main Street	Wheeling	WV	26003
690	Darryl	Shoemaker	VP	HDR	6190 Golden Hills Drive	Minneapolis	MN	55416
691	Bob	Sholl	Env. Eng.	Burns and McDonnell Engin	9400 Ward Parkway	Kansas City	MO	64114
692	Louis	Shoub	Pres.	Crown Systems	3844 N 24th St	Phoenix	AZ	85016
693	Marc	Shoub	Cons.	Crown Systems	3844 N 24th St.	Phoenix	AZ	85016
694	David	Shropshire	Consulting Eng.	Idaho National Laboratory	PO Box 1625	Idaho Falls	ID	83415-371
695	John	Shultz	Proj. Serv. Mgr.	Basin Electric Power Coop	1717 E. Interstate Ave	Bismarck	ND	58501
696	Leo	Sicuranza	Sr. Cons.	Tetra Tech FW Inc	133 Federal Street	Boston	MA	2110
697	FERNANDO	SILVA	MR	SANEAGO	AV FUED JOSE SEBBA, 570	GOIANIA/GO	OT	74805100
698	Eric	Simons	Dir. of Bus. De	Distributed Generation Sy	200 Union Blvd., Suite 304	Lakewood	CO	80228
699	Richard	Simpson	Env. Eng.	NCDAQ - SSCB	1641 Mail Service Center	Raleigh	NC	27699-164
700	Gregory	Sims	Sr. Proj. Mgr.	Weston Solutions, Inc.	1625 Pumphrey Ave	Auburn	AL	36832
701	Kris	Sinclair	Serv. Administ	Entropy International	1a Waterview	Lancaster	OT	LA1 4XS
702	Uday	Singh	VP/Energy	TRC	21 Technology Drive	Irvine	CA	92618
703	Rajeshmal	Singhvi	Chemist	US EPA	2890 Woodbridge Ave., Bldg	Edison	NJ	8837
704	Joseph	Siperstein	Pres.	Ohio Lumex Company, Inc	9263 Ravenna Rd Unit A-3	Twinsburg	OH	44087
705	Sharon	Sjostrom		ADA-ES, Inc	8100 South Parkway, Unit B	Littleton	CO	80120
706	Jay	Skabo	Env. Mgr.	MBU Resources	400 North Fourth Street	Bismarck	ND	58501
707	Richard	Skaggs	Proj. Mgr.	Battelle NW	902 Battle Blvd. - K9-02	Richland	WA	99352
708	Lou	Skibicki		RTP Environmental Associa	2031 Broadway	Boulder	CO	80304
709	Carolyn	Slaughter		Institute of Clean Air Co	1660 L Street, NW	Washington	DC	20036
710	Stephen	Slocumb	Sr. Eng.	Epsilon Associates	150 Main Street	Maynard	MA	1754
711	Kevin	Smith	Sr. Proj. Eng.	Carmeuse North America	Technology Center	Pittsburgh	PA	15225
712	Kara	Smith	Enviromental T	Chickasaw Nation Division	P.O. Box 788	Ada	OK	74821
713	Joshua	Smith	Cons.	ICF Consulting	9300 Lee Highway	Fairfax	VA	22031
714	Dave	Smith	Proj. Leader	Saskatchewan Power Corp.	2901 Powerhouse Dr	Regina	OT	S4N OAI
715	Joe	Smith	Bus. Dev. Dir.	TRC Environmental Corpora	27210 Doverbrook	Huffman	TX	77336
716	Arthur	Smith	Sr. VP and Env	NiSource	801 E. 86th Ave.	Merrillville	IN	46410
717	David	Smith	Mgr. of Env.	Saskatchewan Power Corp.	P.O. Box 2310	Glen Allen	VA	23058
718	Kwang-Chul	Song	Team Mgr.	Korea Electric Power Rese	103-16, Munji-dong, Yuseong-	Taejeon, Korea	OT	305-380
719	John L.	Sorrels	Economist	US. EPA	79 T.W. Alexander Drive	Research Trian	NC	27711
720	David W.	South	Pres.	TM Solutions	7904 Hollington Place	Fairfax Station	VA	22039-316
721	Darrell	Soyars	Env. Eng. IV	Nevada Power Company	6100 Neil Rd. MS#S4B08	Reno	NV	89511
722	Larry	Spann	Env Comp. Spe	Alabama Electric Cooperat	2027 East Three Notch Street	Andalusia	AL	36420
723	Robert	Spellicy	Pres.	Industrial Monitor and Co	800 Paloma, Suite 100	R	TX	78664
724	Justin	Spenillo		US EPA	1200 Pennsylvania Ave NW,	Washington	DC	20460
725	Gary	Spitznogle	Mercury Proj.	American Electric Power	1 Riverside Plaza	Columbus	OH	43215
726	William	Strigg	ISPE Deputy Di	University of Arizona	715 N. Park Ave., 2nd Floor	Tucson	AZ	85721
727	Rick	Sprott	Dir.	Utah Division of Air Qual	150 N. 1950 W.	Salt Lake Cith	UT	84114-482
728	Rameshwar	Srivastava	Prin. Eng.	DOE-NETL	626 Cochrans Mill Road	Pittsburgh	PA	15236
729	Rameshwar	Srivistava	Prin. Eng.	Science Applications Inte	626 Cochrans Mill Road	Pittsburgh	PA	15236
730	Mark	St.Clair		Scott Speciality Gases	6141 Easton Rd., Bldg 1	Plumsteadville	PA	18949
731	Richard	Staehle	Mgr. Bus. Dev	Babcock Power, Inc.	20 S. Van Buren Ave	Barberton	OH	44203
732	Lewis	Staley	VP		5087 Junction Road	Lockport	NY	14094
733	Kathleen	Standen	Mgr., Env Reg	We Energies	22 E. Miffian	Madison	WI	53703

734	Kathleen	Standen	Mgr., Env. Re	We Energies	22 E. Miffian St	Madison	WI	53703
735	Blake	Stapper	Proj. Mgr.	URS Corporation	9400 Amberglen Boulevard	Austin	TX	78729
736	Carole	Stapper	Proj. Mgr.	URS Corporation	9400 Amberglen Boulevard	Austin	TX	78759
737	William	Stark	Sr Env. Eng.	RW Beck	1801 California, Suite 2800	Denver	CO	80202
738	James	Staudt	Pres.	Andover Technology Partne	112 Tucker Farm Road	North Andover	MA	1845
739	Robert	Stedwill	Mgr Env. Prog.	Sask Power	6th Floor, 2025 Victoria Aven	Regina	OT	S4R 4V5
740	Kelly	Steinberg		Compliance Strategies and	1301 Regents Park Dr.,Ste # 1	Houston	TX	77058
741	STEVE	STEINGRAEB	Sr. SALES Eng	AMERON INTERNATIONAL	10681 FOOTHILL BLVD., #450	RANCHO CUCA	CA	91730
742	Paul	Stockwell		PS Analytical	1761 West Hillsboro Blvd.,	Deerfield Beach	FL	33442
743	Erik	Straser	Gen. Ptnr.	Mohr Davidow Ventures	3000 Sand Hill Rd.	Menlo Park	CA	94025
744	Sheldon	Strom	Exec. Dir.	Center for Energy and Env	212 3rd Avenue North Suite 5	Minneapolis	MN	55401
745	Richard	Stuebi	Pres.	NextWave Energy, Inc.	1600 Broadway, Suite 2400	Denver	CO	80202
746	Cathy	Summers	Geologist	US DoE - ARC	1450 Queen Ave. SW	Albany	OR	97321
747	William	Sun	VP	FuelTech Environmental	512 Kingsland Drive	Batavia	IL	60510
748	Terry	Surles	VP, Env.	EPRI	3412 Hillview Avenue	Palo Alto	CA	94303
749	Grant	Sutherland		CSQ Environmental Technol	202-5752 176th St.	Surrey, British C	OT	V3S 4C8
750	Brian	Swanson	Gen. Mgr.	CMC Solutions, L.L.C.	50160 Pontiac Trail, Suite #5	Wixom	MI	48393
751	Larry	Swanson	Sr. Res. Eng.	GE Energy	18 Mason	Irvine	CA	92618
752	Karen	Swiggard	VP	Golden Specialty Consult	931 Seaco Ct.	Deer Park	TX	77536
753	Scott	Swiggard	Pres.	Golden Specialty Consulti	931 Seaco Ct.	Deer Park	TX	77536
754	James	Sydnor	Env. Mgr II	Dept of Environmental Qua	629 E. Main St	Richmond	VA	23219
755	Michael	Szybinski	Env. Spec.	Florida Power and Light	700 Universe Boulevard	Juno Beach	FL	33408
756	Zong	Tang	Sr. Resarch A	Sorbent Technologies	1664 E. Highland Rd. #10	Twinsburg	OH	44087
757	Laura	Tanzer	PhD Candidate	School of Natural Resourc	214 Bio Sci East, PO Box 210	Tucson	AZ	85721-004
758	Troy	Thayer	Reg'l. Sales Mg	Teledyne	6565 Nancy Rich Dr.	San Diego	CA	92121
759	Jesse	The	Pres.	Lakes Environmental Softw	419 Phillips St. Unit 3	Waterloo	OT	N2L 3X2
760	James	Thomas		Enercon Services, Inc.	5100 E. Skelly Drive	Tulsa	OK	74135
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767	George	Thullesen	Dir - Saf and E	Empire District	602 Joplin St.	Joplin	MO	64801
768	Susan	Tierney	Mngng. Prin.	Analysis Group, Inc.	111 Huntington Avenue	Boston	MA	2199
769	Roselyn	Tierra		ENMAX Corporation	141 - 50 Ave SE	Calgary	OT	T2G 4S7
770	Daniel	Todd	Gen. Mgr.	Applied Quantitative Solutions	427-B Main Street	Evansville	IN	47708
771	Todd	Tolbert	Env. Spec.	AEC I	P.O. Box 754,2814 S. Golden	Springfield	MO	65801-075
772	Robert (Robi	Tollett	HS and E Mgr.	Proctor and Gamble	8256 Union Center Blvd	Cincinnati	OH	45069
773	David	Tomlinson	Dir. Power Ser	Ecology and Environment,	2101 4th Avenue	Seattle	WA	98121
774	Louis	Tosi	Ptnr.	Shumaker Loop & Kendrick	1000 Jackson	Toledo	OH	43624
775	Brian	Toth	Sr Env. Eng.	Southern Company	600 N. 18th Street / 14N-8195	Birmingham	AL	35291
776	Bill	Townsend	CEO	Blue Source	48 West Market Street	Salt Lake City	UT	84101
777	Khan H T	Tran	Prin.	AMI Environmental	206 Black Eagle Ave	Henderson	NV	89015
778	Patrick	Traylor	Ptnr.	Hogan and Hartson LLP	555 13th St., N.W.	Washington	DC	20004
779	Jean	Tremblay	Scientific advis	Environment Canada	105 McGill Street, 4th Floor	Montreal	OT	H2Y 2E7
780	Alain	Tremblay	Dr	Hydro-Quebec	75 Boul rene-Levesque	Montreal	OT	H2Z 1A4
781	Andrew	Trenholm		RTI International	3040 Cornwallis Rd	Research Trian	NC	27709
782	Mark	Trexler	Pres.	Trexler Climate + Energy	529 SE Grand Ave, Ste 300	Portland	OR	97214
783	Rod	Truce	Dir.	Indigo Technologies Pty L	Unit 13	Milton, Qld 4064,	OT	4064
784	Gordon	Tucker	Mr.		43860 Shiloh Lane	Lancaster	CA	93535
785	Irfanullah	Tunio	Deputy Dir. (M	Environmental Protection	ST-2/1, Sector 23	Karachi, Pakista	OT	75600
786	Scott	Turner	Ptnr.	Nixon Peabody LLP	Clinton Square, Suite 1300	Rochester	NY	14603
787	Afam	Ugbor		Maricopa County Air Quali	1001 N. Central Ave	Phoenix	AZ	85004
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789	Jeanne	Usitalo	Mktg. Mgr	Perillon Software	30 Porter Rd	Littleton	MA	1460
790	BALAJI	VAIDYANAT	ENV Prog. Spr	ARIZONA DEQ	1110 W. WASHINGTON STRE	PHOENIX	AZ	85007
791	Rajen	Vakharia	Eng.	Wisconsin Department of N	PO Box 7921	Madison	WI	53707-792
792	Robert	Van Ellis	Mgr. - Electric	Lansing Board of Water an	PO Box 13007	Lansing	MI	48901-300
793	Geert	van Grootveld	ir	Dutch Emission Authority	P.O. Box 30945	The Hague	OT	2500 GX
794	Gary	Van Helvoirt	Mgr. Env Prog.	Wisconsin Public Service	700 N Adams St	Green Bay	WI	54307
795	Tim	Vander Wood	Dr.	MVA Scientific Consultant	5500 Oakbrook Pkwy #200	Norcross	GA	30093
796	Sunil	Varma		SRP	P O Box 52025 PAB 352	Phoenix	AZ	85072
797	A. Dahlgren	Vaughan	EH and S Coor	Old Dominion Electric Co	4201 Dominion Boulevard	Glen Allen	VA	23060
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799	Howard	Vickers	Env. Sprv.	Desert Power	12500 East 25500 South	Vernal	UT	84078
800	Krish	Vijayaraghav	Staff Eng.	AER	2682 Bishop Drive, Ste 120	San Ramon	CA	94583

801	Roy	Vincik	Reg'l. Sales Mg	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
802	Dave	Vojtko	Ntnl. Sales Mgr	Horiba	17671 Armstrong Ave	Irvine	CA	92614
803	Thom	Voll	Commercial Dir.	Thermo Electron Corporati	27 Forge Parkway	Franklin	MA	2038
804	David	Vollero	Mgr.,Eng/Ops	York County Solid Waste a	2700 Blackridge Road	York	PA	17402-790
805	Charles	Wakild	Exec. Dir.,EHS	Progress Energy Services	410 S.Wilmington St., PEB 4A5	Raleigh	NC	27601
806	William (Bill)	Walker	Pres.	CleanAir Engineering	500 W Wood St	Palatine	IL	60067-769
807	Evelyn	Walker	Mgr. Emiss. Tr	TransCanada	450-1St SW	Calgary, Alberta	OT	T2P 5H1
808	Ken	Wall		Shaw Environmental	3500 College Blvd., Ste 350	Overland Park	KS	66211
809	Dr. Eric	Walther	VP	TRC	21 Technology Dr.	Irvine	CA	92618
810	Kent	Wanninger	Mgr., Environ S	Midwest Generation EME	440 South LaSalle St	Chicago	IL	60605
811	Kevin	Wanttaja	Mgr.	SRP	P.O. Box 520252 PAB352	Phoenix	AZ	85072
812	Kevin	Ward	Dir. of Sales a	Baldwin	895 E. Patriot Blvd., Suite 107	Reno	NV	89511
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814	John	Watson	Res. Prof.	Desert Research Institute	2215 Raggio Pkwy	Reno	NV	89512
815	Frances	Weatherford	Sr. Mgr.	Tennessee Valley Authority	P O Box 1010, CTR 2T	Muscle Shoals	AL	35662-101
816	Ron	Webb	Pres.	TSI Inc.	500 Cardigan Road	Shoreview	MN	55126
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818	Carl	Weilert	APC Cons.	Burns & McDonnell	9400 Ward Parkway	Kansas City	MO	64114
819	Bill	Wemhoff	Sr. Enviroment	National Rural Electric	4301 Wilson Blvd, Mail Code E	Arlington	VA	22203-186
820	Ramon	West		Vision Monitor	11481 Katy Freeway, Ste 51D	Houston	TX	77079
821	Linda	Whelan	Dir. EHS	Dynegy Inc	1000 Louisiana, Suite 5800	Houston	TX	77002
822	Chris	Whipple	Prin.	ENVIRON	6001 Shellmound St.	Emeryville	CA	94608
823	Cindy	Whitaker		Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
824	Chad	Whiteman	Deputy Dir.	Institute of Clean Air Co	1660 L Street, NW	Washington	DC	20036
825	Karl	Wilber	Corporate Con	Environmental Systems Cor	200 Tech Center Drive	Knoxville	TN	37912
826	Kirk	Wilkerson	Dir. of Sales	California Analytical	6565 Nancy Ridge Dr.	San Diego	CA	92121
827	Dan	Wilkus	Sr. Mgr., Air Pr	Westar Energy	818 S. Kansas Ave.	Topeka	KS	66601
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830	Jason	Williams	Dir., Bussiness	The Shaw Group	4400 College Blvd.	Overland Park	KS	66211
831	Rosemary	Wilson	VP Midwest R	CEED	CEED	Ballwin	MO	63024-105
832	Jay	Wintergreen	Asst. to Pres.	First Environment, Inc	91 Fulton Street	Boonton	NJ	7005
833	Michael Dre	Wooldridge	Asc.	Troutman Sanders LLP	600 Peachtree Street	Atlanta	GA	30308-221
834	Paul	Worhach	Sr. Cons.	Nexant	101 2nd Street, 11th Floor	San Francisco	CA	94105
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836	David	Wright	Dir. Air/Noise D	PCR Services Corp.	233 Wilshire Blvd., # 130	Santa Monica	CA	90401
837	Mei	Xin	Graduate Asst.	University of Nevada, Ren	1664 N.Virginia Street	Reno	NV	89557
838	James	Yann	Mngng. Dir.	ALSTOM Power Inc.	Environmental Control System	Knoxville	TN	37932
839	Andy	Yaros	Mgr. - Env Sys	Old Dominion Electric Coo	5000 Dominion Blvd - 1SE	Glen Allen	VA	23060
840	Jeffrey	Yockey, PE	Env. Eng.	Tucson Electric Power	PO Box 711	Tucson	AZ	85702
841	Carrie	Yonley			271 wolfner Dr	Fenton	MT	63026
842	Maria	Zannes	Pres.	Integrated Waste Services	1331 H Street, N.W., Suite 501	Washington	DC	20005
843	Michael	Zebell	Sr. Prog. Mgr.	ENSR International	W 239 N 2890 Pewaukee Rd.	Pewaukee	WI	53072
844	Michael	Zimmer	Sr. Proj. Mgr.	The Payne Firm	11231 Cornell Park Drive	Cincinnati	OH	45242
845	Patrick	Zimmerman	Dir.	Institute of Atmospheric	South Dakota School of Mines	Rapid City	SD	57701-399
846	Susan	Zinga	Energy Policy	Southface Energy Institut	25 Walnut Circle	Basking Ridge	NJ	7920
847	Ronda	Zivalich		ADA-ES,Inc	8100 South Parkway,Unit B	Littleton	CO	80120
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