Greetings to all our POWID Members!

By Gordon R. McFarland

Many of us attended the February President’s Winter meeting in Jacksonville and had a great time, business and social. I hope you all attended the 45th Annual ISA Power Industry (POWID) Conference and 12th Annual Joint ISA POWID/EPRI Conference 2-7 June 2002, at the Catamaran Resort Hotel on Mission Bay in San Diego, CA. Gary Cohee and staff put together a great event this year. The conference theme was “e2002 - A New Paradigm in the Power Industry’s Use of IT.” The location was super and the weather cooperated nicely. The turnout was good and we had great attendance at our sessions. If you missed the conference then you missed out on some outstanding presentations. I hope you all will try to attend next year’s conference.

Set your 2003 calendars for the 46th Annual POWID Conference and 13th Annual Joint ISA POWID/EPRI Conference that will be held at The Woodlands Hotel in Williamsburg, VA, 16-18 June. It’s an ideal location for the whole family. If anyone is interested in helping with this conference, as session developers or authoring a paper or other functions, or if your company is interested in being a corporate sponsor for the 2003 conference please contact Dale Evely at (205) 992-6649 or at dpevely@southernco.com.

This year POWID will be sponsoring seven sessions at ISA 2002 in Chicago, 21-24 October. Marjorie Widmeyer is coordinating the POWID sessions and has a great program. Plan on attending ISA 2002 in Chicago and be sure to attend the POWID sessions.

The POWID membership is on the rise. As of 31 March 2002, our membership was at 2,651. POWID has a healthy financial balance, and it should be even better after our 2002 POWID Conference financial report is finalized.

In our last issue of WHAT’s WATT we discussed the changes our industry is going through. These changes are continuing and are effecting the careers of many of us. More than ever it is beneficial for power industry professionals, engineers, and technicians to be members of ISA and of POWID. ISA and POWID offer many ways for career development and an effective networking avenue for employment opportunities. I urge all POWID Members to spread the word about ISA and POWID to your fellow workers and to your business associates. For the rest of 2002 let us all strive to bring in new ISA and POWID Members and retain our current membership.

Hope to see you at ISA 2002 in Chicago!

Gordon McFarland
POWID Director
gordon.mcfarland@emersonprocess.com
The 13th Annual Joint ISA POWID/EPRI Controls and Instrumentation Conference sponsored by the ISA Power Industries Division (POWID) and EPRI will take place in Williamsburg, VA, 15-19 June 2003. This year’s theme is “Power Industry Business Intelligence Using Instrumentation, Controls, and Networks.” We welcome your proposed paper on a range of power industry related control system, instrumentation, information system, and technology topics.

We will review all submissions and plan to publish accepted papers in the Conference Proceedings via CD. The highest rated papers will be submitted to ISA Transactions (www.isa.org/isatrans) with POWID’s full endorsement. An additional review will be required to be published in this archival journal.

Guidelines for Submission:

- Intent to Present Application must be submitted electronically and in English by 13 December 2002.
- Indicate “2003 POWID/EPRI Conference” on form.
- Must include a 200-word abstract.
- Papers accepted for publication will require copyright transfer to ISA.
- All participants are required to pay registration fees.

Deadline Dates:

- Abstracts Due: 13 December 2002
- Paper Review Drafts Due: 24 January 2003
- Final Papers Due: 11 April 2003

Attn: Richard Arriola
www.isa.org/powersymp
Phone: (919) 990-9303
E-mail: rarriola@isa.org

Papers will be selected from but are not limited to:

- Advanced Control
- Asset Management
- Economics and Management
- Emerging Applications
- Environmental
- Fossil Technology
- Instrumentation
- Marketing & Sales
- Networking
- Nuclear Technology
- Plant Automation
- Simulation

Primary Contacts:

General Chair
Dale P. Evely
Southern Company
Phone: (205) 992-6649
E-mail: dpevely@southernco.com

ABB Program Co-Chair
Dan Lee
ABB Automation, Inc.
Phone: (440) 585-6063
E-mail: dan.lee@us.abb.com

EPRI Program Co-Chair
Ray Torok
EPRI
Phone: (650) 855-2776
E-mail: rtorok@epri.com

Editorial Review Chair
Don Labbe
Foxboro Company
Phone: (508) 549-6554
E-mail: dlabbe@foxboro.com

ISA Technical Programming
Richard Arriola
Phone: (919) 990-9303
E-mail: rarriola@isa.org

13th Annual Joint ISA POWID/EPRI Conference
46th Annual ISA POWID Conference

Power producers have a variety of assets and data that must be measured, accessed, and intelligently analyzed to improve decision making necessary for today’s competitive environment. Ideally, business and technical decisions are based on factors from the global, regional, and local domain. Realistically however, enabling power producers to cost-effectively integrate and utilize all the potential data to manage their business intelligently will not be easy. It will require a disciplined focus on both the capabilities of the technology and, perhaps more importantly, on the challenges of processing and presenting data for human decision makers.

To meet today’s challenges, smart instrumentation and hybrid controls must provide greater operational flexibility to meet changing business needs. Further integration of business systems, asset optimization systems, and object-oriented systems must provide real-time information to make it humanly possible to absorb and use, without suffering the perils of “information overload.” Advanced control and instrument technology must provide improved means to measure, automate, and/or control the process. Collaboration must improve supply chain, development, and information exchange to achieve marketing goals. This conference program covers the spectrum of technical and business topics related to instrumentation, controls, and networks to satisfy business intelligence needs of power producers.
Future ISA/POWID Conferences

ISA Power Industry Division
- Williamsburg, VA: 16-18 June 2003; post conference courses may be scheduled - TBD
- Denver/Colorado Springs Area: 2004

ISA Annual Meeting
- Chicago, IL: ISA 2002 - 21-24 October
- Houston, TX: ISA EXPO 2003

ISA Technical Conference Series
- Houston, TX: Sicon/02 - Sensors for Industry Conference & Exhibition - 18-21 November 2002
- Houston, TX: Fugitive Emissions-LDAR Symposium - 4-6 February 2003
- Los Angeles, CA: NOx Emissions and Source Monitoring - 18-20 February 2003

You can get CREDITS for attending the Joint ISA POWID/EPRI Conference as many of your peers have. It’s another reason to put this conference on your agenda for next year.

PDH certificates have been awarded at the last three ISA POWID/EPRI Symposia. Over that time period approximately 560 certificates awarding 1,780 Professional Development Hours have been given out.

<table>
<thead>
<tr>
<th>Year</th>
<th>Certificates</th>
<th>PDHs</th>
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<tbody>
<tr>
<td>2000</td>
<td>107</td>
<td>321</td>
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<tr>
<td>2001</td>
<td>248</td>
<td>850</td>
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<tr>
<td>2002</td>
<td>203</td>
<td>609</td>
</tr>
</tbody>
</table>

The purpose of documenting continuing professional competency credits is to demonstrate a continuing level of competency among professional engineers and certified technicians. Symposium registrants who sign an attendance log can receive certificates for each session attended.

Did you know...

You can get CREDITS for attending the Joint ISA POWID/EPRI Conference as many of your peers have. It’s another reason to put this conference on your agenda for next year.

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Additional Information:
- ISA offers CEUs for training courses. This status is provided through the International Association for Continuing Education and Training (IACET). CEUs are not given for committee meetings or presentations but for defined training courses where skills and objectives are presented, tested, and students are given feedback on their performance.
- The CCST® (Certified Control Systems Technician®) renewal program accepts PDHs to validate a CCST’s time in a technical session, expanding his/her knowledge. This can come from on the job training, attending technical sessions, or presenting papers.

Definitions:
- Professional Development Hour (PDH) - A contact hour (nominal) of instruction or presentation which is the common denominator for other units of credit.
- Continuing Education Unit (CEU) - Unit of credit customarily used for continuing education courses. One CEU equals 10 PDHs.
- Course/Activity - Any course or activity with a clear purpose and objective, which will maintain, improve, or expand the skills and knowledge of the licensee.
Cyber Security Sessions at ISA 2002

Sponsored by POWID, FPID, G&C, TXD, ASD, TMD and the Standards & Practices Dept.
ISA 2002 Technical Conference, 21-24 October, Chicago, IL

Monday, 21 October
9:30 a.m. – 11:00 a.m.

Real Time Control System Security
Issues and Direction
The Issues and Challenges — an Overview
NIST or NSA
The Electric Power Industry
Joe Weiss
Examples of Cyber Attacks and System Failures
Industry specialist
Developer: Joe Weiss, EPRI

1:45 p.m. – 3:15 p.m.

Vendor Solutions to Maintain Real Time Control and Network
Honeywell Approaches to Cyber Security Threats
Honeywell
Allen Bradley’s Approach to Security, Access, and Connectivity
Allen Bradley
Foxboro Approaches
Foxboro
Technology Summary
All
Encryption
Intrusion Detection and Resolution
(Security Agents, etc.)
Processes and Procedures
Who Offers What Support Today?
A Vision of the Future — Remote Method Security in a Distributed Processing Architecture
B. Taylor and S. Muftic
Developer: Bob Webb, Power Engineers

3:30 p.m. – 5:00 p.m.

The Role of Standards in the Development of Secure Control Systems Design
ISA-84 — Programmable Electronic System (PES) for Use in Safety Applications
Vic Maggiori
ISA-95 — Enterprise/Control Integration
J. Unger
ISA POWID Activities
Marjorie Widmeyer
Future Directions Standards Integration or Diversification?
Robert Webb
Developer: Bob Webb, Power Engineers

Tuesday, 22 October
No Cyber Security Sessions

Wednesday, 23 October
9:30 a.m. – 11:00 a.m.

Network Applications
Applying Fieldbus to US Power Plants
Asset Optimization: Start with Unit Performance
Developer: Karen Clay, Siemens Westinghouse Power

1:45 p.m. – 3:15 p.m.

Internet (In)Security
Dr. Sujeet Shenoi, Oliphant Professor of Mathematical and Computer Sciences at The University of Tulsa is one of the leading computer scientists in the United States in the field of computer security, information assurance, and anti-cyber terrorism. He leads a team of faculty that have gotten TU named one of 22 National Centers of Excellence in Information Assurance by the National Security Agency, and one of six universities awarded a “Cyber Corps” program by the National Science Foundation. TU has also been awarded a DoD Cyber Corps program, being the only institution to have both programs, and the only one to offer three levels of NIST certification in security training. (The Cyber Corps was established in 2001 modeled on ROTC, providing full tuition, room and board scholarships for two years to students who will complete a degree—BS, MS, or PhD—in two years if they agree to work for the federal government in a civilian position for two years upon graduation.)

Shenoi is also an outstanding teacher, having been named the US Professor of the Year in 1998 for doctoral level institutions by the Carnegie Foundation’s Council for the Advancement and Support of Education.

Developer: Sujeet Shenoi, University of Tulsa

ISA 2002 Technical Conference Schedule for Power Industry Division (POWID)

Tuesday, 22 October
9:30 a.m. – 11:00 a.m.

Development of Control Systems for Combined Cycle Power Plants
Developer: Marjorie Widmeyer, SLAC

PLC-Based Control System for Turbogas Units
Salvador Jayme, Instituto de Investigaciones Electricas

Feed Forward Neurofuzzy Speed Control for a Turbogas Unit
Salvador Jayme, Instituto de Investigaciones Electricas

Modernization of Combined Cycle Power Plant Control Systems: From Analog to Digital
Marino Sanchez-Parra, Instituto de Investigaciones Electricas

Neurofuzzy PI Speed Controller for a Turbogas Unit
Raul Garduno-Ramirez, Electrical Research Institute
ISA POWID Awards

ISA Power Division held its annual Honors & Awards Luncheon on 3 June 2002 in conjunction with the 45th ISA Power Industry Conference in San Diego, CA. The following are the recipients of the four major awards that were presented.

POWID Achievement Award

This award was created for the purpose of recognizing individuals for their outstanding achievement, original design application, or special contributions toward the development of engineering concepts in the field of instrumentation and controls for the advancement of electric power generation.

The 2002 recipient was James Batug of PP&L Generation. Jim has been involved in the power industry for over 25 years and has considerable experience in instrumentation and control of stack emissions monitoring, control system retrofits, and new plant application. He is currently the chairman of ISA Standard for CEMS and COMs (SP77.81). He has been a session developer for the past three conferences as well as authoring a number of papers for both ISA and EPRI. Congratulations Jim and thanks for all of your work in the industry!

Jim Batug Receiving Achievement Award from POWID Director Gordon McFarland

If you know of a member of ISA’s Power Industry Division deserving of the POWID Achievement Award (outstanding achievement, original design application, or special contributions toward the development of engineering concepts in the field of instrumentation and controls for the advancement of electric power generation), please complete the attached form and send it to Roger Hull by 1 November 2002, as indicated at the bottom of the form on page 7.

History of the POWID Achievement Award

1977 Alfred Watson Westinghouse Electric Corp
1978 Oliver W. Durrant Babcock & Wilcox Company
1979 Samuel G. Dukelow Bailey Control Company
1981 Richard H. Morse Leeds & Northrup Company
1983 Porter J. Womeldorf Illinois Power Company
1984 Robert L. Criswell Foster Wheeler Energy Corp.
1985 John E. Coles New Orleans Public Service Co.
1986 Robert N. Buschell EBASCO Services, Inc.
1987 Q. V. Chou Ontario Hydro
1988 Peter J. Clelland Philadelphia Electric Company
1989 Gordon McFarland Combustion Engineering
1990 Paul Kenny Sargent & Lundy
1991 Richard Hottenstine Gilbert/Commonwealth
1992 Joe Weiss EPRI
1993 Harold Hopkins Utility Products of Arizona
1994 Marjorie A. Widmeyer Washington Public Power Supply
1995 Edwin M. Good Florida Power Corp.
1996 Robert N. Hubby MAX Control Systems
1997 Robert W. Hill Amtech Services
1998 Cyrus Taft EPRI
1999 Ron Johnson Sargent & Lundy
2000 Ron Hicks Black & Veatch
2001 Leonard Gruber Westinghouse
2002 Jim Batug PP&L Generation
POWID Service Award

This is awarded for outstanding service in the field of instrumentation. The service of the individual is noteworthy, exemplary, or unique and exceeds the normal duties of the office held. The service is of a nature that advances the stature of the Power Division and/or ISA.

The 2002 recipient of the Service Award was Gary Cohee. Gary has spent considerable hours working on behalf of the ISA Power Industry Division. He was the Conference General Chairman for 2002 in San Diego. He has also been a session developer, an author, paper reviewer, and technical program coordinator for previous POWID conferences. Gary has been an ISA Member for over 23 years. All of Gary’s hard work has been greatly appreciated by those attending the conference as well as by the POWID Executive Board.

If you know of an individual deserving of ISA’s Power Industry Division Service Award (outstanding service in the field of instrumentation. The service of the individual is noteworthy, exemplary, or unique and exceeds the normal duties of the office held. The service is of a nature that advances the stature of the Power Division and/or ISA), please complete the attached form by 1 November 2002, and send it to Roger Hull, as indicated at the bottom of the form on page 7.

POWID Facility Award

This award is designed to honor facilities that have demonstrated innovative application of control system or instrumentation technology in the power industry:

- Successful application in a power generation plant
- Identified benefits
- General applicability to the industry
- Recipient is a facility (power plant, dispatch center, environmental treatment facility, simulator, etc.)
- Can be an international location
- Applies technology and/or equipment available through use of standard components or practices (not “one time specials”)

Reliant Energy’s W.A. Parish Plant received the 2002 Facility Award. This eight unit site generating nearly 4000MW’s has been modernized to improve emissions, and reliability while minimizing operating costs. The plant has recently installed DCS equipment, low NOx burners, SCRs, intelligent sootblowing, and high fidelity operator training simulators.

Past Recipients

<table>
<thead>
<tr>
<th>YEAR</th>
<th>UTILITY</th>
<th>PLANT</th>
</tr>
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<tbody>
<tr>
<td>2002</td>
<td>Reliant Energy</td>
<td>W. A. Parish</td>
</tr>
<tr>
<td>2001</td>
<td>Consumers Energy</td>
<td>J. H. Campbell</td>
</tr>
<tr>
<td>2000</td>
<td>Trans Alta Corp</td>
<td>Sundance</td>
</tr>
<tr>
<td>1999</td>
<td>Montana Dakota Utilities</td>
<td>Heskette</td>
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<tr>
<td>1997</td>
<td>Virginia Electric Power</td>
<td>Mount Storm</td>
</tr>
<tr>
<td>1995</td>
<td>Cinergy</td>
<td>Bisbon</td>
</tr>
<tr>
<td>1995</td>
<td>Michigan State University</td>
<td>T.B. Simon</td>
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<tr>
<td>1994</td>
<td>Central &amp; Southwest</td>
<td>Oklaunion</td>
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<tr>
<td>1993</td>
<td>Alabama Power</td>
<td>Gaston</td>
</tr>
<tr>
<td>1992</td>
<td>Philadelphia Electric</td>
<td>Eddystone</td>
</tr>
</tbody>
</table>

If you know of a power facility worthy of this prestigious award, now is your chance to nominate it. Nomination for the 2003 Facilities Award are being taken. Just complete the following form and return it by 1 November 2002 to Roger Hull (as indicated at the bottom of the form on page 8).

POWID Technical Paper Award

Each year POWID recognizes the best paper(s) from the previous year’s conferences.

The four best papers from 2001 are:

“Certification of a Selective Catalytic Reduction Equipped Combined Cycle Generating Unit” by Johnny M. Hay and James W. Bice of Southern Co.


Our congratulations to all the authors of these papers. All four papers will be published in upcoming issues of the newsletter, including this one. Enjoy!
2003 ACHIEVEMENT AWARD NOMINATION FORM

This award was created for the purpose of recognizing individuals for their outstanding achievement, original design application, or special contributions toward the development of engineering concepts in the field of instrumentation and controls for the advancement of electric power generation.

Nominee’s Name: ____________________________________________________________________________________________

Contributions to the Power Industry: ____________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Contributions to ISA and/or Power Division: _______________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Other Comments: ____________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Nominated By: ______________________________________________________________________________________________

Please submit to Roger Hull by 1 November 2002 at roger.hull@emersonprocess.com.

2003 SERVICE AWARD NOMINATION FORM

This award is for outstanding service in the field of instrumentation. The service of the individual is noteworthy, exemplary, or unique and exceeds the normal duties of the office held. The service is of a nature that advances the stature of the Power Division and/or ISA.

Nominee’s Name: ____________________________________________________________________________________________

Contributions to ISA: ________________________________________________________________________________________
____________________________________________________________________________________________________________
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Contributions to ISA Power Division: __________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Other Comments: ____________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Nominated By: ______________________________________________________________________________________________

Please submit to Roger Hull by 1 November 2002 at roger.hull@emersonprocess.com.
2003 FACILITIES AWARD NOMINATION FORM

Facility Name: ________________________________________________________________________________________________

Location: ____________________________________________________________________________________________________

Description of Facility: ________________________________________________________________________________________
____________________________________________________________________________________________________________

What is innovative about it? __________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

What was learned? ____________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

What are the benefits to the facility, to ISA/POWID (e.g., Productivity, Operating Flexibility, Reliability, Availability, Efficiency, Other)?________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

What are the expected benefits to the Industry? __________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Nomination Submitted By: ____________________________________________________________________________________
____________________________________________________________________________________________________________

Who to contact at the facility for more information? ______________________________________________________________
____________________________________________________________________________________________________________

Name, address and phone number of nominator: __________________________________________________________________
____________________________________________________________________________________________________________

Key Project Dates:
Start: __________________________________________Installation: __________________________________________________
Testing Period: ______________________________________In-Service: ____________________________________________

Major contributors: __________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

Other awards received by the facility: __________________________________________________________________________

Additional Comments: ________________________________________________________________________________________
____________________________________________________________________________________________________________

Please submit to Roger Hull by 1 November 2002 at roger.hull@emersonprocess.com.
Certification of a Low Level NOx Continuous Emissions Monitoring System

J. Wade Bice
Lead Environmental Specialist
Alabama Power Company
GSC #8
Calera, Alabama 35040

Johnny M. Hay
Supervisor
Alabama Power Company
GSC #8
Calera, Alabama 35040

Keywords

Low level NOx emissions, CEMS, Selective Catalytic Reduction, Combined Cycle

ABSTRACT

The Acid Rain Part 75 certification of a low level Oxides of Nitrogen (NOx) emitting Unit can present numerous challenges. The most challenging area is performing the Relative Accuracy Test Audit (RATA). Alabama Power Company recently certified a Continuous Emissions Monitoring System (CEMS) on a 500 megawatt combined cycle generating unit. The Unit has a SIP NOx emission limit of 0.013 pounds per million Btu (mmBtu) which is equivalent to 3.5 ppmv NOx at 15% O2. The CEMS is also equipped with an ammonia analyzer. Both the CEMS and reference method (RM) utilize dilution extractive monitoring technology.

There are several areas of 40 CFR 60 reference methods that present unique challenges to correctly performing the certification RATA. Some of which are meeting the analyzer calibration error check, individual run bias and drifts for low spans. Established known errors with the calibration gases and the manufacturer’s specifications for the instruments almost total the allowable error. The use of significant digits, when calculating the relative accuracy, has a large impact on the final results. RM run corrections based on the calibration results can result in a negative emission rate for the run.

INTRODUCTION

Many challenges are present when performing a certification for a low emissions level CEMS. The certification tests are specified in 40 CFR 75, Appendix A and Appendix B. The steps to performing the RATA’s are dictated in 40 CFR 60, Appendix A, Methods 2, 3, 4, 6, 7, 10, 19, and 20. The specific methods dealing with the NOx measurements discussed in this paper will be methods 3A, 7E, and 20. These test methods have an inherent amount of error. The calibration gases and pollutant analyzers also have a known amount of error. The reference methods have built in quality control checks that must be
successfully completed during the course of a RATA. The calibration checks allow
constant percentage errors at various stages during the testing, but these error checks are
based on the span of the analyzer. As the span value decreases, the errors are significantly
increased because the errors are expressed as a percentage of the span of the analyzer.
These errors and other RM protocol’s will be discussed in this paper.

SOURCE DESCRIPTION

The CEMS is located on a new combined cycle electric generating unit. The unit is
comprised of two combustion turbines (CT). Each CT has supplemental duct burners and
selective catalytic reduction (SCR) for controlling NOx emissions. The exhaust gases
from both CT/duct burners pass through heat recovery steam generators (HRSG). Both
the CT’s and the duct burners use pipeline natural gas as the only type of fuel for
combustion. The exhaust from each turbine drives an electric generator and then enters
the duct burner section for additional heating before entering the HRSG’s. The SCR’s are
located internal to each HRSG. The exhaust gases exit the SCR’s and enter the exhaust
stack where they are then vented to the atmosphere. The steam generated by both
HRSG’s is utilized by a steam turbine. The total electrical output from both A side and B
side is nominally 500 megawatts. The SCR’s are equipped with vanadium pentoxide
catalyst and ammonia injection for NOx control. The unit is equipped with two separate,
identical CEMS. One is located on the A side stack and the other on the B side stack.

CEMS DESCRIPTION

The CEMS located on the unit is a Spectrum System’s, Inc. Model 300 system utilizing
out of stack dilution extractive technology. The components consist of an air purification
system, air control system, out of stack dilution probe, heated umbilical line, CO₂
analyzer, NOx analyzer and a data acquisition and handling system (DAHS). The NOx
analyzer is also equipped to measure the ammonia slip. The dilution ratio of the probe is
50:1 with the critical orifice being located in an external heated chamber. The full scale
of the NOx monitor is 10 ppm and 10 % for the CO₂ monitor. No moisture removal
system is necessary; therefore, all gases are measured on a wet basis. The dilution air
purification system removes ambient CO₂, ambient NOx, hydrocarbons, and any
moisture that might be present before the air is delivered to the probe to be mixed with
stack gas.

The NOx monitor measures both the ammonia slip and the NOx emissions. The ammonia
concentrations are determined by pulling a slipstream from the diluted sample. The
slipstream is routed through a high temperature stainless steel converter located on the
stack adjacent to, and in close proximity, to the probe. The converter changes the
ammonia (NH₃) to NO and then it is transported to the monitor for analysis. A second
molybdenum converter is located in the housing of the analyzer. This converts NO₂ to
NO in order to accurately determine the total NOx emissions. This is important because
the ratio of NO to NO₂ is supposedly much higher on units equipped with SCR’s than on units without SCR’s.

REFERENCE METHOD EQUIPMENT DESCRIPTION

The reference method system is basically a copy of the previously described CEMS with some minor differences. The RM uses a NOx analyzer and is not capable of detecting NH₃. The RM has an in-stack dilution probe and it is equipped with a motor driven controller for sampling at various stack depths during the testing. The RM used a heated sample umbilical for testing. The heated sample line was operated at 225 °F for the test. The instruments were calibrated and checked with EPA Protocol 1 calibration gases. The data is collected and processed with a dedicated computer. The software used for data collection and calculations is an off the shelf package created specifically for reference method testing. All of the analyzers and computers are located in an environmentally controlled portable test trailer. The calibration gases and air cleanup system is located in a separate area of the trailer that is totally separated from the pollutant monitors. All reference method equipment used for this test was new; this was the first source tested by this equipment.

PRETEST MEETING WITH THE STATE AIR QUALITY AGENCY

The test team had several concerns with performing such low level NOx RM testing. Very little historical data was available regarding low level emission testing with gas fired turbines. There were specific points discussed in the Agency meeting that will be discussed in this paper. The test team emphasized the specific areas of concern in the RM’s that posed potential problems. The final decision was that the Agency would have representatives on site that was familiar with RM testing. The Agency representatives and the test team leader would review any calibration checks that exceed the specified limits and make an immediate decision as to the validity of the test data.

REFERENCE METHOD TESTING PROCEDURES

RM 7E is the instrumental analyzer method for determining NOx. The instrument used for the RATA uses chemiluminescence technology for measuring the NOx. The monitor’s principle of operation is to measure both the nitric oxide (NO) and nitrogen dioxide (NO₂) portion of the gas stream to get the total NOx in the exit gas. RM 3A measures the diluent concentrations of the gas stream. Carbon dioxide (CO₂) was used as the diluent for both the RM and CEMS systems. The CO₂ analyzer uses non-dispersive infrared (NDIR) technology to determine the percentage of CO₂ in the gas stream.
The reference methods require that the test equipment must pass several checks prior to testing on a source. The equipment used for this RATA passed all required checks, including a NOx converter efficiency check, interference check, and system response time check.

The reference methods specify that the span of the analyzer should be “selected such that the pollutant gas concentration equivalent to the emission standard is not less than 30 percent of the span.” (Section 2.1, Method 6C). The monitors must be challenged with three separate calibration gases. The three ranges must be a zero level gas, a mid range gas which is 40% - 60% of the span, and a high level gas which is 80% - 100% of the span. It is immediately obvious that if the permitted discharge limit is 3.5 ppmv, then the span of the analyzer should be set at 5 ppm. However, it would be very hard to procure the exact calibration gases required for the calibration error checks if the span was set at 5 ppm, for this reason a span of 10 ppm was selected for this test.

The first test required by RM 7E is the analyzer calibration error check. The analyzer cal check requires the analyzers to be directly challenged by the calibration gases. But, a dilution extractive system requires the calibration gases to pass through the critical orifice located in the probe in order for the actual dilution to occur. Obviously, one cannot perform a direct analyzer calibration with a dilution extractive system without some mechanism that properly dilutes the calibration gases prior to delivery to the monitor. In essence, the analyzer calibration check is verifying the accuracy of the entire sample train and eliminating some of the inherent error of the sample train during the initial instrument calibrations. The system is challenged by three different calibration gases. The formula for determining the Analyzer Calibration error is:

\[
\left( \frac{\text{Instrument Output} - \text{Cal Gas Value}}{\text{Instrument Span}} \right) * 100
\]

The Analyzer Calibration Limit is +/- 2%. Once the Analyzer Calibration Check’s are successfully completed, the system must pass the System Bias Check. The System Bias Check is designed to determine the amount of error introduced by the sample transport system. However, if a dilution extractive system is used, there should be no difference between the monitor outputs from the Analyzer Cal Check and the System Bias Check because the analyzers have been calibrated to include and null out the system biases. To perform the System Bias Check, the system is challenged with the zero level gas and the upscale gas that most closely approximates the actual effluent concentration. The formula for determining System Bias is:

\[
\left( \frac{\text{Instrument Output} - \text{Analyzer Cal Response}}{\text{Instrument Span}} \right) * 100
\]

The System Bias error limit is +/- 5%.

Once the System Bias Check has passed, a minimum of twice the system response time is allowed between the end of the last cal gas and the start of data collection. A 21 minute,
or longer, block of stack gas emission data is collected with the probe dept being altered at seven (7) minute intervals. At the conclusion of each test run, the System Bias Check is repeated. This identifies any error that is introduced in the sample train as the test progresses. The System Drift is checked simultaneously with the Bias Check. The System Drift is the amount of calibration difference that occurs between the cal check prior to the run and the cal check immediately after the run. The drift is limited to +/- 3%. The formula for the Drift is:

\[
\left( \frac{\text{Final System Cal. Resp} - \text{Initial System Cal Resp}}{\text{Instrument Span}} \right) \times 100
\]

All of the cited formulas use the Instrument Span in the denominator. As the denominator gets smaller, the percent difference of the total absolute difference of the numerator is magnified. For example, a 1.5 ppm difference on a 100 scale analyzer is 1.5 % error. However, a 1.5 ppm difference on a 10 scale analyzer is now magnified to 15 % error. Realistically, a 1.5 ppm difference is very small with reference to stack testing. Basically, if a RM analyzer is full scaled at 10 ppm, the allowable absolute difference for the Analyzer Calibration Check is only 0.2 ppm, 0.5 ppm for the System Bias Check and only 0.3 ppm for the System Drift Check. Ultimately, if the analyzer was ranged at 5 ppm to comply with the “should be selected such that the pollutant gas concentration equivalent to the emission standard is not less than 30 percent of the span” clause stated earlier, the maximum allowable difference would be 0.1 ppm, 0.25 ppm, and 0.15 ppm, respectively.

There are known errors before the start of the test. In accordance with the manufacturers specifications and literature, the calibration gases are +/- 2%, the RM NOx Analyzer is +/- 1% linearity, and the 24 hour full scale drift is +/-1%. Some consultants have estimated that Method 7E has a +/- 5% margin of error. The total error is the square root of the sum of the squares. Using only the known cal gas error and instrument error, the known error before the start of the test is 0.245 ppm. Using the cal gas error, instrument error, and the estimated Method error, the starting error is as high as 0.557 ppm. Basically, we can use the known errors with the low instrument span and fail the required Drift and Bias checks, yet have a perfectly good Reference Method system.

Method 7E also requires that the 21-minute run average be corrected based on the pre and post run calibration results. The formula for adjusting the average is found in 40 CFR 60, Method 6C, Section 8, Equation 6C-1 and states:

\[
C_{\text{gas}} = (C - C_o) \times \frac{C_{\text{ma}}}{C_m - C_o}
\]

Where,

- \(C_{\text{gas}}\) = Effluent gas concentration
- \(C =\) Average Effluent Gas measured during the test run
Co = Average of the Initial and Final system bias check responses for the zero level gas 
Cm = Average of the Initial and Final system bias check responses for the upscale gas 
Cma = Actual concentration of the upscale calibration gas 

At low level NOx emission levels, it is conceivable that the average zero gas value could exceed the run average; therefore, resulting in a negative NOx run average. For example, if the pre run and post run zero gas average exceeds the run average, the resulting component correction will be negative. Specifically, in the above formula, if C < Co, the results of equation 6C-1 will be negative. The only way this is possible is if C is 0.5 or less. But, given the current permit levels and the operating efficiency of the new gas combustion Units, it is conceivable that the NOx ppm concentrations of the gas stream could be less than 0.5 ppm downstream of SCR’s. This assumption is based on a full scale of 10 ppm for the RM analyzer and that the Analyzer Calibration Results are very close to the actual calibration gas values. Therefore, if the full scale remained at 10, the 0.5 ppm calibration error would subsequently pass the System Bias Check, therefore making it a valid run. If the difference were greater than 0.5 ppm, then the System Calibration error would exceed the 5 % limit and subsequently invalidate the run data.

Both the NOx ppm and the CO₂ must be corrected before the NOx mass emission rate is calculated.

RATA CALCULATIONS

The ultimate goal of performing a RATA is to establish a relative accuracy (RA) result. Basically, the RA is a statistical comparison of the data collected by the RM and the data collected by the CEMS by measuring identical gas streams during identical time frames. The specific equations for computing relative accuracy can be found in 40 CFR 60, Appendix B, Specification 2, Section 7. The RA must be less than 10 % relative accuracy for Acid Rain requirements and less than 20 % of the mean value of the RM test data in terms of the units of the emissions standard or 10 % of the applicable standard, whichever is greater for Performance Specification (PS) 2, Subpart Da of 40 CFR 60. However, the Acid Rain regulations have a low emitter’s clause that allows the tester to forego the relative accuracy check and use an absolute difference of the data. To qualify as a low emitter, the source must be below a NOx emission rate of 0.200 lbs/mmBtu. The low emitter’s may then ensure that the difference between the mean RM run averages and the mean CEMS run averages is less than 0.020 lb/mmBtu. But, 40 CFR 60 has no low emitter clause and the relative accuracy stipulation still applies.

The NOx emission rates for the combined cycle Units tends to be very small. The seemingly minute differences in the compared emission rates can be much larger differences in relative accuracy. Therefore, the use of significant digits is imperative and useful. The majority of the calibration gases are significant to three digits. The EPA’s Electronic Data Report Version 2.1 only requires NOx rates to be reported to the thousandths. The RA calculations will vary greatly depending on the number of significant digits used in the calculations. Seemingly small absolute differences are once
again magnified when the RA calculations are performed. A majority of gas turbines with added duct burners will qualify as low emitters and easily pass the Part 75 RA criteria, but some may encounter problems passing the PS 2 requirements for relative accuracy. Obviously, PS 2 has some fundamental flaws when applied to the new low NOx units. Table 1 shows the effects that rounding could have on the final NOx mass emission values.

<table>
<thead>
<tr>
<th>RM NOx lbs</th>
<th>RM NOx ppm</th>
<th>RM % CO2</th>
<th>CEM NOx lbs</th>
<th>CEM NOx ppm</th>
<th>CEM % CO2</th>
<th>Absolute Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.003104</td>
<td>1</td>
<td>4</td>
<td>0.003104</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0.003951</td>
<td>1.4</td>
<td>4.4</td>
<td>0.001774</td>
<td>0.5</td>
<td>3.5</td>
<td>0.002177</td>
</tr>
<tr>
<td>0.004027</td>
<td>1.44</td>
<td>4.44</td>
<td>0.001620</td>
<td>0.45</td>
<td>3.45</td>
<td>0.002408</td>
</tr>
<tr>
<td>0.004035</td>
<td>1.444</td>
<td>4.444</td>
<td>0.001594</td>
<td>0.455</td>
<td>3.545</td>
<td>0.002441</td>
</tr>
</tbody>
</table>

Table 1

Reiterating, the seemingly small rounding truncations magnify the possible errors in calculating the mass emissions and subsequently the final relative accuracy’s as well.

Table 2 demonstrates the magnified affects that seemingly small absolute differences in the test data have on the relative accuracy calculations. The average RM and CEMS numbers represent nine identical test runs. In each case, the test data only differs by 0.001 lb/mmBtu. However, as the average emissions decrease the relative accuracy increases. One can see that the Part 75 low emitters passing requirements can be met with ease, but the Part 60 requirements to meet a 20 % RA is challenging.

<table>
<thead>
<tr>
<th>Avg RM NOx lbs</th>
<th>Avg CEMS NOx lbs</th>
<th>Difference</th>
<th>Relative Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0.002</td>
<td>0.001</td>
<td>100.00</td>
</tr>
<tr>
<td>0.002</td>
<td>0.003</td>
<td>0.001</td>
<td>50.00</td>
</tr>
<tr>
<td>0.003</td>
<td>0.004</td>
<td>0.001</td>
<td>33.33</td>
</tr>
<tr>
<td>0.004</td>
<td>0.005</td>
<td>0.001</td>
<td>25.00</td>
</tr>
<tr>
<td><strong>0.005</strong></td>
<td><strong>0.006</strong></td>
<td><strong>0.001</strong></td>
<td><strong>20.00</strong></td>
</tr>
<tr>
<td>0.006</td>
<td>0.007</td>
<td>0.001</td>
<td>16.67</td>
</tr>
<tr>
<td>0.007</td>
<td>0.008</td>
<td>0.001</td>
<td>14.29</td>
</tr>
<tr>
<td>0.008</td>
<td>0.009</td>
<td>0.001</td>
<td>12.50</td>
</tr>
<tr>
<td>0.009</td>
<td>0.010</td>
<td>0.001</td>
<td>11.11</td>
</tr>
<tr>
<td>0.010</td>
<td>0.011</td>
<td>0.001</td>
<td>10.00</td>
</tr>
<tr>
<td>0.011</td>
<td>0.012</td>
<td>0.001</td>
<td>9.09</td>
</tr>
<tr>
<td>0.012</td>
<td>0.013</td>
<td>0.001</td>
<td>8.33</td>
</tr>
</tbody>
</table>

Table 2
As stated above, the tester may also be within 10% of the applicable standard and pass the Part 60 requirements. Table 3 shows that as the emission standards are lowered, the test becomes harder pass due to the lowering of the permitted discharge limits.

<table>
<thead>
<tr>
<th>RM vs. CEMS Difference</th>
<th>Emission Standard</th>
<th>Relative Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0.013</td>
<td>7.69</td>
</tr>
<tr>
<td>0.001</td>
<td>0.012</td>
<td>8.33</td>
</tr>
<tr>
<td>0.001</td>
<td>0.011</td>
<td>9.09</td>
</tr>
<tr>
<td><strong>0.001</strong></td>
<td><strong>0.010</strong></td>
<td><strong>10.00</strong></td>
</tr>
<tr>
<td>0.001</td>
<td>0.009</td>
<td>11.11</td>
</tr>
<tr>
<td>0.001</td>
<td>0.008</td>
<td>12.50</td>
</tr>
<tr>
<td>0.001</td>
<td>0.007</td>
<td>14.29</td>
</tr>
<tr>
<td>0.001</td>
<td>0.006</td>
<td>16.67</td>
</tr>
<tr>
<td>0.001</td>
<td>0.005</td>
<td>20.00</td>
</tr>
<tr>
<td>0.001</td>
<td>0.004</td>
<td>25.00</td>
</tr>
<tr>
<td>0.001</td>
<td>0.003</td>
<td>33.33</td>
</tr>
</tbody>
</table>

*Table 3*
FINAL OBSERVATIONS

It appears that low NOx emissions can be monitored with a CEMS. The CEMS have demonstrated they are capable of passing the battery of initial certification tests. The RATA can be passed easily for the Part 75 portion when invoking the low emitters clause for calculations. The PS 2 requirements could pose problems when the low NOx rates are subjected to RA calculations. Alabama Power Company has installed several low NOx CEMS and passed the required tests for both Part 75 and Part 60 requirements.

The tables used for demonstration purposes in this paper assume a consistent difference between the reference method value and CEMS value of 0.001 lb/mmBtu. This is a small difference in the emission rate of NOx. The relative accuracy’s are significantly increased if the average differences increase by more than 0.001. For example, if the RM value is 0.007 and the CEM value is 0.008, then the resulting relative accuracy is 14.29%. However, if the RM value is 0.007 and the CEM value is 0.009, then the RA is 28.57%.

The Sum of the Squares of the known errors can make establishing an exact NOx emission rate questionable. Again, with such small NOx emission rates, seemingly small absolute differences will be large percentage differences if one was trying to establish a specific emission rate. Sources of possible errors are the calibration gas concentrations, monitor biases, monitor linearity over the span range, monitor drift over time, and absorption, quenching, or interference’s by the sample train.

Rounding errors in the calculations could make an impact on the final results of the stack test. The tester must be consistent in the rounding scheme and the use of significant digits when testing a low NOx emitting Unit.
An Impact on Plant Performance
from Advanced Instrumentation

Joseph W. Harpster, PhD
Intek, Inc.
Westerville, OH 43082

ABSTRACT

The importance of advanced instrumentation to directly measure assumed or unknown subsystem properties or characteristics of power plants, operating within the current market, is presented. These measurements are needed to quantify critical parameters, not only in units with older control hardware, but also for those equipped with modern information systems, which may or may not contain simulation computations, for plant control and management. One such measurement is air in-leakage into the shell side of a steam surface condenser. This measurement, along with an understanding of its response to behavior of steam and non-condensables within the condenser space, is discussed. This understanding provides the foundation for a comprehensive theoretical treatment of how air behaves in a condenser, and its effect on condenser performance.

The use of RheoVac® air in-leakage and condenser diagnostic instrumentation will be presented. This instrument provides the ability to measure properties of the gases entering the vent line from the air removal section of a condenser. It will be shown that these data, along with other condenser operating parameters, can be combined to describe air passage within the condenser. Also described are the performance characteristics of the condenser as they are affected at different levels of air ingress. The impact of air in-leakage on excessive sub-cooling, resulting in high dissolved oxygen, will be presented. A practical control point for maintaining air in-leakage in operating plants will be argued from the viewpoint of minimizing dissolved oxygen and improving heat rate.

INTRODUCTION

This paper presents the description of a new measurement based model that provides the basis for a theoretical description of the behavior of a power plant steam surface condenser performance under the influence of air in-leakage. The measurement is a quantification of properties of the water vapor and non-condensable gas mixture flowing in the vent line between the condenser and the exhauster. These properties are used, along with condenser measurements and operating conditions, to identify gas mixture properties inside the condenser. This model is then used to predict important condenser performance and behaviors which is compared to plant measurements and observations to confirm model validity. The measurement is shown to be compatible with requirements for modern power plant information systems supporting O & M, plant life, asset management and predictive maintenance.

BACKGROUND

In 1963, Professor R.S. Silver(1) published a stimulating paper dealing with the general theory of surface condensers where it was stated that, “It is well known to all operators and designers of condensing plants that the presence of a small proportion of air in the vapor can reduce the heat transfer performance in a
marked manner.” In a recent publication by EPRI\(^2\) (January, 2000), to which the author made contributions, on the effects of air ingress, it is stated, “but the presence of even small amounts of air or other non-condensables in the shell space can cause a significant reduction in the effective heat transfer coefficient.” In effect, for thirty-eight years, this understanding has remained entrenched and unchanged. In neither of these publications nor any other publication or paper known to the author, has a quantifiable amount of air in-leakage into an operating condenser resulted in a measured change in condenser performance.

The currently accepted description of a condenser and the formulas for determining its performance are as follows. The illustration in Figure 1 represents the temperature profile of cooling water passing through tubes in a condenser. Here, \( T_v \) is the vapor temperature which can be set equal to the hotwell temperature, \( T_{mp} \), \( T_{cw1} \), and \( T_{cw2} \) are inlet and outlet circulating water temperatures. TTD is the terminal temperature difference, \( \bullet \ T_{cw} \) is the rise in circulating water temperature, and \( \bullet \ T_{im} \) is defined as the Grashof logarithmic mean temperature difference, which is the mean temperature driving force for heat flow between the exhaust steam vapor and cooling water in the condenser tubes. The relationship between \( \bullet \ T_{im} \) and others in the diagram is

\[
\Delta T_{im} = \frac{T_{cw2} - T_{cw1}}{\ln \left( \frac{T_v - T_{cw1}}{T_v - T_{cw2}} \right)} \quad \text{(All temperatures in °F)} \quad \text{Eq. 1}
\]

which can be written as:

\[
\Delta T_{im} = \frac{\Delta T_{cw}}{\ln(1 + \frac{\Delta T_{cw}}{TTD})} \quad \text{Eq. 2}
\]

Since \( \bullet \ T_{cw} \) is due to a steam load \( Q \) (BTU/hr) from the turbine requiring energy removal sufficient to convert it to condensate, we can write

\[
Q = \dot{m}_{cw} c_v \Delta T_{cw} \quad \text{(Heat load to the circulating water)} \quad \text{Eq. 3}
\]

also,

\[
Q = \dot{m}_{s} h_{fg} \quad \text{(Heat load from steam condensation)} \quad \text{Eq. 4}
\]

where \( \dot{m}_{cw} \) (lb/hr) is the mass flow rate of circulating water, \( c_v \) (BTU/lb·°F) the specific heat of water, \( \dot{m}_s \) (lb/hr) the mass flow rate of steam, and \( h_{fg} \) (BTU/lb) the enthalpy change (latent heat of vaporization) of incoming steam. Combining Equations 3 and 4, we have:

\[
\Delta T_{cw} = \frac{\dot{m}_s h_{fg}}{\dot{m}_{cw} c_v} \quad \text{Eq. 5}
\]

which defines the rise in circulating water temperature in terms of mass ratio of steam flow to circulating water flow and two identifiable properties. Consistent with good engineering heat transfer practice in describing heat exchangers, \( Q \) is related to the exposed heat transfer surface area \( A \), and \( \bullet \ T_{im} \), with a proportionality factor characteristically called the heat transfer coefficient, \( U \). This relationship is given by:

\[
Q = U A \cdot \Delta T_{im} \quad \text{Eq. 6}
\]

Combining Eq. (6) with Eq. (2) and (3), we have:

\[
\dot{m}_{cw} = \frac{UA}{c_v \ln(1 + \frac{\Delta T_{cw}}{TTD})} \quad \text{Eq. 7}
\]

which, following rearrangement, becomes:

\[
TTD = \frac{\Delta T_{cw}}{e^{(\frac{\Delta T_{cw}}{TTD})} - 1} \quad \text{Eq. 8}
\]

Since \( c_v \) is nearly constant, and \( \dot{m}_{cw} \) and \( \bullet \ T_{cw} \) held constant through a fixed load \( Q \) and with \( A \) assumed constant, the terminal temperature difference becomes only a function of \( U \), or:

\[
TTD = f(U) \quad \text{Eq. 9}
\]

The theory goes on to say that the thermal resistance \( R \), the inverse of \( U \), can be described as the sum of all resistances in the path of heat flow from the steam to the circulating water, given by:

\[
R = \frac{1}{U} = R_u + R_s + R_g + R_l + R_w \quad \text{Eq. 10}
\]
where, a is air; c, condensate on tubes; t, tube; f, fouling and w, circulating water. Historically, much effort has gone into describing analytically each of these series resistances. The best characterized are $R_c$, $R_t$, and $R_f$. Values of $R_c$ dealing with condensate on the tubes, have gained a lot of attention with some success; and $R_t$ has essentially been ignored with the exception of near equilibrium diffusion limited experimental measurements and its associated theory. The latter is generally believed to be very complex and limited data is available. The general belief is that small amounts of air will dramatically affect the heat transfer coefficient, resulting in an increase in the values of $T_{in}$, TTD, and T/IM. The importance to the work to be presented is that $R_a$ is assumed to be treatable in a manner similar to tube fouling, as shown in Equation 10.

**DEFICIENCIES OF THE CURRENT CONDENSER MODEL**

To examine the validity of the existing model, tests can be made. It should be expected that if a large number of power plant steam turbine condensers were tested under a normalized or similar condition, a common agreement or trend would exist in the measured heat transfer coefficient. These tests would confirm the usefulness of Equations 2 and 6 in describing performance of given condensers. Gray reports the determined heat transfer coefficients, using Equation 6, vs. circulating water tube velocity for many clean tube condensers normalized to 60°F inlet circulating water. These data are shown in Figure 2. According to the theory, all data should lie scattered about a neat curve as shown by HEI. Gray's data shows that this is not the case; he concluded that the measured variation indicates the need for an improved design basis. The degree of disagreement goes far beyond the subtle modification coefficients discussed elsewhere which is the subject of modern theoretical endeavor.

With reference to Figure 1, $Q$ is a measurable quantity and its value is relatively easy to ascertain. $T_{in}$ on the other hand is not so easy to determine. It is assumed that it is the same for each tube in the condenser. For this to be the case all tubes must have the same flow rate, equal internal fouling (or none at all) and identical environments on the shell side. However, an overwhelming amount of data is available showing that this is not the case. Discharge temperature in the outlet water box may be non-uniform and tube exit temperatures vary as much as 10°F or more over large areas even though flow rate in each tube is the same. Work by Bell shows 20°F variations which he attributes to "air binding." The use of an overall average value of $T_{in}$ should however, be in proportion to $Q$. But, this does not guarantee that the form of Equation 2, 6 or 8 in determining the heat transfer coefficient value is valid.

The value of A in Equation 6 is measured for a given condenser as being the total tube surface area. The form of Equation 6, however, reflects a different understanding for A. In this equation, A has the meaning that it is the useful area participating effectively as a heat exchange surface. That would include condensate on the tube surface and sub-cooled condensate drops or streams, in transit under the force of gravity, in the space between tubes. If any portion of the condenser is not involved significantly in condensing steam, and its numerical value is known, then the physical tube surface area A may be the wrong value to use in determining the condenser heat transfer coefficient. The above air binding is an example.

Another limitation of the model is the lack of understanding of air in-leakage behavior within the shell side of the condenser. Instead of a "little amount of air affecting condenser performance," measurements show that as long as the air in-leakage is below the capacity of air removal equipment to remove air at a suction pressure compatible with the hotwell temperature equilibrium pressure, no excess turbine back pressure is
experienced. Very high air in-leakage can be prevented from affecting condenser performance simply by adding more exhausters. This means that the model developed which shows air converging on tubes by virtue of scavenging by radially directed condensing vapor is not valid throughout the condenser as some may believe.

Further, when air in-leakage exceeds the capacity of the exhausters the pressure begins to rise above an observed saturation level. Under these conditions condenser performance is known to be adversely affected. Following from Equations 6, 9 and 10 the value of TTD should increase causing a rise in the $T_e$ and a subsequent rise in hotwell temperature. In-plant measurements, however, do not always support a rise in hotwell temperature resulting from air in-leakage induced excess back pressure. Added excess back pressure often appears as an air partial pressure above that of the hotwell temperature-driven saturation water vapor partial pressure. Further, there is no analytical description for the condenser pressure saturation response at low air in-leakage.

A number of these deficiencies will be discussed in this paper in sufficient detail to justify and verify the validity of this new model for understanding condenser performance. Analytic treatment of the remaining deficiencies is the subject of another treatise.

CONDENSER MEASUREMENTS

Measurements of air in-leakage in steam surface condensers has been performed using a patented multi-sensor probe since 1994. This measurement is made in the exhaust vent line at a convenient location between the condenser shell and the exhauster suction port. There are four measurements made on the flowing gases along with reasonable assumptions regarding its composition that permit quantifying the mass flow rate of the gas mixture constituents. It is assumed that the mixture is composed of water vapor and air. All non-condensables being removed from the condenser are included in the measured amount of air.

The probe, shown in Figure 3, consists of a dual probe thermal flow sensor, a temperature sensor that is also used as the flow sensor reference, a pressure sensor and a sensor to measure the relative saturation of the water vapor component. A microprocessor based electronics package provides for mathematical manipulations of thermodynamic equations describing the gas mixture to separate the total mass flow rate of the gases into the two identified components. In doing so, various properties are computed which are shown in Figure 3. The usefulness of these parameters have been discussed in several publications, special focus is directed to the water-to-air mass ratio because of its clear indication for relating the threshold of air in-leakage to the onset of excess condenser back pressure.

The instrument accuracy for measuring air in-leakage is about 1 SCFM with a precision of 0.1 SCFM. It was this instrument that allowed well defined property measurements in the vent line to permit precise quantification of sub-cooling within the condenser subsections and identification of gas dynamics inside the condenser described in this paper. Without this instrument and insight from past observations in the open literature by referenced authors, the work presented here would not have been possible.

BASIC CONDENSER MODEL

Model with No Air To understand the behavior of a condenser under the influence of air ingress we must first understand its behavior without air, and other non-condensables. This view permits us the luxury of examining
a very simple hypothetical configuration without the complexity of obstructions and an air removal section (ARS).

This hypothetical condenser is shown in Figure 4. It would be a somewhat practical design if there was no air in-leakage or if there was no production of other non-condensable gases developed in the water and steam cycle, since all of the load could be condensed and a vacuum maintained. Assume an hexagonal patterned obstruction-free tube bundle of radius $R = 12.37$ ft, containing $n_t = 20,272$ tubes of 1 inch outside diameter, 22 ga wall, located on 2 inch centers, and each tube length $L = 68$ feet. The density of tubes $d_t$ in the tube bundle becomes 42.16 tubes/ft$^2$.

Assume that circulating water flow and applied load having a steam mass flow rate of $\dot{m}_s = 2.4441 \times 10^6$ lb/hr, results in a hotwell temperature $T_{hwr} = 108^\circ$F and a turbine back pressure $P = 2.45''$ HgA. Since it is common to expect the same circulating water outlet temperature for each tube, we can say without apology that each tube is responsible for condensing the same amount of steam at a rate given by:

$$\dot{m}_s = \frac{2.4441 \times 10^6}{20,272} = 120.56 \text{ lb/hr}$$

Eq. 11

We may further assume that the steam flow is distributed such that the velocity of the steam toward the tube bundle outer boundary area, $a$, is uniform over this total surface region and is radially directed inward. This velocity is given by:

$$v_r = \frac{\dot{m}_s}{(\rho_s a)} = 36.0 \text{ ft/sec}$$

Eq. 12

where $\rho_s$ is the inverse of the specific volume of entering steam at the temperature of 108$^\circ$F. For a familiar reference to all readers, this velocity is equivalent numerically to a speed of 24.6 MPH, for this condenser.

To see how this velocity changes throughout the bundle, we first examine the inward directed mass flow rate as a function of radial distance. The number of tubes, $n_t$, that exist inside the cylindrical area described by radius, $r$, is the product of this area and the tube bundle density, $d_t$, given by: $n_t = \rho_t r^2 d_t$ The mass flow of steam, $\dot{m}_s$, is then simply $n_t$ multiplied by the mass flow rate per tube, from Equation 11, given by:

$$\dot{m}_s = \rho_s v_r r^2$$

Eq. 13

The steam velocity dependence on radial distance is then given by Equation 13 divided by steam density and the cylindrical surface area of the tube bundle confining the tubes within radius $r$, or:

$$v_r = \frac{\dot{m}_s d_t r}{2 \rho_s L}$$

Eq. 14

Equation 14 shows that for the geometry considered the radial velocity is directly proportional to the radial distance going to zero at the geometric center of the tube bundle. The solid line in figures 5A & 5B shows the radial distribution of mass flow rate and velocity of steam for the ideal no air condenser (along with other cases to be discussed later).

Recall that the hotwell temperature is $T_{hwr} = 108^\circ$F and each tube has a condensation rate of $\dot{m}_s = 120.56$ lb/hr. An acceptable value for the circulation water velocity is $v_w = 6.33$ ft/sec. We may also assume an inlet circulating water temperature of $T_{cwl} = 85^\circ$F. Note that the total condensing surface area $A$ is 360,889 ft$^2$ derived from tube geometry and defined values, and that the surface area of each tube is $A_t = 17.8$ ft$^2$. 
To solve for the heat transfer coefficient $U$, the circulation water mass flow rate $m_{cw}$ must first be calculated using the inner tube cross sectional area $a_i = 0.00486$ ft$^2$, water density $\rho$, and the above flow velocity $v_{cw}$, giving $m_{cw} = \rho \cdot v_{cw} \cdot a_i = 6909.1$ lb/hr/tube or 279,889 GPM/condenser. Now, using Equation 5 and an enthalpy value $h_{w}$ of 1032.5 for $T_{cw} = 108^\circ$F, then $T_{cw} = 18.024^\circ$F. Knowing that $TTD = T_v - T_{cw}$, we obtain $TTD = 4.98^\circ$F. From Equation 2, $T_{lm} = 11.78^\circ$F. Finally, using Equation 6 we can solve for $U$ obtaining a value of $593.8$ BTU/(ft$^2$ x hr x $^\circ$F). Since all tubes in the condenser act the same, the values of $U$ and $T_{lm}$ for the whole condenser are the same numerical values for each individual tube.

The performance parameters and operating conditions discussed above are summarized as case 1 in Table 1. If there were no air in-leakage nor other non-condensables entering the shell space of this condenser, it would be a suitable design for 535 MW generating unit.

**Table 1 - Summary of Hypothetical Condenser Performance**

<table>
<thead>
<tr>
<th>Case</th>
<th>% Tubes Lost</th>
<th>$T_v$ ($^\circ$F)</th>
<th>Pressure ($HgA$)</th>
<th>Active Area Circulating Water Out ($^\circ$F)</th>
<th>Condensate per Active Tube ($lb/hr$)</th>
<th>Active TTD ($^\circ$F)</th>
<th>Active $\cdot T_{lm}$ ($^\circ$F)</th>
<th>Apparent Heat Transfer Coefficient ($\frac{BTU}{ft^2\times hr\times^\circ F}$)</th>
<th>Area Coefficient $\cdot$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>108.00</td>
<td>2.450</td>
<td>103.02</td>
<td>120.56</td>
<td>4.980</td>
<td>11.78</td>
<td>593.80</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>108.46</td>
<td>2.483</td>
<td>103.35</td>
<td>123.03</td>
<td>5.442</td>
<td>12.33</td>
<td>567.01</td>
<td>0.955</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>109.45</td>
<td>2.556</td>
<td>104.15</td>
<td>128.26</td>
<td>6.432</td>
<td>13.49</td>
<td>517.95</td>
<td>0.873</td>
</tr>
<tr>
<td>4</td>
<td>11.1</td>
<td>110.84</td>
<td>2.660</td>
<td>105.24</td>
<td>135.62</td>
<td>7.822</td>
<td>15.08</td>
<td>462.98</td>
<td>0.780</td>
</tr>
<tr>
<td>5</td>
<td>22.2</td>
<td>114.45</td>
<td>2.950</td>
<td>108.08</td>
<td>154.97</td>
<td>10.980</td>
<td>18.56</td>
<td>375.40</td>
<td>0.632</td>
</tr>
<tr>
<td>6</td>
<td>33.3</td>
<td>119.25</td>
<td>3.376</td>
<td>111.84</td>
<td>180.76</td>
<td>16.232</td>
<td>24.13</td>
<td>287.96</td>
<td>0.485</td>
</tr>
</tbody>
</table>

Model with an Amount of Air: Consider now what happens if an amount of air is injected into this condenser. It should be obvious that the high speed of the radially directed steam will carry (scavenge) the air toward the center of the condenser where it will accumulate as shown in Figure 6. Since the total pressure in the central region is essentially that of the condenser, an equilibrium is established between the air and water vapor such that the sum of their partial pressures is equal to the condenser pressure. This demands a drop in water vapor pressure with a consequential drop in its temperature. The only way for the temperature to be reduced is to slow the rate of condensation on these tubes allowing the circulating water temperature rise per unit length to be lower throughout this tube bundle region. The lack of heat transfer from condensing steam due to the presence of air is the cause for the region to drop in temperature, and results in condensate sub-cooling. It is these tubes in this region of the condenser that behave in a manner described elsewhere in the literature$^{3}$ but generally thought to prevail throughout the whole of the condenser. Air cannot exist and does not exist in a concentrated form around tubes in the steam rich, high velocity region outside the central region of the condenser tube bundle.

It is not unexpected that this region would contain a very low mass ratio of water vapor to air. Henderson and Marchello$^{3}$ showed that the ratio of measured heat transfer coefficient with air present, on a condensing tube, to the heat transfer coefficient with no air, plotted against mole percent of non-condensable air in vapor was dramatic, giving rise to the general belief the presence of even a small amount of air or other non-condensable in the shell space of a condenser can cause a significant reduction in the effective heat transfer...
coefficient. Their obtained laboratory data, originally shown as mole percent dependence, is presented in Figure 7, modified to show with high resolution the corresponding water-to-air mass ratio.

It has been shown from plant tests, for a water vapor to air mass ratio of less than 3 measured in the exhauster line, the exhauster back pressure will rise. From Figure 7 the heat transfer coefficient for this mixture is reduced to 10% of its no air value. For purposes of illustrating the model we will assume there is no condensation in a region with a water vapor to air mass ratio of • 3. This allows us to define a few useful terms. The outside region having high vapor concentration of condensing steam and relatively high velocities may be called the "Steam Wind" region. The air enriched area is identified as the "Stagnant" region, as velocities can be near zero since there is no condensing steam driving the velocity. Practically, there is no sharp demarcation line between these two regions as may be explained by thermodynamics of concentration gradients.

Returning to the above, we will assume the amount of air is sufficient to effectively eliminate condensation on all centrally located tubes inside the space defined by one third the tube bundle radius, or 11.1% of all tubes are removed from service. To observe the effect on excess back pressure and vapor temperature we proceed essentially as before. The hotwell temperature may rise to 110°F; and the reason for this will be explained later. The steam load will remain the same but since the number of active tubes are reduced to 18,022 we have from Equation 11: \( \dot{m}_v = 135.6 \text{ lb/hr} \), which is the steam mass flow rate per tube for each tube in the Steam Wind region of the condenser.

To determine the new equilibrium condenser steam temperature and corresponding condenser pressure, we first assume a new vapor temperature of 110°F from which the corresponding \( h_{sv} \) (enthalpy) value of 1031.4 BTU/lb is obtained. The new circulating water temperature rise, at the same flow rate as before, across the tube length for each active tube is found from Equation 5 to be:

\[
\Delta T_{sw} / \text{tube} = \frac{(135.6 \times 1031.4)}{1 \times 6909.12} = 20.25^\circ \text{F}
\]

Eq. 15

The value for • \( T_{lv} \) can be obtained from Equation 6 on a per tube basis, using the above no-air heat transfer coefficient, as:

\[
\Delta T_{lv} = \frac{135.6 \times 1031.4}{5938 \times 17.8} = 132^\circ \text{F}
\]

Eq. 16

and the terminal temperature difference, on a per tube basis, is found from Equation 2 to be:

\[
TTD = \frac{\Delta T_{sw}}{(e^{h_{lv} / h_{sv}} - 1)} = 559^\circ \text{F}
\]

Eq. 17

from which \( T_v = 85 + 20.25 + 5.59 = 110.84^\circ \text{F} \), which is sufficiently close to the assumed 110°F that iteration is not needed. The resulting condenser pressure becomes \( p_v = 2.660 \) HgA, giving an excess back pressure of 2.660 • 2.450 = 0.210"HgA, caused by the presence of air.

Assuming this space in the stagnant zone is only 6°F sub-cooled, but keeping in mind that since the region is assumed to have no steam condensation, it could therefore reach, in the limit, the temperature of the inlet circulating water. The water vapor pressure in this region is dictated by the temperature of 110.84 • 6.0 = 104.84°F, which is 2.233"HgA having a density of .00326 lb/ft³. The air partial pressure \( p_a \) must therefore be 2.660 • 2.233 = 0.427"HgA for this region to be in equilibrium with the remainder of the condenser. From the well known relationship:

\[
0.622 = \frac{p_v}{p_a}
\]

Eq. 18
the mass ratio is determined as $m_v / m_a \cdot \frac{e}{v} = 0.622 \times \frac{2.233}{0.427} = 3.25$, in agreement with the desire to have negligible heat transfer.

The gas space volume of the stagnant zone $V_{st}$ is given by:

$$V_{st} = \left( \pi \left( \frac{12}{3} \right)^2 \times 68 \right) - \left( 2.250 \times \pi \left( \frac{1}{3} \right)^2 \times 68 \right) = 294.14 \text{ ft}^3$$  

Eq. 19

where the second term is the volume taken up by the enclosed tubes. As a consequence of Equation 19, with a mass ratio of 3 and the stated water vapor density, the total mass of air in $V_{st}$ becomes $m_a = 294.14 \times \frac{1}{3} \times 0.00326 = 0.3196 \text{ lb}$. This condition is realized with 4,256 standard cubic feet of air inserted into the condenser.

Should, however, this vapor space fall to within $2^\circ F$ of the inlet circulation water, or $87^\circ F$, $p_v = 1.293 \text{ "HgA with: } \rho_v (87^\circ F) = \frac{1}{51.9} = .00195$ and $p_a = 2.660 - 1.293 = 1.376$ where, from Equation 18

$$\rho_v = \rho \cdot \frac{p_v}{p_a} \cdot \frac{622}{0.00331}, \text{ giving } \frac{m_v}{m_a} = \frac{0.00195}{0.00331} = .588 \text{ and, } m_a = 294.14 \times .00331 = .9736 \text{ lb}.$$

At this lower temperature the stagnant zone would contain 13 standard cubic feet of air. It should be noted that the region is effectively eliminated from the overall condensation process regardless of the amount of sub-cooling below $6^\circ F$ but the amount of air to isolate the region is a function of the amount of sub-cooling. It is anticipated that the degree of sub-cooling will be a function of the stagnant zone size and gas dynamics, a subject of future work.

Using methods similar to the development of Equation 13 and 14, with $r$ being the radius of the stagnant zone, we may obtain for the mass flow rate $m_{r, st}$ and steam velocity $v_{r, st}$ with a stagnant zone of air, as:

$$\dot{m}_{r, st} = \dot{m}_r \left[ \frac{(e)^2}{(v)^2} - 1 \right]$$

and

$$v_{r, st} = \frac{\dot{m}_{r, st}}{2 \pi r L}$$  

Eq. 20 & 21

Table 1 shows not only the above data as case 4, but also, the effects of other reductions in the number of tubes available for condensation. It shows how excess back pressure increases with the number of tubes removed from the condensation process within the stagnant zone. As air blocks the number of tubes principally in the center of the condenser driven by the Steam Wind region, condenser back pressure and temperature will rise, increasing the condensation load per active tube.

It should be noted that the heat transfer coefficient $U$ per tube does not change for active tubes as can be observed from the use of Equation 6. It may be expected, as the load on a condenser increases, the value of $T_{in}$ increases proportionally, with no change in $U$ or $A$, as long as the tubes in $A$ are active tubes.

This could explain most of the non-conformance with theory as presented by Gray for the large number of condensers he evaluated. Although he made these measurements following cleaning of the tubes, he showed no clear evidence that exhausters were capable of removing air in-leakage sufficiently to prevent air caused excess back pressure in his study. It should become obvious that a coefficient $\cdot \cdot \cdot$ (Table 1) should be used in Equation 6 to modify $A$, when air is present, in attempting to compute fouling contributions to changes in $U$.

Hotwell Temperature Behavior with Air In-Leakage Common to condenser behavior with variable and known air in-leakage is that the hotwell temperature may or may not increase with the accompanying
increases in condenser pressure and steam temperature. The model presented explains this variable behavior.

Referring to Figure 8, the sixth case (33.3% case) shown in Table 1, the active tubes are those lying within the annular region (areas B & D) of the tube bundle. For condensate to reach the hotwell it essentially drains downward in a vertical direction. Condensate produced in this region falls at a surface vapor temperature of approximately 119°F. For the geometry shown the number of tubes in area D are 3,634 and these tubes produce a condensate mass flow rate \( \dot{m}_{c,D} \) of \( 3,634 \times 180.8 \text{ lb/hr/tube} = 0.6570 \times 10^6 \text{ lb/hr} \). The other active tubes in the annular region B, convert the remaining steam load to condensate at a rate of \( (2.4441 \cdot 0.6570) \times 10^6 = 1.787 \times 10^6 \text{ lb/hr} \).

Let us evaluate what happens to the temperature of condensate produced in area D as it falls through the stagnant area C having inlet circulating water temperature of 85°F. Using the heat transfer equation:

\[
\dot{m}_{c,D}(T_{c,i} - T_{f,i}) = \dot{m}_{c,w}(T_{f,cw} - T_{c,w}) \tag{Eq.22}
\]

assuming \( c_{pc} = c_{pc,cw} \) and setting \( T_{f,cw} = T_{c,i} \) and \( T_{f,cw} = T_{f,cw} \) with \( c \) referring to condensate, \( cc \) to cold condensate, \( cw \) to circulating water, \( i \) is initial and \( f \) final temperatures, we can now solve for \( T_{f,cw} \) after finding that \( \dot{m}_{c,w}/\dot{m}_{c,D} = 37.94 \) and knowing that, \( T_{c,i} = 119.03°F \) and \( T_{f,cw} = 85°F \), the result is that \( T_{f,cw} = 85.87°F \). A possible consequence of cooled condensate originating from area D reaching the bottom of area C having a mass flow rate of \( \dot{m}_{c} = \dot{m}_{c,D} \) at about \( T_{c,cw} = 86°F \) is that it will then mix with condensate from all of area B, having a mass flow rate of \( \dot{m}_{c} \) at temperature of 119.0°F resulting in a hotwell temperature, \( T_{hw} \), given by:

\[
T_{hw} = \frac{\dot{m}_{c} \times T_{c,i} + T_{cw}}{\frac{\dot{m}_{c}}{\dot{m}_{c,cw}} + 1} \tag{Eq. 23}
\]

This mixed condensate yields a hotwell temperature of 110.12°F, close to the initial no air hotwell temperature of 108°F. Whether this 2.12°F difference is due to needed model refinements or energy mixing assumptions, the fact remains that it is far removed from what some observers may expect, 119.03°F; and very close to some in-plant observations obtained when air induced back pressure increases are present. This observed temperature difference between the hotwell temperature and vapor temperature is commonly recognized as "condensate sub-cooling." The noted excess back pressure is not caused by series thermal impedance, similar to what may be found from tube fouling, although this is the belief of many students of condenser engineering and science. It should be noted that condensate falling through area C is indeed sub-cooled, and finds itself, while in this region, in the presence of high concentrations of air. This condition becomes the major contributor to high dissolved oxygen. Table 1 shows the results for other smaller stagnant regions of this condenser.

The response shown here, which is not always the case, will be seen to have little difference in operating condensers, and will be the subject of another paper. However, briefly, Figure 9 shows a more practical condenser configuration containing an Air Removal Section (ARS) and vent line that exits the shell, ending at an exhauster suction connection. Let the steam load and number of tubes and all other conditions be the same as in the hypothetical condenser model and allow the shrouted ARS to occupy about 2 ft³ of the tube sheet containing 84.3 tubes. If there is no air in-leakage the system will operate essentially the same as before. All tubes will condense equal amounts of steam and since there is no in-leakage the exhauster would not need to be operated and the load per tube would be 120.58 lb/hr.
If air leaks into the condenser sufficiently high in the condenser to have complete mixing with the steam, this air will be scavenged toward the center of the condenser where the ARS is located. The exhauster will extract this air at a rate equal to the input rate. As long as the gas mixture density times the ACFM flow rate is sufficient to extract the water vapor and air mass flow rates following sub-cooling in the vent of the ARS at a vapor to air mass ratio above 3, the amount of air in-leakage will not insulate the tubes at the ARS inlet and thus contribute to the condenser's pressure. This has been determined by the multi-sensor probe measurements and is generally understood by many engineering and operating personnel.

If, however, the air in-leakage becomes sufficient to allow a stagnant zone to develop around the ARS, tubes will become insulated, reducing the ability to condense steam and the back pressure will rise in the condenser in the manner described for the hypothetical condenser. This along with sub-cooling is the major cause for tube corrosion on those tubes located near the central ARS section of condensers.

**SUMMARY**

Although scavenging, air binding, sub-cooling, dissolved oxygen and excess condenser back pressure have been extensively discussed in the literature, it is believed that the work presented here provides the first analytical description of their interrelationship. Some of the discussed deficiencies related to condenser performance can now be characterized as a result of accurate measurements using the described multi-sensor probe, on operating condensers. The remaining are left for another presentation due to length of text.

A model has been put forward which is believed to be the foundation for improvement on the general theory of vapor surface condensers. The model shows a distinct differentiation between the analytical description commonly used to describe devices in the general category of heat exchangers particularly, and practically when non-condensables are present with the condensables.

The model presented allows for condenser design modifications and/or retrofit to significantly reduce the causes of corrosion on central tubes. As with all new findings, there is opportunity for invention and several patents are pending.

**ACKNOWLEDGMENTS**

The author wishes to thank Mr. Richard Putman who provided an introduction to the work of R.S. Silver during our labors on the EPRI Condenser In-Leakage Guideline and who critiqued some of the early concept developments. The author also, appreciates the efforts of the RheoVac® team at Intek who reviewed and commented on advancements made during the period of early development. The efforts of Mr. Bryan Campbell are particularly appreciated for helping to prepare all of the graphical presentations from closed form analytical expressions. Finally, the hard work of Carlene Foulke and Marilyn Harpster in preparation of the draft and maintaining the schedule is greatly appreciated.

**References**

2. Putman, R.E. *Condenser In-Leakage Guideline* EPRI, TR-112819, January 2000

8. Rheotherm® Flow Instruments and RheoVac® Multi-sensor Air In-Leakage Instruments are registered trademarks of Intek, Inc., Westerville, Ohio 43082.


Figure 1. Condenser Temperature Profile and Thermal Parameter Definition

Figure 2. Condenser Test Results

Figure 3. Multi-Sensor Probe and Output Measurement Data (Courtesy of Intek, Inc.)

Figure 4. Hypothetical Pure Steam Condenser with No Air In-Leak

Figure 5A. Steam Mass Flow Rate vs. Radial Distance of Condenser Tube Bundle

Figure 5B. Steam Velocity vs. Radial Distance of Condenser Tube Bundle
Figure 6. Air Concentration in the Center of the Tube Bundle

Figure 7. Normalized Heat Transfer Rate vs. Water-to-Air Mass Ratio

Figure 8. Regions of the Tube Bundle Showing Active Tubes (B&D) and Inactive Tubes (C)

Figure 9. Conventional Condenser Tube Bundle with Air Removal Section

Table 1: Summary of Hypothetical Condenser Performance

<table>
<thead>
<tr>
<th>Case</th>
<th>$T_{\text{in}}$ (°F)</th>
<th>$T_{\text{w}}$ (°F)</th>
<th>Pressure (HgA)</th>
<th>Circulation Water Out (°F)</th>
<th>Heat Transfer Coefficient (W/m²K)</th>
<th>Coefficient (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>108.0</td>
<td>108.0</td>
<td>2.450</td>
<td>103.02, none</td>
<td>599.8</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>106.4</td>
<td>110.7</td>
<td>2.654</td>
<td>105.24, 85.5</td>
<td>599.6</td>
<td>0.94</td>
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<tr>
<td>3</td>
<td>107.8</td>
<td>114.3</td>
<td>2.938</td>
<td>108.08, 85.7</td>
<td>599.8</td>
<td>0.88</td>
</tr>
<tr>
<td>4</td>
<td>110.1</td>
<td>119.0</td>
<td>3.355</td>
<td>111.85, 85.9</td>
<td>599.8</td>
<td>0.81</td>
</tr>
</tbody>
</table>
Two new topics were discussed at the meeting regarding proposed projects. They were 1) development of a “cyber security” standard that would address issues unique to nuclear power plants; and, 2) development of a document that provides generic instrument uncertainty calculations that can be applied at nuclear power plants in lieu of plant specific calculations. Bob Webb has agreed to be the interim chairman of the cyber security effort while Bill Sotos has agreed to act as interim chairman of the generic instrument uncertainty project. Initial development of both will proceed over the next few months to establish a committee and write a title, scope, and purpose. Committee volunteers are encouraged.

Meeting attendance was also discussed. While attendance at the POWID meetings is usually good, other meeting times have been less successful in the past few years. It was decided that the SP67 committees will not meet again until next year’s POWID meeting. Subcommittees will attempt to meet using Web casts, teleconferences, or other non face-to-face meetings.

Subcommittee Reports

**ISA67.01** Transducer and Transmitter Installation for Nuclear Safety Applications
*Chairman – Vacant*

The standard, 67.01-1994, Transducer and Transmitter Installation for Nuclear Safety Applications. In final approval process. No action required of the SP67 or SP67.01 committees.

**ISA67.02** Instrument Sensing Line Piping and Tubing Standards for Use in Nuclear Power Plants
*Chairman – R. Neustadter*

The ANSI/ISA-S67.02.01-1999 standard has been published. ANSI/ISA-S67.10-1994 has been successfully balloted for withdrawal. The committee is now resting.

**ISA67.03** Reactor Coolant-Pressure-Boundary Leak Detection
*Chairman – I. Sturman*

This standard has been determined to be out of date and no longer used. It was thought that this standard had been ballotted and approved for withdrawal. However, no record of that vote was found by ISA staff. This is being investigated and if necessary will be reballotted for withdrawal. There may be an interest with respect to new plants that is being investigated by the chairman. Chairman Sturman has been in contact with the NRC and received a review of the draft revision he had prepared. The new revision will be distributed to SP67 and the committee will determine if a need exists for this standard as revised. This will be discussed at the next POWID meeting.

**ISA67.04** Setpoints for Safety-Related Instrumentation Used in Nuclear Power Plants
*Chairman – R. Queenan*

This committee is very active and met San Diego (the first since the Orlando meeting last July). The following Technical Reports are under development:

- ISA-TR67.04.03, Indication Uncertainties and Their Relationship with Indicated Values
- ISA-TR67.04.04, Use of As Found/As Left Calibration Data
- ISA-TR67.04.09, Graded Approaches to Setpoint Determination (being balloted)
- ISA-TR67.04.14, Use of the Monte Carlo Uncertainty Combination Method for Setpoint Evaluation. (May get dropped – no chairman available)

Other Technical reports previously considered have either been published or dropped.

The subcommittee is still working on revising the standard and recommended practice. Significant activity will continue throughout the year and at the Williamsburg meetings in June 2003. A committee conference call will be held on 11 September 2002.

**ISA67.06** Response Testing for Nuclear Safety-Related Instrument Channels in Nuclear Power Plants
*Chairman – J. Redmon*

The revision to the standard is being balloted by ANSI. Expect to publish in July 2002. The subcommittee will then take a well-deserved break.

**ISA67.14** Qualification and Certification of Instrument and Control Technicians in Nuclear Power Plants
*Chairman – Vacant*

ANSI/ISA-S67.14.01-2000 has been reaffirmed and published. No additional activity to report.

**ISA67.16** Safety Related, Digital Based System Upgrades at Nuclear Power Plants
*Chairman W. Sotos*

The committee is inactive including all working groups. The current chairman has been seeking a volunteer to step in as a new chairman, but will stay until he has a replacement. No action taken at this time.

**ISA67.17** Installation of Non-Conductive Fiber Optic cable in Nuclear Power Plants
*Chairman D. Ozarowicz*

This committee is still forming. It intended to have its first meeting in San Diego but was unable to meet due to the chairman’s unavailability (work related). The first meeting will now likely be held in Williamsburg, VA, in June 2003.
**ISA SP77 Fossil Power Plant Standards Committee Report**

12 February 2002, Jacksonville, FL

Submitted by Wayne Holland - Chairman

**SP77 Director's Report – Wayne Holland**

The SP77 Committee agreed at the SP77 meeting held on 12 September 2001, during the ISA 2001 Conference in Houston, to write a memo to support the $25 standards download benefit. There had been some concern that the benefit might go away but so far this benefit seems to be staying in place. Another year of evaluation will be done by ISA before anything is decided.

In 2001, Standard sales were at $615,000 of which $44,000 is attributable to the download benefit.

Approximately 1200 people took advantage of the standards download benefit.

Not surprisingly, the sale of individual standards has dropped.

There has been a decline in Standards Staff support, due to ISA staff reductions in November 2001. Therefore, committees are being asked to become more autonomous and rely less on staff support. It has been recommended that each standards committee appoint an editor to assist staff. Bob Hubby volunteered to be the editor for the SP77 committee. The S&P Board will make a recommendation to the Executive Board that one (1) full-time staff member be added back to the Standards department.

A special S&P Board subcommittee was formed to investigate the impact of security issues on ISA standards and to coordinate with related IEC efforts in IEC SC65A and IEC SC65C.

For the complete set of S&P Board minutes, go to: http://www.isa.org/fmo/admincom/s&pboard/S&P_Board_02-02-11_Minutes.pdf

**Subcommittee Reports**

**ISA77.14 Steam Turbine Controls**

*Chairman - Denny Younie*

Loanna Overcash reported that Denny Younie’s e-mail address has been updated and that anyone with an assigned section for the draft should contact Denny with a copy of what they have done so far. Allen Zadiraka reported that progress was made on the draft during the last meeting held on 12 September 2001, during the ISA 2001 Conference in Houston, and that it is approximately 75% to 85% complete. The subcommittee plans to meet in June 2002 during the ISA 45th Annual POWID 2002 Symposium, San Diego.

**ISA77.20 Simulators-Functional Requirements**

*Chairman - Alex Lekich*

Loanna Overcash reported that an extension has been filed for ANSI/ISA-77.20-1993, Fossil Fuel Power Plant Simulators – Functional Requirements. The extension expires 16 May 2004. The SP77 committee will review the Scope and Purpose of the document to determine what should be done.

**ISA77.40 Combustion Controls Reaffirmation**

*Chairman - Gordon McFarland*

Gordon McFarland reported that assignments on the draft have been made and some comments have been received to date. The subcommittee plans to meet in San Diego. Bob Hubby has consolidated the comments received into one draft and Gordon McFarland will get these out prior to the meeting to be held at the POWID 2002 Conference in San Diego.

**ISA77.42.02 Feedwater Controls - Drum Level Measurement**

*Chairman - Randy McSpadden*

Randy McSpadden was not in attendance. The SP77.42.02 sub-committee last met on 9 July 2001, during the POWID 2001 Conference in Orlando. Work is continuing on the draft document.

**ISA77.43.01 Unit/Plant Demand Development Reaffirmation**

*Chairman - Cyrus Taft*

Loanna Overcash reported that this Standard was before the S&P Board for approval for re-affirmation. Upon approval by the S&P Board, the document will be updated by ISA S&P Staff and sent to ANSI for accreditation.

**ISA77.44.01 & 77.44.02 Steam Temperature Controls**

*Chairman - Dan Lee*

Loanna Overcash reported the SP77.44.01 (for drum boilers) and SP77.44.02 (for once-through boilers) documents have been published.

**ISA77.60 Human/Machine Interface**

*Chairman - R. Hubby*

Bob Hubby reported the status of SP77.60 as follows:

- **SP77.60.01-Draft Control Panel Layout & Design** Withdrawn
- **SP77.60.02-2000 Alarms** Published
- **SP77.60.04-1996 CRT Displays** Published
- **SP77.60.05-2001 Task Analysis** Published

**ISA77.70 Instrument Piping Instrumentation**

Although this committee is currently inactive, the document, ANSI/ISA-77.70-1994, Fossil Fuel Power Plant Instrument Piping Installation will need to be reaffirmed. Loanna Overcash has filed an extension with ANSI, granted until 17 April 2004.
ISASP77.81 Continuous Emissions Monitoring  
Chairman - Jim Batug

ANSI/ISA-TR77.81.05-1995, Standard Software Interfaces for CEMS Relative Accuracy Test Audit Data, needs to be reaffirmed. Loanna Overcash has filed another extension with ANSI that expires October 2004. The general consensus among members present was that there seems to be little interest in this subcommittee since no one is showing up for planned meetings for this group. This issue will be discussed further at the SP77 meeting scheduled during the ISA POWID 2002 Conference in San Diego.

SP77.81.01 CEMS Compendium of Definitions  
Status Uncertain

SP77.81.02 CEMS Guidelines for Verifying  
Withdrawn

SP77.81.03 CEMS Draft Specifications  
Withdrawn

SP77.81.04 CEMS Fuel Oil Flow Meters  
Withdrawn

SP77.81.05 CEMS Software Interfaces for RATA  
See Text Above

Liaison Reports

a. NFPA - Dan Lee

Dan Lee was not in attendance. Allen Zadiraka reported that the NFPA multi-burner committee met last week. The NFPA 85 Fall 2003 schedule has been made and the committee is accepting proposals for recommendations on content for the document; NFPA 85-2001, Boiler and Combustion Systems Hazards Code. Proposals will be accepted until 28 June 2002. The committee will address all comments in September 2002 and publish responses in January 2003.

Zadiraka also reported that the ABMA has published a document on Combustion Control. They are trying to get the NFPA to reference it. If this happens, ISA should be referenced as well.

Action Item: Allen Zadiraka to look into getting ISA referenced also.

b. IEEE – Cyrus Taft

No report submitted.

c. ASME – Wayne Holland

No report submitted.

d. SP5.1 – Dan Lee

No report submitted.

PowerTech Corner

Cyrus W. Taft, PE

At the Auction or How I Filled Up My Basement

As I gradually came out of my deep sleep to the sound of the radio playing quietly, I tried to figure out what day it was. It seemed like it was Saturday but why was the radio waking me up? Was it really Friday and I had one more day of work? While I lay there waiting for my brain to reach valves wide open, I could hear the birds chirping so I knew it really was morning. Finally it came to me, it was Saturday and I had an important engagement today. I was heading for a government surplus auction. And not just any surplus auction, but one at Oak Ridge National Laboratory (ORNL).

As a child, I used to look at the ads in the back of Popular Science magazine. These included go-kart and mini-bike kits, rock polishing machines, telescopes and government surplus sales. The surplus ads usually had a picture of an Army Jeep with words like "Buy this Jeep for $10." I always thought it sure would be neat to pick up a Jeep or some other Army contraption for peanuts. But where I lived in Florida, there were no government surplus sales. They just seemed out of reach.

Somewhere along my life’s journey, this desire to get government surplus stuff morphed into a desire to collect old technical stuff. The first evidence of this was in about 1983 when plants in the Southern Company started replacing the old chart recorders. My boss at Southern Company Services at the time, Ted New, was a former Leeds and Northrup service and sales man. As I was learning about instrumentation and measurement techniques, he would try to explain how the L&N equipment worked. He indoctrinated me on the wonders of Leeds and Northrup chart recorders including the old MicroMax and the SpeedoMax G. There weren’t many MicroMax’s left in Southern plants, but there were hundreds of the SpeedMax G’s.

Now if you have never seen a SpeedMax G recorder, you have really missed a fine piece of engineering. The first time Ted showed one to me, I was enthralled at the intricate castings and gear drives that filled up the guts of the instrument. It really is true that they don’t make them like that anymore. As a mechanical engineer, I have always appreciated mechanisms and machines.

continued on page 34
Whenever I was working at one of the Southern plants, I would ask the I&C techs if they had any old recorders or other instruments that they wanted to get rid of. In many cases, they had some stashed in a corner of the shop waiting to be thrown out. Over the course of a few years, I picked up about 4 SpeedoMax G’s, a Hagan ring balance meter, 2 L&N 250 recorders, a L&N 165 recorder, a Bailey pneumatic round chart recorder, a Hagan pneumatic drive unit, and a few other odds and ends.

When I started work at the EPRI I&C Center about 8 years ago, two new opportunities to collect more old stuff arose. First, the Center is at the Kingston Plant of TVA which was built in the early 50s. It still had most of its original instrumentation including the Republic control system with vacuum tubes. Almost everything has now been upgraded, but I managed to save a few of the old recorders and several of the Republic control system modules.

Another interesting item that has been salvaged is a hot reheat steam flow nozzle.

My second opportunity to collect stuff is due to my proximity to Oak Ridge. For those not familiar with Oak Ridge, it is a large U.S. Department of Energy production and research facility. During the cold war they enriched uranium and made nuclear bomb parts there. It is also the site of the Oak Ridge National Laboratory. ORNL is home to several thousand researchers and is in the process of being modernized. As a result many older buildings are being cleaned out and the furniture and equipment is being auctioned off.

The ORNL auctions are held in a nondescript metal building behind an unused reactor containment building. A typical auction has about 600 lots, many of which are furniture items like filing cabinets, desks and chairs. But there are always many other interesting items. Some of the most interesting lots are wooden pallets loaded with odds and ends. Small items like pressure regulators, vacuum pumps, pressure gauges and fittings are typical on the pallets.

Items that are too big or heavy to put in the building are kept outside. Things like 12’ metal welding tables, fancy aluminum test stands, a blacksmith forge, 12’ diameter cooling tower fans and 8” diameter 10’ long stainless steel bar stock are some examples.

At my first auction, I was like a kid in a candy store. When my son and I arrived home in my pickup truck, my daughter greeted us with, "Oh my gosh, it’s the Beverly Hillbillies." And she was right. That truck was loaded!! I’ve controlled myself better since then but I’m still considering joining AA, Auctions Anonymous.

There are always some instrumentation related items for sale and two that I’ve bought are shown in the pictures on this page. One was listed as a theodolyte but by searching the manufacturer’s Web site I determined it was really a traveling telescope cathetometer. It’s used to measure linear distance in vertical or horizontal directions and it is certainly an unusual piece. New ones sell for $5,800 but I only paid $9. I also picked up a nice precision pressure gauge set up for calibrations.

I’ve had to scale back my acquisitions lately due to lack of space in the basement and garage. But I still keep my eyes open for “special” trinkets.

Many, maybe most, of you probably think I am a little strange. My family would likely agree with you. But it’s a pretty harmless hobby and it might give me something to do in my retirement.

For the next installment of PowerTech Corner I’ll get back to a more technical topic, plant performance monitoring. As always I welcome your comments and suggestions.

Cyrus W. Taft, PE
Chief Engineer
EPRI I&C Center
714 Swan Pond Road
Harriman, TN  37748
Tel: (865) 717-2017
Fax: (865) 717-2020
E-mail: cutaft@compuserve.com
NOTICE: VENDOR STRATEGIC ALLIANCE

If you’re a supplier to the Power Industry and are looking for a means to supplement your current advertising, and strengthen your presence in the Power Industry, this could be the program you’ve been looking for. The ISA POWID Vendor Strategic Alliance program is a new initiative that offers a flexible, varied and cost effective means of advertising your products and services to automation professionals working in, and serving, the Power Industry. Although rates for the various Strategic Alliance Products have not yet been approved by the POWID Executive Committee, they are promisingly modest. The following is provided for your information and consideration. We encourage you to visit the POWID Web site and read future What’s Watt Newsletter issues for further announcements regarding this exciting new program.

STRATEGIC ALLIANCE between POWER INDUSTRY VENDORS and ISA POWER INDUSTRY DIVISION (POWID)

Mission Statement
The Power Industry Division of ISA through its Web page, newsletter, annual symposium, and technical sessions at the annual conference and exhibit shall be the resource of choice for the power plant practitioner to obtain information, standards, and solutions to power plant problems relating to any instrument, system, or automation technology applied in a power plant.

Method
To accomplish POWID’s mission, its communications with Division Members through its Web page and newsletters must be the vehicle of choice for vendors, architect engineers, power industry researchers, and generating company personnel to get answers relating to any instrument, system, or automation technology applied in a power plant. In addition the Power Industry Division needs to form strategic alliances with all vendors, architect engineers, researchers, and generating company users to provide access to the over 2,500 Power Division Members who represent a very significant buying influence in the power industry.

Products
POWID will offer the following strategic alliance products to the business enterprises that make up the power industry worldwide.

1. **POWID’s Watt’s What Newsletter** advertising to introduce to Division Members the major players in the Power Industry. Ads will include major or new products and how the Division Member can get detailed application information through the vendor’s Web site which will be linked to the POWID Web site.
   
   Estimated preliminary price per column inch for newsletter advertising $25.

2. **POWID Web Page** advertising including banner ad and link to vendor Web site (excluding virtual trade show buyer tracking features). The POWID Web page will also contain a POWID schedule with all relevant shows of interest to POWID Members, the latest newsletter for those who would prefer online newsletters, list of all ISA POWID standards including title and scope and purpose with facility to order online, latest information on forthcoming POWID symposium including online registration for conference and online reservation for conference hotel, past symposia proceedings with paper title author(s) and abstract with facility to order online, POWID executive board minutes, annual report, and division roster.

   Estimated preliminary price per month for banner ad and link to vendor Web site, $25 per month.

3. **Virtual Trade Show** feature using @ Industry Software package or comparable package to include the following features:
   - For show host – ISA POWID - manage exhibitor/attendee registrations including storage and reporting of critical exhibitor/attendee demographic information, integrate with existing systems, maintain all show information through a Web-based interface.
   - For the exhibitor – the power industry vendors/AE’s/utility users/researchers – provide exhibitor directory, online/off line advertising, promote exhibitor events, provide the ability to sell products directly from the show, and follow up with attendees before, during, and after the show.
   - For the attendee – the POWID Member – provide easy-to-use interface for finding companies, products and services, register for and review all show presentations (sessions), save company/product information in user profile for later review or to trigger auto- responses from exhibitors, and contact exhibitors before, during, and after the show.

   Estimated cost of $100 per vendor plus $25 per vendor advertisement.

4. **Physical Trade Show** at the Annual Joint ISA POWID/EPRI Controls and Instrumentation Conference

   Estimated Costs: Facility - $5,000-10,000; Food - $5,000 for 200 people.

5. **Coffee Break Refreshment Sponsorship** at the Annual Joint ISA POWID/EPRI Controls and Instrumentation Conference

   Estimated preliminary price of $500 per vendor.
ISA POWID Executive Committee Meeting Minutes

The 130th meeting of the ISA POWID Executive Committee was held on 11 September 2001, at the Hyatt Hotel in Houston, in conjunction with the ISA 2001 Conference & Exhibit and ISA President’s Fall Meeting.

ATTENDANCE:

<table>
<thead>
<tr>
<th>Members Present</th>
<th>Members Absent</th>
<th>Others Present</th>
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<tbody>
<tr>
<td>Don Christopher</td>
<td>Dan Antonellis</td>
<td>Joe Weiss</td>
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<td>Gary Cohee</td>
<td>James Batug</td>
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<td>Danny Crow</td>
<td>Bob Hubby</td>
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<td>Dale Evely</td>
<td>Don Labbe</td>
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<td>Ron Hicks</td>
<td>Jason Makansi</td>
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<td>Wayne Holland</td>
<td>Milton Neher</td>
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<td>Roger Hull</td>
<td>Rudy Neustadler</td>
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<td>Dan Lee</td>
<td>Robert Smoak</td>
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<td>Gordon McFarland</td>
<td>Harold Sternberg</td>
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<td>David Roney</td>
<td>Marland Stanley</td>
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<td>Michael Skoncey</td>
<td>Bob Szczurbacki</td>
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<td>Tom Stevenson</td>
<td>Cyrus Taft</td>
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<td>Joe Vavrek</td>
<td>Denny Younie</td>
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<td>Bob Webb</td>
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<td>Majorie Widmeyer</td>
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I. MEETING CALLED TO ORDER
Gordon McFarland, Power Industry Division Director, called the meeting to order at 1:38 p.m.

II. INTRODUCTION OF MEMBERS AND GUEST

III. APPROVAL OF THE PREVIOUS MINUTES

IV. AGENDA ADDITIONS AND/OR CORRECTIONS
 Added under Old Business
 POWID/EPRI Relationship Committee.

 Added under New Business
 Number of Division Symposia-Proposed Increases
 ISA NOx Emissions Conference, LAX, 20-21 February 2002
 DOE Controls Workshop, Chicago, 5-7 November 2001
 MOP Issues
 IEEE Standards on Information Security
 The agenda as amended was approved by a show of hands by the ExCom members.

V. FINANCIAL REPORT
No Report was submitted.

VI. COMMITTEE REPORTS
Nuclear Power Plant Standards, SP67/NIPIE
Bill Sotos submitted a written report on SP67.

Fossil Power Plant Standards, SP77
Wayne Holland submitted the SP77 report on the 9 July 2001 meeting held during the POWID 2001 Conference.

Honors & Awards
Roger Hull has succeeded Milton Neher as the POWID Executive Committee Honors and Awards Chairman. Roger reported that the Power Industry Division had won, for the 4th year in a row, the ISA Industry & Sciences Department’s “Outstanding Division of the Year Award.” Roger also announced that Joe Weiss, a former POWID Executive Committee member, had been named a “FELLOW” by ISA.

Newsletter
No report was submitted.

Publicity
Joe Vavrek reviewed the results of the publicity survey he distributed to the attendees at the POWID 2001 Conference in Orlando. Joe also reported that we had two exposures in Power Magazine for the POWID 2001 Orlando Conference, the March/April, 2001 issue and the May/June, 2001 issue, and is trying to have the POWID 2002 Conference advertised in the same monthly issues for 2002.

Membership
Danny Crow reported that the POWID membership was 2,233 as of the end of June 2001. Danny reported that ISA said that they would correct the electronic form for multiple year membership renewals beginning in mid-July 2001. Danny also indicated that he and Gordon McFarland receive “dropped” Member lists from ISA and that Gordon sent letters to former Members who have dropped their Division membership to let them know that their membership had been dropped and asking them why they dropped.

Editorial Review
No report was submitted.

Historian
No report was submitted.

Nominating
(This is covered under the New Business, paragraph a.)

Long Range Planning
Ron summarized the discussions of the POWID Long Range Planning Committee (LRPC) into the following three items:

ITEM #1 POWID 2004 Conference Details
Ron is to contact Charlotte Clayton of ISA to begin a hotel/site selection process for the POWID 2004 Conference in Colorado Springs or Denver. The price range is targeted to be less than $150 per night, and the time frame is targeted from mid-June to mid-July.

ITEM #2 POWID Conference Publicity
Ron said our channels of publicity for Conference advertising was as follows:
- EPRI/DOE/Other ISA Divisions
- POWID Newsletter
- Advance Program
- Web Site
- POWER Engineering Magazine
- Vendors
Ron recommended that consideration be given by the POWID ExCom to
appoint a Communication Chairperson to coordinate these various channels of communications. The ExCom would define the Communication Chairperson's role and select an individual to fill this role.

ITEM #3 EPRI Contract
Ron reported that a Committee was appointed at the POWID 2001 Conference Executive Committee meeting in Orlando to address the Power Industry Division's relationship with EPRI with respect to their involvement with POWID Conference Programming and their level of participation. The Committee members are: Danny Crow, Committee Chairperson, Jim Batug, Don Christopher, Dale Evely, Ron Hicks, Wayne Holland, Cyrus Taft, Harold Sternberg, and Tom Stevenson. Ron reported that action items for this committee would be to:
- Review the old contract
- Write a new contract (Danny Crow)
- Have contract in place for POWID 2003 Conference
- POWID Past Director to Champion effort

Web Page
Gary Cohee submitted a written report. Gary reported that the POWID Web site had received 643 “hits” during 1999, 1647 “hits” during 2000, and as of 7 September 2001, has received 1172 for 2001. The “hits” during 2001 are averaging about 150 per month. This trend continues to indicate a healthy growth in use as our membership has become more aware of the Web page existence.

1. Professional Development
Tom Stevenson reviewed the training courses being considered for the ISA POWID 2002 San Diego Conference. He discussed the PDH forms issued at the ISA POWID 2001 Conference and said that he was reviewing means to provide electronic copies so that a session participant would have his name electronically printed on the PDH form and given to him at the end of each session. Tom also mentioned that CCST<sup>®</sup> testing was not done at the POWID 2001 Conference but was being considered for the POWID 2002 Conference.

OLD BUSINESS
a. Strategic Alliance with Power Industry Vendors
   No discussion on this subject.

b. ISA 2002 Fall Event-POWID Participation-Volunteers
   The ISA 2002 Conference & Exhibit will be held in Chicago, IL, from 21-24 October 2002. ISA is returning to a similar format to the past instead of the rotating TECH/EXPO format. It appears that the Divisions now may have to come up with their own papers for the Conference.

c. POWID 2002 Conference and ISA 2002 President's Summer Meeting
   POWID Director Gordon McFarland noted that the ISA 2002 President's Summer Meeting is scheduled to begin on the Friday just after our ISA POWID 2002 Conference in San Diego ends. This may limit POWID's representation at the ISA President's Summer Meeting. ISA is also sponsoring a Western Regional Conference in Las Vegas the week after the ISA PSM, which could possibly impact our attendance at the POWID 2002 Conference.

d. Other Schedule Conflicts with POWID Conferences
   Honeywell has scheduled their National User's Group Meeting in Phoenix during the third week of June 2002, which could also impact our attendance at the POWID 2002 Conference.

e. ISA POWID/EPRI Relationship Committee
   This committee was discussed under the Long Range Planning Committee Report. The Committee did not schedule a meeting during the ISA 2001 Houston Tech/Expo Conference. Danny Crow, Committee Chair, said the committee's inaugural meeting would most likely be held during the ISA POWID 2002 Conference.

NEW BUSINESS
a. Board Member Resignations/ Nominations for New members
   The following resignations from the POWID ExCom were received and accepted: Ron Johnson, Joe Weiss, Reed Wiegle, and Bob Hill. The POWID Executive Committee extended it's appreciation and gratitude to Bob, Ron, Joe, and Reed for their support and hard work over the years.

   The POWID Executive Committee membership stands at 28, leaving 4 open membership slots on the POWID ExCom. The Power Industry Division Manual of Procedures (MOP) authorizes a total of 32 members, of which 16 are to be utility members, 8 are to be Vendors, and 8 are to be A/E's. Four potential candidates were considered by the POWID Executive Committee Members for membership. After considerable discussion, the following three individuals were voted onto the POWID Executive Committee: Bill Sotos, Gary Gipson, and Ramesh Shankar.

   Noted that with the addition of the 3 new ExCom Board members, the Board has a total of 31 members, one short of our authorized 32 members. Director Gordon McFarland asked the Board members to consider other potential candidates, especially utility individuals, and submit their names for consideration.

b. POWID Scholarship Endowment
   ISA had sent a memo to POWID Director Gordon McFarland requesting that the Power Industry Division consider contributing to the ISA Educational Scholarship Endowment Fund. ISA will match POWID's contributions. After discussions regarding the funding of the program the POWID Executive Committee unanimously approved the motion that the Power Industry Division approve $20,000 for the ISA Educational Scholarship Endowment Fund.

c. STUDENT Competition and POWID
   Director Gordon McFarland reported that POWID had contributed $500 to ISA for the Student Competition events scheduled at the ISA 2001 Fall Event. Roger Hull reported that student competition sessions were held on the morning and afternoon of 10 September with eleven teams comprised of students from all over the world. Ron Hicks reported that the technical questions could be improved; only a few questions related to the Power industry; and, several questions were repeated showing a need for more POWID participation.

   POWID volunteers at the Student Competition sessions were Roger Hull, Danny Crow, Ron Hicks, and Tom Stevenson.
d. Division Symposia-Increase of Five Additional Symposia by 2004

Director Gordon McFarland reported that he had received a letter from ISA stating that it planned to add five additional symposia per year by 2004. ISA requested support from the Divisions in terms of submitting papers and developing sessions. Everyone agreed that it was difficult enough to find authors and session developers to support our own Division programming needs. It was also noted that with the changes made in ISA programming for the Fall TECH/EXPO Conferences, the Divisions would most likely resume the responsibility for soliciting papers and session developers for this event.

e. NOx Emissions Conference at Los Angeles, 20-21 February 2002

Director Gordon McFarland reported that information he had received from ISA indicated that this 1½ day program would have 6–7 presentations, each 20-30 minutes in length. ISA asked POWID to provide 2 to 3 presenters, and informed Gordon that any papers given at this program would not prevent POWID from using the same paper at the POWID 2002 Conference.

Gordon assigned the action item for Jim Batug to ask the individual authors of his session of their interest in presenting their papers at the NOx Program in Los Angeles in February 2002.

f. DOE Controls Workshop

POWID Director Gordon McFarland reported that Stanley Chen has replaced Gorey Mukhergee at the DOE.

g. MOP Issues

This topic was not discussed.

h. Informational Security Issues/Joe Weiss/ISA Standards

Joe Weiss attended the POWID Executive Committee Meeting to discuss System Security issues. Joe reported that he has been asked by IEEE to review IEEE Standards that may be impacted by system security issues. Joe has raised this issue with the ISA S&P Board, strongly recommending that ISA SP67 and SP77 Standards Committees make an effort to also identify any standards that might be impacted by system security issues.

ISA/POWID CONFERENCES

a. Orlando – July 2001 – Ron Hicks/Rudy Neustadter

Ron Hicks updated the POWID 2001 Conference reporting that the Conference made about $24,000 to $26,000, thanks primarily to the $35,000 received from the seven “sponsoring” vendors that submitted $5,000 each. Ron reported that there were somewhere around 167 to 177 paid registrations with a very high number of 980 room nights due to a large number of guests. Ron expressed concern there were too many training courses offered, that there was a perception by some attendees' managers that the five day format was too long, and some publicity issues relating to ISA and EPRI support. Ron also reported that were some lingering problems with our “obligations” to the sponsoring vendors regarding free advertising in the POWID newsletter.


Gary Cohee, POWID 2002 Conference General Chairman, gave a verbal update of the current status of the POWID 2002 Conference. In summary, Gary reported the following:
- Conference Budget has been approved by the POWID ExCom Board, submitted to, and approved by ISA
- Program Sessions and Developers in place
- Conference Web site is on-line on the POWID Web page site
- Call for Papers was included in the POWID 2001 Conference Program Brochure
- Gary Cohee said that the POWID 2002 Conference would use the POWID Web page site. The Catamaran Hotel would be the site of the POWID 2002 Conference. The following are some of the key Conference contacts:
  - General Chairman
    - Gary Cohee
  - Technical Program Chairman
    - Dan Lee
  - ISA Staff Support
    - Richard Arriola
  - Training Program Coordinator
    - Tom Stevenson
  - Publicity
    - Joe Varek
  - Guest Program
    - Michael Sconcey
  - Editorial Review
    - Don Labbe

The POWID 2001 Conference will be 2½ days in length with Standards meetings and training courses scheduled for Wednesday afternoon, and all day Thursday, and Friday, if needed. There will be a $5,000 vendor “sponsoring” fee and a formal letter is being sent to several vendors soliciting their participation. The ISA Marketing Division will co-sponsor the conference. There will be a spouses’ lounge, but no formal programs. Gary also reported that Joe Vavrek and Richard Arriola (ISA) are assisting in publications and publicity. Bob Stratman, ABB Vice-President, is the keynote speaker for the Conference.

c. POWID 2003 Conference

Williamsburg, VA

Dale Evely, General Chair for the POWID 2003 Conference, reported that Dan Lee had volunteered to be the Program Chair, and that Allan Zadiraka had volunteered to be one of the Session Developers. Dale said that a request for session developers and papers was submitted to the POWID newsletter.

d. POWID 2004 Conference

Colorado Springs or Denver, Colorado

The Long Range Planning Committee (LRPC) passed a resolution, during its meeting held on 7 July 2001, to recommend to the POWID ExCom that the ISA Conference Site Selection Committee focus on the Denver/Colorado Springs area for a potential hotel for this Conference. The POWID ExCom approved this location at its 8 July 2001 meeting. Also, during the LRPC meeting held on 7 July, Denny Younie volunteered to serve as the General Chairman for the POWID 2004 Conference. POWID Director Gordon McFarland confirmed that appointment at the 8 July ExCom meeting.

X. TECH/EXPO CONFERENCES

a. Houston, 21-24 September, ISA 2001

Marjorie Widmeyer coordinated the POWID participation at the ISA 2001. She reported that POWID had the following three sessions/session developers for ISA 2001:

- Session ISA005: Informational Security for Networked Plant Control and Monitoring Systems
  - Developer: Joe Weiss
  - Time: 10:15 a.m. - 11:45 a.m.
  - Panel Session
Welcome New Power Industry Division Members

April 2002

Gerard R. Amzallag
Tadaaki Ando
Budi Arief
Bruce Rhodes Bacon
Carolyn Eugenia Beamer
Elias Byer
G. Paul Buchner
Frederick Paul Burdo
Matt N. Carter
Gary J. Chmiel
Liam Corbett
Susan J. Crawford-Young
Jerker Delsing
Terry E. Duvall
Guillermo Flores
Bert P. Fontenot
Mark Frasca
Samuel P. George
Veronique Noell Holmes
William Stansbury Horne
Jivan P. S. Kaura
Chuck Klepaski
John Kowalcheck
Glen Martin
Brian Lee Mast
S. Mulukumaravel
Andre Nascimento
Fabio Nugnezi
Kevin Michael O'Neill
Richard Allan Palmer
John A. Phillips
Bo Pi
Larry K. Ripper
Holly Rotalsky
Jeffrey G. Schleis
Janine A. Servino
Babatomi O. Sodipo
Ronald W. Sovak
Glen Sterling Stockhouse
Gregory Standerger, PE
John Stevens
Randy Chris Sundell
Jean-Roch Talbot
Michael R. Walker
Deric Wallace
Rush L. Warren
Jerald W. Wiser
Eytan Wulfsohn
Robert Eddie Yearta
Chris D. Bassett
Bernard J. Begley
Don R. Berry
Jim S. Birger
Gary R. Bishop
Daniel E. Booton
Buz Burridge
Bradley J. Carlson
Donald Thomas Casper
Mariano Cejalvo Regadera
Richard M. Crossan
Thomas Anthony Cusimano
Charles Dominique
James J. Dougherty, Jr.
Harry S. Elliott
Alan Ferrin
Kenneth Frederick
J. Freeke
Joseph L. Garza
Mark R. Ginther
Brian E. Hardee
William Heidenreich
Terry L. Hendrix
Steven Hetzel
Shiro Hino
Jwo-Guang Hon
Richard S. Irvine
Lesley R. Jacobowitz Murawski
Brian Johnson
Lay Khoon-Ong
James Wesley Kranz, AAE
Jeremy J. Leader
Roger Villalba Lesaca
Fred H. Levario
Daniel C. Logan
Walter C. Maag
Michael Mamakos
Christopher Marcey
Howard W. McGinnis
James S. McKellar
Ron A. Nall
Anthony Joseph Ortolani, Jr.
Nirmal Kumar Pande
Catherine H. Peak
Alicia Perez Ballester
Jason Alan Petersen
Dean T. Prickett
Steven T. Riviere
Roger J. Sala
Robert F. Sikora
Swarndeep Singh
Kevin M. Smith
Ryan M. Stone
Barry Straight
Robert T. Stub
Teresa K. Taylor
Hien Trinh
Naohiko K. Urai
Thomas VanNorman

June 2002

Rafaf Abdulkabbar Al-Faraj
Thomas J. Barker
Larry Bolton
Anthony F. Brown
Bruce Jay Butler
Richard Clark
Alan Cook
Duane P. Corcoran
Joe C. Cravey, Jr.
Bobby Currie
Jerrod W. Dehn
William A. Doidge
Anibal Dos Santos
Yasser Ibrahim Elbaya'a, Sr.
Dale Jon Evans
Dale E. Evely, PE
Christopher A. Ganz
Shawn W. Gaylord
Jose Francisco Gonzalez
Joseph H. Goodrich
Jeffrey L. Hardin
Guy Hardwick
Thomas Hardy
Jonathon Isaac
Will D. Johnson
James C. Knight
Norman Levasseur
Rafael Marquet Lopez
Tristan S. McCollion
William Kelsey McNich
James Patrick McMahon
Bill McQuat
I. Komang Suadnyana
Mertayasla St.
Brad A. Milam
Dieter Montanez
Christine S. Ng
David O'Brien
Sarfraz Hussain
Roshanali Panjwani
Christopher J. Rasmussen
Sambhu Easwaran Potti Sarma
Edward English Smith
Dan M. Sylvester
William P. Van Nostrand
Claus L. Walton
Tristan J. Williams

Director Gordon McFarland noted that the turnout for all three sessions was good with several POWID ExCom and other POWID Members in attendance. Bob Hubby reported that the ISA 2001 would be the last year for technology themes.

b. Chicago, IL, ISA 2002 Conference and Exhibit

No one has volunteered yet to serve as POWID’s Coordinator for this conference.

X. NEXT EXECUTIVE COMMITTEE MEETING

Recommended for 11 February 2002, in conjunction with the 2002 ISA President’s Winter Meeting.

XII. ADJOURNMENT

The POWID Executive Committee meeting was adjourned at 4:55 p.m.
ISA POWID Executive Committee Meeting Minutes

The 131st meeting of the ISA POWID Executive Committee was held on 10 February 2002, at the Adam’s Mark Hotel in Jacksonville, FL, in conjunction with the ISA President’s Winter Meeting.

I. MEETING CALLED TO ORDER
Gordon McFarland, Power Industry Division Director, called the meeting to order at 1:05 p.m.

II. INTRODUCTION OF MEMBERS AND GUEST

III. APPROVAL OF THE PREVIOUS MINUTES

IV. AGENDA ADDITIONS AND/OR CORRECTIONS
The agenda was approved as written.

V. FINANCIAL REPORT
No report was submitted. Bob Hubby reported a balance of $51,788 as of 31 December 2001.

VI. COMMITTEE REPORTS
a. Nuclear Power Plant Standards, SP67/NPIE
   No report was submitted.

b. Fossil Fuel Power Plant Standards, SP77
   Wayne Holland submitted the SP77 report for the 12 September 2001 meeting held during the ISA 2001 Conference & Exhibit in Houston.

c. Honors & Awards
   Roger Hull submitted a written report. Roger emphasized that a nomination form for the POWID Facility Award, Distinguished Service Award, and the POWID Achievement Award was sent to POWID ExCom members on 2 February 2002 with a request for the forms be returned by 1 March 2002; the ballot to follow in mid-March. Roger also reported that the Best Papers from the POWID 2001 Orlando Conference had been selected and would be published in future POWID newsletters.
   Wayne Holland reminded everyone that, for the 4th year in a row, the Power Industry Division won the ISA 2001 Outstanding Division award for the Industries and Sciences Department of ISA. The POWID Board recognized Gordon McFarland and his efforts as Director of POWID, and Roger Hull and his efforts as Past Director of POWID in achieving this award for 2001.

d. Newsletter
   No written report was submitted.
   Loanna Overcash reported that the newsletter draft was submitted to ISA Publications, and had gone to press.

e. Publicity
   No written report was submitted.
   Gary Cohee reported that Joe Vavrek had provided excellent support for the publicity efforts to promote the POWID 2002 Conference in San Diego.

f. Membership
   No written report was submitted. Bob Hubby reported that the current POWID membership was 2,681 as of the end of December 2001, which represented a 43% increase from the beginning of the year. Bob also noted that were similar large increases in some of the other ISA Divisions.
   Wayne Holland noted that a new incentive for ISA membership allowed ISA Members to gain access to all Standards documents (for an additional $25 added to the membership fee). Gordon McFarland acknowledged the appeal of the incentive for individuals to want to join ISA or remain as existing members.

g. Editorial Review
   No written report was submitted.

h. Historian
   No written report was submitted. Bob Webb reported that he had received all the old POWID historic files from Harold Hopkins (previous POWID Historian). Bob said that he has not yet finished his review of these files, which are quite extensive.

i. Nominating
   No written report was submitted. Wayne Holland reported that the POWID ExCom roster stands at 31 members. The ISA POWID MOP (Manual of Procedures) allows 32 members that should be comprised as follows: 8 vendors; 8 A/Es; and 16 utility. Gordon McFarland requested a utility member nomination to fill the remaining POWID ExCom slot.

j. Long Range Planning
   No written report was submitted. Long Range Planning
Committee meeting, 10 February 2002:

Attendees:
- Ron Hicks
- Gordon McFarland
- Gary Cohee
- Richard Arriola (ISA Technical Conference Coordinator)
- Wayne Holland

**Item #1: Contract with EPRI and POWID Delineating ISA POWID/EPRI Conference Responsibilities (Carryover Item)**

This was a carryover item from previous meetings of the POWID LRPC in reference to the committee formed in Orlando in July 2001, to examine and define the responsibilities of EPRI and ISA POWID in Conference programming. There were 2 action actions:

- Research the old contract written for the joint 1992 POWID/EPRI Conference held in Kansas City.
- Write a new contract.

It was suggested that either Bob Webb or Ed Good might have copies of the old contract. Danny Crow, Chairperson of this Committee, was to arrange a meeting on this subject at the POWID 2002 Conference in San Diego.

**Item #2: Communication Chair Proposal**

A new Communications Chairperson position for the POWID Executive Committee was proposed to coordinate the activities of: the POWID Web page; Advertising; Newsletter; Publicity; and, Vendor Sponsorships/Alliances. The Communication Chairperson would function only to coordinate the activities of the various Chairpersons who have the responsibilities for the functions listed above, not actually to get involved in those functional activities.

**Item #3 POWID Newsletter Standard Features**

It was suggested that the POWID Newsletter contain more standard, recurring features, such as: an event calendar that included POWID, ISA, and other relevant event information; vendor advertisements; POWID Conference Chairperson promotion; Standards Committee Chairperson’s articles; etc. It was pointed out that Dan Antonellis (Newsletter Editor) was already doing this, but practically dictated moving articles around in the newsletter to reflect article size and availability, which compromised standard features.

**Item #4 ISA Web Guide**

It was suggested that our membership lacked information on how to efficiently and effectively access the POWID Web Page. It was proposed that a guide from ISA be obtained and included in our newsletter for our membership to access POWID Division information. It was felt that it should be clearly communicated as to what information Members and non-members of ISA and the ISA Power Industry Division, respectively, could obtain from the Web site. Richard Arriola (ISA Staff) committed to provide this information to the POWID newsletter editor.

**Item #5 Present & Future Conference Locations**

One of the primary responsibilities of the POWID LRPC is to consider locations/sites for future POWID Conferences. The POWID LRPC reviewed the locations of recent, past conferences, and listed the POWID conference locations in the near future that had been approved by the POWID ExCom. Then, the LRPC considered future potential POWID Conferences locations/sites. The main criteria is to rotate the Conferences from East to West US, and “in-between”. Cities in Canada were not ruled out as potential POWID Conference sites.

**Recent Past Conferences:**
- 1998 Scottsdale, AZ
- 1999 St. Petersburg, FL
- 2000 San Antonio, TX
- 2001 Orlando, FL

**Future Conferences Approved by the POWID Executive Committee**

San Diego, CA
Williamburg, VA
Colorado Springs or Denver, CO

**Potential Sites for Future POWID Conferences**

Savannah, GA; Raleigh, NC; Nashville, TN; Las Vegas, NV; San Antonio, TX; and Minneapolis/St. Paul, MN
St. Petersburg, FL; Orlando or Melbourne, FL; and the Washington, D.C., Area

The next step is for the LRPC Chairman to present the 2005 to 2007 potential sites to the POWID ExCom for its consideration. With the ExCom’s approval, the POWID Division Director, Gordon McFarland, will request ISA staff to evaluate potential hotels and report back to the POWID ExCom at a latter date.

The following comments were made by the meeting attendees (Note: all comments and discussions were in reference to Item #1 above, the EPRI/POWID Conference responsibilities contract):

- Ramesh Shankar said that he would probably replace or augment Cyrus Taft’s place on the ISA POWID/EPRI Conference Responsibilities Committee.
- Bob Webb said that he would search Harold Hopkins’ POWID historical files for the POWID/EPRI contract used for the 1992 joint POWID/EPRI Conference held in Kansas City, and Ramesh Shankar said he would look through the EPRI files for this contract.
- Gordon McFarland said that he would contact Danny Crow and confirm if Danny planned to have a meeting of this committee during the POWID 2002 Conference in San Diego.
- Gordon McFarland volunteered to serve as the “Champion” for this committee to see that things were moving forward with the objective of having an agreement or MOU in place between POWID and EPRI for the POWID 2003 Conference in Williamsburg.

**k. Web Page**

No written report was submitted. Gary Cohee reported that the usage of the POWID Web page was up about 10% in 2001, as measured by the number of “hits” received over the previous year. Gary also reported that he was trying to maintain an event planner on the POWID Web page, but needed input from all POWID ExCom members.
Gary encouraged any POWID ExCom member with information that they wanted to display to the POWID membership to send that information to him in electronic form, and he would post this information on the POWID Web page. Gary also pointed out that you do not have to be a member of the Power Industry Division to access the POWID Web page.

I. Professional Development
No written report was submitted.

VII. OLD BUSINESS
a. Strategic Alliance with Power Industry Vendors
It was noted that the strategic alliance with Power Industry vendors had been a major contributing factor to the financial success of the POWID 2002 Conference in Orlando. Seven vendors participate as sponsoring Conference vendors. As sponsors, the vendors were allowed to display their corporate banners in locations at the conference, and offer product literature in the vicinity of the registration booth. In addition, the participating sponsoring vendors were granted advertisement in an upcoming issue of the POWID newsletter.

Gary Cohee reported that POWID would have significantly fewer sponsoring vendors signed up for the POWID 2002 Conference in San Diego.

b. ISA 2002 Chicago Fall Event - POWID Participation/Volunteers
Gordon McFarland reported that Marjorie Widmeyer has agreed to be POWID’s Chairperson for the ISA 2002 Fall Conference. There were enough unsolicited papers received to have three sessions. Tentative plans call for Bob Hubby to be a session developer for one of these sessions and Gordon McFarland to serve as the session developer for another session. An additional session, using the best papers from our POWID 2001 and 2002 Conferences is being considered. A volunteer is needed to serve as the Session Developer for this session.

POWID is also considering a panel session on power plant security issues; Bob Webb has agreed to be the Session Developer.

c. POWID Scholarship Endowment
Bob Hubby and Gordon McFarland discussed the scholarship endowment fund created by ISA in 2001. ISA will match the amount of funds a Division earmarks for scholarships. The Divisions retains the right to say how and to whom the scholarship funds are awarded (within some boundaries). With the Power Industry Division balance of $51,788 as of 31 December 2001, Bob and Gordon opened a discussion for the POWID Executive Committee to consider the merits of providing some funding for the ISA scholarship endowment fund for the year 2002. The POWID Executive Committee Board was in full agreement that the disposition of surplus Division funds should be earmarked for purposes that would benefit the Power Industry and enhance the Power Industry Division of ISA while making sure that the contributions have tax exemption status. Contributions for scholarships to students who are pursuing careers in the Power Industry have been the traditional outlet for surplus account balances. The discussion shifted to the degree of control that POWID would maintain over any funds contributed to the ISA scholarship endowment fund. The advantage of a Division contributing to the ISA scholarship endowment fund is that our contributions would be doubled, with ISA contributing a matching amount. Bob Hubby, as Past Vice President of ISA Industries and Sciences Department, said that he would work with ISA on the contract terms and conditions to make sure that POWID has an input and say on how any of the scholarship funds POWID contributes to this fund are awarded.

The motion carried by a show of hands with no dissenting votes.

Note: A similar motion for providing funds for the year 2001 was raised, discussed, and approved by the Power Industry Division Executive Committee during a meeting held in Houston on 11 September 2001. Apparently, ISA never debited the POWID financial statements to reflect the $20,000 approved by the POWID Executive Committee during that meeting. The $20,000 approved by the POWID ExCom during the meeting held on 10 February 2002, was a debit to the POWID financial statements for the period ending 31 March 2002.

VIII. NEW BUSINESS
No items were discussed.

IX. ISA/POWID CONFERENCES
Orlando ~ July 2001 – Ron Hicks, General Chairman/Rudy Neustädter, Program Chairman
A written report was not submitted. The only remaining items discussed were the final financial numbers from the Conference. Although conference attendance did not meet expectations, the $35,000 received from the 7 sponsoring vendors provided positive cash flow to POWID.

San Diego–June 2002 – Gary Cohee, General Chairman/Dan Lee, Program Chairman
Gary Cohee submitted a report that includes the following:

- Conference Highlights, Hotel, & Contacts Overview
- Conference Theme
- Technical Conference Topics
- Keynote Speaker Biography
- San Diego Tourism Activities
- Preliminary Conference Program
- Conference ISA POWID/EPRI/DOE Committee
- Conference Schedule
- Conference Technical Paper Abstracts
- Conference Registration and Training Seminar Fee Summary
- Conference Schedule
- Brand & Name Recognition Program Guidelines
- (Sponsoring Vendor)

Gary reported that:
- the response for the call for papers had been very good with approximately 47 papers submitted.
- the decision was made to have ISA conduct the training courses on Wednesday afternoon after the Conference concludes, or on Thursday.
- the ISA Sales and Marketing Division has bowed out of par-
participating in the Conference after some misunderstandings.

- Florida State University will be allowed to put up a poster in the registration area without having to pay the $5,000 sponsoring vendor fee. Gary explained that FSU was a not-for-profit academic institution, and their poster would advertise engineering related opportunities at FSU with a power generation focus. Also, FSU submitted a technical paper for the POWID Conference.

- re: the Department of Energy’s participation in the POWID 2002 Conference, Marley Stanley will be in attendance at the Conference, but could not commit to develop a session.

Gary expressed his gratitude for the support he had received for the POWID 2002 San Diego Conference from Richard Arriolla (ISA Staff), Dan Lee (Program Co-Chairman), Tom Stevenson for setting up the training courses, Joe Vavrek (Publicity), and to all the others who had contributed.

Williamsburg, VA, 15-20 June 2003 – Dale Evely, General Chairman/Dan Lee, Program Chairman

No written report was submitted. The 2003 ISA Power Industry Division Conference will be held 15-20 June 2003 (Conference Sessions: 16-18 June) at the Woodlands Hotel in Williamsburg, VA. POWID Director Gordon McFarland reported that Dale had prepared a Conference budget which was submitted to ISA and approved.

A call for papers and for volunteers to serve as Session Developers was placed in the September 2001 and February 2002 POWID Newsletter.

Colorado Springs or Denver, June/July 2004 – Denny Younie, General Chairman

A written report was not submitted. Denny Younie is looking for a Program Chairperson and Session Developers for this POWID Conference. A budget has not yet been submitted to ISA.

X. ISA TECH/EXPO CONFERENCES

Houston, 21-24 September, ISA 2001

A written report was not submitted. Marjorie Widmeyer coordinated the POWID participation at the ISA 2001 in Houston. Marjorie reported that she had not received a report from ISA that denoted the funds that ISA would credit to our Division’s financial accounts for POWID’s participation in the ISA 2001. Marjorie was not sure if POWID would receive any money from ISA for POWID’s participation in ISA 2001 because of the confusion at ISA as to whom would provide the papers for the Conference and whom would review them.

Chicago, IL, ISA 2002 Conference and Exhibit

See Old Business, Topic b.

XI. Next Executive Committee Meeting

POWID Director Gordon McFarland advised that the next POWID ExCom meeting would be held on 2 June 2002, from 1 to 5 p.m. at the Catamaran Resort Hotel in San Diego, CA, in conjunction with the ISA POWID 2002 Conference.

XII. ADJOURNMENT

The POWID Executive Committee meeting was adjourned at 3:08 p.m.

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2002 POWID Division Officers

**DIRECTOR**

Gordon R. McFarland  
Westinghouse Process Control  
125 Shelby Drive NE  
Eaton, GA 31024-8889  
Tel: (706) 484-0570  
E-mail: gordon.mcfarland@emersonprocess.com

**PAST DIRECTOR/CHAIRMAN NOMINATING COMMITTEE**

Roger Hull  
Westinghouse Process Control  
203 Monticello Dr.  
Chagrin Falls, OH 44022-3158  
Tel: (440) 247-9373  
E-mail: roger.hull@wpc.frco.com

**SECRETARY/TREASURER**

Wayne Holland  
Southern Company  
Mail Bin 10160  
241 Ralph McGill Blvd., NE 16th Floor  
Atlanta, GA 30308  
Tel: (404) 506-7207  
E-mail: wholland@southernco.com

**EDITORIAL REVIEW - FALL CONFERENCE**

Bob Webb  
Power Engineers, Inc.  
114 Washington St.  
Point Richmond, CA 94801  
Tel: (510) 215-0638  
E-mail: rcw4@ix.netcom.com

**EDITORIAL REVIEW - SPRING CONFERENCE**

Don Labbe  
IPS - Foxboro  
33 Commercial St., C42-2E  
Box 289  
Wadsworth, TX 77483  
Tel: (361) 972-7063  
E-mail: wgsotos@stpegs.com

**STANDARDS & PRACTICES CHAIR**

William G. Sotos  
STP Nuclear Operating Co.  
Ms N3001  
PO Box 289  
Wadsworth, TX 77483  
Tel: (361) 972-7063  
E-mail: wgsotos@stpegs.com

**MEMBERSHIP CHAIRMAN**

Danny Crow  
TXU  
Bldg. 605, Suite 138  
9000 W. Jefferson  
Dallas, TX 75211-9304  
Tel: (972)343-3792  
E-mail: danny.crow@txu.com

**PUBLICITY**

Joe Vavrek  
Sargent & Lundy  
55 E. Monroe St. 25W53  
Chicago, IL 60601  
Tel: (312) 269-2270

**SECTION/DIVISION LIAISON**

Open

**TREASURER**

Robert C. Szczerbicki  
Neles Automation  
MAX Control Systems  
1180 Church Rd.  
Lansdale, PA 19446  
Tel: (215) 393-3924

**2003 POWID SYMPOSIUM GENERAL CHAIR**

Dan Evely  
Southern Company Services, Inc.  
Bin B411  
44 Inverness Center Parkway  
Birmingham, AL 35242  
Tel: (205) 992-6649  
E-mail: dpevely@southernco.com

**NEWSLETTER EDITOR**

Dan Antonelli  
IPS – Foxboro  
33 Commercial St., B51-IC  
Foxboro, MA 02035-2099  
Tel: (508) 549-6344  
E-mail: dantonel@foxboro.com

**WEB SITE COORDINATOR**

Gary Cohee  
Applied Control Systems  
PO Box 5847  
Beaumont, TX 77726  
Tel: (409) 921-3226  
E-mail: gcohee@compuserve.com

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