ISA Division Newsletter
Spring 2002
Steve J. Marrano, Editor

Water and Wastewater Industries Division

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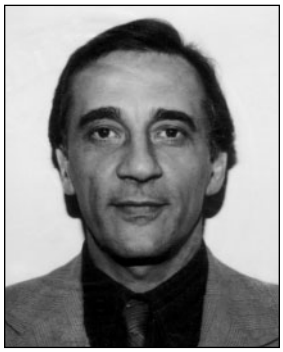
ISA Water & Wastewater Industries Division

Director's Message



By Joseph T. Provenzano

Greetings WWID Members!
While I was unable to attend the President's Winter Meeting, held this past February in Jacksonville, FL, planning continues within WWID to support those activities outlined in the Division's business plan for 2002. I do plan to attend the President's Summer Meeting in Research Triangle Park, North Carolina (where ISA Headquarters resides), 8–12 June 2002. WWID will host a Division meeting so if you are in the area, please plan on attending.

Bob Dusza, Treatment Manager for the City of Manchester, CT Wastewater and Water Treatments plants, and I will present a paper tutorial to support the New Jersey Section's Symposium to be held in Fairfield, New Jersey, 7 May 2002. The tutorial will describe an "In Plant" DCS system used to monitor and control the City of Manchester's Water and Wastewater Treatment plants. For more information on the ISA New Jersey Section's Tabletop Show and Symposium visit **http://www.isanj.org/**.

I have started to secure paper abstracts to select 6 papers that WWID will present at **ISA 2002** to be held in Chicago, 21–24 October 2002. Visit **http://www.isa.org/isa2002/** for more information on this upcoming event!

WWID is working with Ed Ladd, Director of Conferences and Technical Programs for ISA, on a Symposium to be held in 2003. If you are interested in assisting the Division as it moves forward with the plans, please contact me directly at **joe_provenzano@hotmail.com**.

Good News! As of the end of the year 2001, WWID's membership was at 1,737 members. This represents a growth of about 32% over the previous year. I want to thank all of you for signing up for the Water and Wastewater Industries Division. I am always looking for volunteers! If you would like to contribute any articles that you think might make interesting reading in our newsletter please contact Steve Marrano our Newsletter Editor at **smarrano@voicenet.com**.

I would like to take this opportunity to remind you of yet another great benefit for our Division members. Thanks to our E-mail list server, you are no longer restricted to just networking with your peers locally. You can now get advice and ask questions electronically all around the world. For more information please visit our Division website at **www.isa.org/divisions** and click on the Water and Wastewater link.

Finally, I have to make a very important appointment in selecting the new WWID Director-Elect. The Director-elect will serve for the remainder of 2002 as I finish up my last year as WWID Director. The Division Director-elect assists the Director in achieving the goals and objectives of the division. If you are interested in this position, please contact me immediately at the e-mail address below. This is a great opportunity for you to become active in ISA!

I will continue to remind you that we deal with one of the planet's most critical resources, Water. Be proud of what you do and continue to move forward in this Industry and with WWID.

Sincerely,

Joseph T. Provenzano
Water & Wastewater Division Director
joe_provenzano@hotmail.com

Understanding flowmeter specifications

by John Davis

This article was reprinted from InTech*, August 2001.*

Get out your calculator and read the fine print: 'over full range' vs. 'of full range.'

A common problem in water reclamation plants is selecting proper instrumentation equipment. Plant personnel will try to choose equipment that monitors accurately with minimal maintenance. Users see equipment accuracy presented in many ways, however, and it's important to understand the differences.

If an instrument has an accuracy claim of 0.5% of full scale, for instance, you should recognize that the actual accuracy diminishes as the operating conditions fall below the full-scale setting. Sometimes, though, you will hear claims that a meter offers 0.5% of reading over full range. Although the difference may sound insignificant, it could be very costly to the owner.

Imagine, for instance, that a paddlewheel flowmeter claims to have an accuracy of ±0.5%. Suppose, further, it is a percent of full range, and the full range is 50 feet per second (ft/sec).

If the flow range you will use it in is 6 ft/sec, which is common in treatment plants, the actual accuracy is much different than you might expect:

0.005 x 50 ft/sec = ±0.25 ft/sec

If you apply this accuracy against a flow rate of 6 ft/sec, you see that the actual accuracy is:

±0.25/6 ft/sec = ±0.0417, or 4.17%

Comparing a magnetic flowmeter with an accuracy of 0.5% of reading to a Doppler flowmeter with an accuracy of 0.5% of full range yields a similar result.

A common problem occurs when a city or municipality uses two different types of flowmeters. Imagine one meter is a highly accurate magnetic flowmeter located in a meter vault to monitor the plant's effluent flow, and the other is a Doppler meter monitoring the influent flow; this meter's accuracy diminishes as the flow rate drops.

Case histories have shown that the plant appears to be either generating wastewater, because the effluent is more than the influent, or something is evaporating the wastewater. We know in both cases that neither of these conditions really exists. What is really happening is that the Doppler meter is not matching the accuracy of the magnetic meter. The difference between 0.5% of 12 million gallons a day (Mgd) and 4.17% of 12 Mgd is substantial:

4.17% - 0.5% x 12 Mgd = 0.44 Mgd, or 305 gal/min

Matters are made even worse if the Doppler meter is used for pacing chemical feed into the wastewater with the same inaccuracies, resulting in either overdosing or underdosing. Water treatment plants have low, average daily, and high peak demand flows, and further, low and average daily flows occur more frequently. This demonstrates the importance of being cautious in choosing meter types for those flow variables.

Many types of flowmeters suffer in performance as the flows decrease and approach the lower end of their viable flow range; therefore, pacing during low flow periods may be highly suspect. Chemicals are becoming more costly, analytical instruments for measuring the effects of these chemicals are becoming costly, and corrosion due to underdosing or overdosing wastewater can be costly to equipment. All of these may contribute to effluent that is a danger to wildlife and, in extended cases, human life.

Repeatability

Another tool in evaluating equipment is repeatability, defined as the quantity that characterizes the ability of an instrument to give identical indications or responses for repeated applications of the same value of the quantity measured under the same conditions of use. In the past, when equipment operated on motion balance, where equipment used linkages and temperature compensation values, repeatability was critical.

Today, however, a number of field instruments work on force balance techniques, such as piezoelectric crystals, capacitance, and strain gauges. These all work on the principle that if you put a force on an instrument, there should be no motion, though an electric signal is generated on the output of that instrument. There are still flow, level, and chemical measuring devices that do not work on the force balance principle, and for these types, looking at the repeatability of that piece of equipment is still important. A steady widening of the repeatability is an indication that something is going wrong with the instrument.

Although some might believe good repeatability is a measure of accuracy, that is incorrect. To understand the difference between accuracy and repeatability, imagine an archer shooting at a conventional archery target. Suppose one archer hits the bulls-eye consistently. Because he was always accurate, the shots were repeatable. Now imagine an archer that hits the target but misses the bulls-eye consistently. Although the archer has good repeatability, the archer was not accurate. Good repeatability does not guarantee accuracy. If you do not see a proper accuracy statement on equipment but only a repeatability statement, be cautious.

Rangeability and uncertainty

One of the most common problems with instrumentation equipment is the exaggeration of its range. How many times have you heard a meter can read flow rates at velocities of 1–100 ft/sec, giving the impression that you can read flows accurately through that total velocity range?

What often goes unmentioned is that the particular meter's accuracy has a 10:1 turndown ratio. This means that a meter sized to measure a range of 0–30 Mgd has a true accuracy over the full range 3–30 Mgd. Below 3 Mgd, the meter accuracy diminishes.

Additionally, different types of meters have different turndown ratios over their full range. It is common for a Venturi tube, for example, to have two transmitters measuring the flow. This is because a Venturi tube with one transmitter measures accurately with a 6:1 turndown ratio over the full range. So if we look at a range of 0–30Mgd, the meter's accuracy diminishes below 5 Mgd.

The range over which the instrument meets the stated linearity of uncertainty requirements is its "rangeability." Uncertainty is the range of values within which the true value lies with a specified probability. Uncertainty of ±1% at 95% confidence means the instrument will give the user a range of ±1% for 95 readings out of 100.

Another common error occurs during the equipment sizing. In the water reclamation industry, it is a common practice to assume that solids in wastewater will settle out around a velocity of 2 ft/sec. A magnetic flowmeter reads accurately if the minimum velocity is above 2 ft/sec, but below this, settling is likely to occur—and who can then say what the accuracy really is?

Typically, designers size plants to handle increased flow capacities for 20 years. For this reason, designers often oversize pipes for early life-cycle flow, and there is corresponding settlement inside the pipe. This settling can also occur in the inner liner of the meters. Because these meters are velocity-sensing devices with an assumed constant cross section, they will give a false reading if the inner liner becomes coated with sludge.

A solution may be to reduce the size of the meter to increase velocity by utilizing a pipe reducer on the inlet side and a pipe expansion section on the discharge side of the meter. If possible, avoid connecting the reducer and expander directly onto the meter. Manufacturers recommend that when you reduce the pipe, the flowmeter has a minimum of six to 10 pipe diameters upstream from an elbow or valve and at least two pipe diameters downstream of a pipe elbow or valve. This provides a less distorted flow profile for the meter to read.

Be certain you can afford to lose the pressure head when you reduce the meter. Maximum velocities should not exceed 15 ft/sec. By maintaining a minimum scouring effect inside the pipe, your sludge buildup inside pipes and any in-line equipment will diminish, helping avoid measurement errors and costly maintenance downtime.

Misconceptions and truths

Some people will ask for the accuracy of a certain flowmeter, level, or pressure-measuring device and, upon hearing a low number, think that everything involved with the flowmeter will be of the same accuracy. However, the meter accuracy is not the accuracy for the entire flow system. A mathematical equation known as the root mean square (RMS) correctly determines the accuracy of the complete system. Consider the case of a magnetic flowmeter that records flow locally, sending an analog signal to an operator's workstation via a programmable logic controller (PLC).

You must look at each component's accuracy: a magnetic flowmeter (±0.5%), a magnetic flowmeter transmitter (±0.5%), a wire connection to the recorder (±0.01%), a wire connection to a local control panel terminal block (±0.01%), and the I/O card of the PLC (0.4%). Each component in the system has its own measurement errors and uncertainties, which contribute to the overall accuracy of the complete system. In real cases, there could be more components attached to a control system.

To use the RMS method, first square each number, yielding 0.000025, 0.000025, 0.00000001, 0.00000001, and 0.000016. Second, add the numbers. Then find the square root of the sum. The entire system has an accuracy of approximately ±0.813% instead of 0.5%. This accuracy equation works for any individual chemical, pressure, level, temperature, or flow loop.

Remember, too, that no two flowmeters or instruments will have exactly the same accuracy. For this reason, the accuracy statement should indicate a ± component.

When choosing an instrumentation control strategy, look at all the manufacturers' equipment literature regarding accuracy; consider the range, repeatability, turndown ratio, and piping constraints; choose similar equipment types; and utilize the RMS equation. **IT**

FIRST ANNAUL ISA WATER & WASTEWATER INSTRUMENTATION SYMPOSIUM

CALL FOR PAPERS

EVENT DATE
20–21 August 2003

SYMPOSIUM CHAIR
Joe Provenzano

REVIEW COMMITTEE
George Wolkowisky
Thomas McAvinew
Paul Lanzillotta
Steve Marrano

PRODUCT SHOWCASE
The Symposium will be held in conjunction with a tabletop product showcase featuring water & wastewater treatment products from the world's leading manufactures and vendors. Contact Karl Coleman at (919) 990-9408 or e-mail **kcoleman@isa.org** for more information on the Product Showcase.

SPEAKER REGISTRATION
- Speakers must register for the Symposium
- $175 for both days
- No charge if only attending the day you present

The First Annual ISA Water & Wastewater Industry Symposium will take place August 20-21, 2003 in Orlando, FL. The ISA Water & Wastewater Industries Division welcomes your proposed paper topics with special emphasis on the practical industry applications and the latest technological developments in the area of water & wastewater treatment and instrumentation.

This conference is intended to create a forum in which paper presentations, tutorials and panels will allow the transfer of information from the world's leading experts on water & wastewater related treatment systems and technology to industry professionals.

Join fellow industry experts in presenting the latest information on these vital areas of water & wastewater industry technology

Possible paper topics will include, but are not limited to

- Controls, Instrumentation and SCADA
- Pipe Cleaning, Inspection and Maintenance
- Plant Construction and Engineering
- Pumps
- Corrosion Proofing
- Environmental
- Valves, Actuators and Fittings
- Filtration and Separation
- Water Treatment Chemicals
- Plant Design and Maintenance
- Monitoring and Analysis
- Pipes and Pipe Components
- Aerators and Blowers
- Water Disinfection
- Activated Carbon
- Radar Level Devices

Guidelines for Submission

- Application and Abstract registration must be submitted electronically and in English by **31 December, 2002** at this website www.
- 500 word or less abstract
- Draft Paper Deadline **31 March 2003** submitted electronically
- Final Paper Deadline **1 July 2003** submitted electronically
- Paper length is 12 pages including figures and illustrations
- Papers accepted for publication will require copyright transfer to ISA

sponsored by

ISA Water & Wastewater Industries Division

Letters to the Director

Hi Joe,

I am a newly certified Tech and I just thought I would drop you a line and tell you about my experience with the CCST exam and Study class. I went to Raleigh/Durham in December and went through the 4-day study class for the exam and I will tell you it was one of the best classes I have ever attended and I would highly recommend it to anyone considering taking the level 1 exam. The only issue I have with it is that the exam and program are designed for more manufacturing type instrument technicians and not the average instrument Tech in a wastewater or clean water environment. I see there is now a division for wastewater and that is great and I hope maybe someone will look into what I am talking about. I know several guys from my section who had to take the exam 2 and 3 times to pass it but thanks to the ISA class that I took I made it the first time. I know people always complain when things are a little wrong so I just wanted to let someone know that the class and the instructor were excellent.

Thanks,
Tom Nelson

Dear Tom,

I am happy to hear of your success combining the CCST training, along with passing the CCST exam the first time. I am going to include your e-mail in my next WWID newsletter and have your comments passed on to others that may be preparing for tests like the CCST. WWID and ISA appreciate the time that you took in sharing your experience.

Regards
Joe T. Provezano

Dear Mr. Provenzano,

Thank you very much for your welcome letter and introducing your division. Please find some words about our company, too:

ECOM Instruments, Inc is an American subsidiary of ECOM R.Nied GmbH in Germany. Our office in Houston was opened last February. All we do is the modification of portable/ hand held devices into intrinsically safe ones—specially made for use in hazardous areas. All the products are intrinsically safe according to European CENELEC regulations—more and more become the US approval, too (mainly for use in Class I Div 1/2 areas).Our products are quite new in the US and make the work in hazardous areas more safe and quicker. We serve mainly the pharmaceutical-, chemical- and refining industries—everywhere there are gas hazardous areas. I would appreciate if you would find some minutes for visiting our website www.ecom-ex.com to find more information about us and our products.

Where do I find the set up of the e-mail list?

Thank you very much.

Sincerely,
Markus Nied, ECOM Instruments, Inc.
m.nied@ecom-ex.com
www.ecom-ex.com

Dear Markus,

It was nice hearing from you and I am happy that the WWID welcome letter was well received. I am going to take the opportunity to introduce you and your company to the WWID membership in our upcoming Newsletter.

Thank you for your interest in the WWID e-mail list discussion group. You can subscribe yourself to the WWID e-mail list by going to www.isa.org and clicking on divisions. You can then click on the Water and Wastewater Division link and from our website you will find information about our e-mail list. Or you can subscribe directly at

http://www.isa.org/shellcgi/lyris.pl?enter=water&return=http://www.isa.org/divisions/division/1,1577,21,00.html.

Please feel free to contact me with any further questions regarding your membership to the Water and Wastewater Division.

Regards,
JTP

If you have questions or comments regarding your WWID membership, contact Joe Provenzano at **joe_provenzano@hotmail.com**—he would love to hear from you!

CCST Program Benefits Managers, Technicians

As a manager, you understand workplace challenges: intensifying competition, the need to increase efficiency, and pressure to recruit and maintain experienced employees. To keep your competitive edge, your company needs highly skilled employees. ISA's Certified Control Systems Technician® (CCST®) program provides validation of one's experience and skills. ISA's CCST Program helps you increase your companys' credibility, bidding, and service value as well as document your technicians' skills for quality and governmental agencies.

"The ISA CCST program gives me a standard for measuring the quality and experience in technicians that my customers demand," says Mike Raines, Senior Project Engineer, with Instrumentation and Controls, Inc. "We require all of our Instrument Technicians to acquire and maintain their certification."

ISA established the CCST program in 1995 to recognize and document technicians' knowledge, education, and experience in measurement and control. The program was developed in conjunction with the Instrument Technicians Labor-Management Cooperation Fund, the Instrument Contracting and Engineering Association (ICEA), the International Brotherhood of Electrical Workers (IBEW), and the United Association of Plumbers and Pipe Fitters (UA).

The CCST exam covers eight performance areas or domains: calibration, loop checking, troubleshooting, start-up, documentation, project organization/administration, maintenance/repair, and using microprocessor-based instruments and controllers.

The CCST program offers three levels of certification with varying education and experience requirements. Level I requires a minimum of five years of education, training, and/or work experience. Level II requires seven years and Level III requires 13 years. CCSTs must renew their certification every three years, while working at least 30 hours per week in the field of measurement and control.

ISA has reference publications, training courses, and distance education products to assist those preparing for certification and/or interested in skill enhancement. ISA Press publishes Study Guides for each of the three exam levels in addition to their new *Technician's Guide* series of books covering each domain. The ISA Training Institute offers a three-day, hands-on course, Certified Control Systems Technician (CCST) Review that helps prepare technicians for the Level 1 exam. The newly released SUPERTECH, Version 2.0, is an interactive software program that allows users to evaluate their skills and knowledge as instrument technicians. All of these are available at **www.isa.org.**

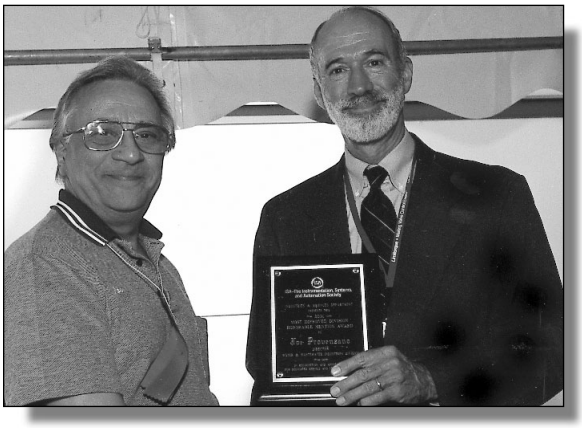
You can get more information on ISA's CCST program at **http://isa.org/CCST** or e-mail **CCST@isa.org**, or call CASTLE™ Worldwide (ISA's testing agency) at (919) 572-6880.

2002 CCST Exam Schedule

Exam Date	Levels	Application Deadline
20 July 2002	Levels I, II, and III	24 May 2002
12 October 2002	Levels I, II, and III	30 August 2002
14 December 2002	Levels I, II, and III	1 November 2002

With more than 50 public exam sites located throughout North America, there's sure to be one near you. Or, if you have four or more technicians who want to take the exam, ISA will bring the exam to you at no additional charge. Contact ISA for more details.

Snapshots from the Joint A&T/I&S Department Awards Luncheon at ISA 2001



WWID Director, Joe Provenzano (left), accepts the 2001 I&S Department "Most Improved Division" Award from the 2001 I&S Vice President, Robert Hubby (right)

Going from left to right the names are as follows: Alan Hopkins, BAU/Hopkins Inc.; Steve Shaddox, City of Houston Maintenance Manager; Joe Provenzano, Aaron Associates GM (Director WWID); Pete Landgraf, Montgomery Watson Engineers (Principal Eng); Andrew Kayser, ISA Senior Member; Robert Dusza, Town of Manchester Ct. Treatment Manager

S&P News

by Tom McAvinew

The long-awaited ISA-5.7, a standard for developing P&IDs first proposed by Al Iverson of the S&P Board in 1995, is getting closer to being issued. First, however, it will be issued as a document developed by the Construction Industries Institute (CII) as Process Industries Practice (PIP) PIC001, "Piping and Instrumentation Diagram Documentation Guide" using an ANSI "Draft Standard for Trial Use" (DSTU) protocol. Under this ANSI procedure, ISA will have three years to receive comments and revise the DSTU as an ANSI/ISA standard. This PIP document has been in existence for several years, and it was felt that with some revision it could be molded into a standard consistent with long standing ISA standards easier than starting one from scratch. It has taken some time to work out publication details with CII, but the DSTU proposal is currently being voted on by the ISA-SP5 committee prior to presentation to the S&P Board for approval. A mid-summer issue is anticipated.

FYI, the CII is a consortium, operating out of the University of Texas at Austin, of about 30 member companies made up of engineering & construction and operating firms in the chemical/petrochemical industry. The operator segment generates some 50% of the worldwide income for that industry, while the E&C segment accounts for approximately 70% of the income for that industry.

At the President's Winter Meeting in Jacksonville, ISA's Department Board and Executive Board approved a motion by S&P VP Marty Zielinski to establish a Standards Matching program that would match any individual or corporate donation of $25 or more to the ISA Standards Foundation (ISF) up to a maximum match of $250,000 annually. Matching funds will come from the ISA reserves as an internal transfer from the ISA general fund to the ISF. In case you've forgotten, the ISF was set up about 10 years ago with the intent of providing the means to fund standards development apart from Society budgets which were being trimmed severely. The ISF was to be funded with donations from interested firms or individuals with only the interest available for use. At the present time, the ISF has only about $75,000 and so a large boost in this principal is required to yield enough interest to be of use. It is anticipated that this program will have a result similar to the Scholarship Matching program approved in June of 2001. That program has experienced a dramatic increase in donations by several orders of magnitude.

Comments, questions? Call me at 720-377-9369, or e-mail me at t.mcavinew@forerunnercorp.com

Water and Wastewater Websites of Interest

ISA Water and Wastewater Division

As a Division within ISA, WWID's goal is to keep Engineering and Control specialists well informed technically as well as commercially. This is accomplished by providing members with access to the latest technical information concerning water and waste. Membership provides the latest news and information relating to instrumentation and control systems in water and waste management flowing to you daily so you're always up-to-speed. Maintain control of your career and boost your knowledge of your specialty and visit your Division's website!

http://www.isa.org/divisions/

ISA Water and Wastewater Technical Discussion Forum (E-mail List)

An E-mail list is a discussion group to which all ISA Water and Wastewater Industries Division members with e-mail capability may subscribe. The E-mail list is unmoderated and open to new subscribers. Current subscribers will receive all mail sent to the E-mail list until they choose to modify their membership settings or unsubscribe. Questions, news, new product information, and opinions are desirable input for this mailing list. The mailing list information maintained by the e-mail list administrator is held strictly confidential and is not available to the public.

http://www.isa.org/shellcgi/lyris.pl?enter=water&text_mode=0&lang=english

Water and Environment Federation (WEF)

The Water Environment Federation (WEF) is dedicated to the preservation and enhancement of the global water environment. WEF provides a range of materials describing today's water quality issues, including household hazardous waste, biosolids recycling, and watershed management. Web site visitors can access the latest water quality news, conduct research, and register for MyWEF to customize the site with their preferences. The Web site also features a fast, easy, secure online Bookstore and Library.

http://www.wef.org

Air & Waste Management Association (AWMA)

The Air & Waste Management Association (A&WMA) is a nonprofit, nonpartisan professional organization that provides training, information, and networking opportunities to 9,000 environmental professionals in 65 countries. The Association's goals are to strengthen the environmental profession, expand scientific and technological responses to environmental concerns, and assist professionals in critical environmental decision making to benefit society.

http://www.awma.org/

National Ground Water Association (NGWA)

The National Ground Water Association, founded in 1948, is a not-for-profit professional society and trade association for the ground water industry and professions. Our more than 16,500 members from nearly 70 nations include the world's leading ground water geologists and hydrologists, engineers, ground water contractors, manufacturers, and suppliers of ground water-related products and services.

http://www.ngwa.org

NSF International, The Public Health and Safety Company

Another Water/Wastewater information treasure-house!! NSF offers a few on-line publications. Click the "NSF Publications," then "Brochures, Educational and Technical Information, and Communication Aids" for free sample copies of information. Also see the "On-line Newsletters" for on-line copies of: *Standard of Excellence, Regulatory World*, and *Water Works*.

http://www.nsf.org/

U.S. Environmental Protection Agency

EPA's mission is to protect human health and to safeguard the natural environment—air, water, and land—upon which life depends. The EPA provides leadership in the nation's environmental science, research, education and assessment efforts. The EPA works closely with other federal agencies, state and local governments, and Indian tribes to develop and enforce regulations under existing environmental laws. The EPA is responsible for researching and setting national standards for a variety of environmental programs and delegates to states and tribes responsibility for issuing permits, and monitoring and enforcing compliance. Where national standards are not met, the EPA can issue sanctions and take other steps to assist the states and tribes in reaching the desired levels of environmental quality.

http://www.epa.gov/

Water & Wastewater Division New Members

December 2001

Bernard W. Adams
Bader Alkhalifa
Greg D. Allert
Carlos Cardozo Aparicio
Gord Bandy
A. E. Brennecke
Ronald I. Brown, Jr.
Joseph W. Cornell
Armando C. Diaz
Richard B. Dimarco
Thomas A. Dunn
Edward Goodwillie
Gary Guidry
Edward W. Heidel, Jr.
Steve Houlahan
James Irwin
Kenneth L. Kirkland
Stanley M. Lazuka
Glenn Levanti
Djoni Lukman
Mario Michaud
Robert M. Moore
Bert B. Morgan
Gino L. Moscardelli
Austin Nurse
David Pizer
Fredrick Popov
Richard L. Racette
Toby R. Thomann
Randy P. Vsetecka
Frank Y. Wang
Kenneth A. Wilson
Harry R. Winegar

January 2002

Ali Ataian
Joe Badry
Rakesh Batra
Alexander John Churchill
Paul Dackermann
Bennett L. Fanjoy
Tracey L. Fligg
James Robert Gatlin
Pradip R. Jansari
Donald J. Jenkinson
Donald R A Jones
Philip J. Kase
Steve M. Keen
William E. Lloyd, II
Peter J. Luciano
Carl A. Mabee
William Manders
Robert Austin Martin
Paul M. O'Connor
David Pollard
Bhagcmand Bmagwandass Ramchandani
J. D. Reid
R. E. Richards
James M. Richmond
Grant L. Ritter
J. C. Rutledge
Maurizio Schiavini
Peter Sestak
John B. Sharp
Allan K. Shea
Daniel J. Sheldon
Russell Charles Snyder
W. Michael Sutton
Steven J. Valdez
Michael S. Watkins
Robert M. Wenyon
Robert Michael Williams
Nancy Watanabe Wong
Larry B. Zellers

February 2002

Emanuel Anderson, Jr.
Scott R. Berlier
Patrick J. Bilot
Daniel J. Bond
Edward Britt
Phillip Thomas Cates
Normand Chabot
Carlos Perdomo Cortes
Marshal Thomas Deane
Bob Doucette
Rodney Epker
Malcolm Earl Gavin
Kevin E. Hill
Philip R. Kiser
Jeffrey D. Klemetsen
Dana Krause
Kang Soong Lai
Brian Alan Lehmann
Bruce Liang
Stephen K. Locke
Tariq Mahmood
George Frank Martin
Timothy J. McCreary
William G. Mealus
Michel Muller
Kevin Nolan
Adam Justin Parham
Harry G. Paris
Fernando A. Rathgeb
Timothy J. Reardon
William R. Shosho, PE
Frank Jesse Smith
Louis P. Stern
Andy Vacanti
Ken Vogel
Brian Walsh
Jeffrey Williams

What You Need To Win!

ISA 2002

Your One-Stop Strategy

All the tools you need to win under one roof, at one time — ISA 2002.
21-24 October 2002 • Chicago, Illinois

*Consider **ISA 2002** as your personal crew chief; a friendly mentor with a group of specialized instrumentation, systems, and automation resources to help you get ahead, and stay ahead of the competition. Just show up, pick a vehicle – conferences, training courses, product displays, and networking opportunities, and drive your company and career into the winner's circle. There's simply no better way to build and retain your skills, tap new technologies, and stay connected.*

Your **ISA 2002** team includes:

- **ISA 2002 Technical Conference –** Super-charge your brain with 300 sessions in more than 50 topical areas.
- **ISA 2002 Emerging Technologies Conference –** Faster, longer, better: Learn what the future holds and how to get there.
- **ISA 2002 Exhibition –** Find new tools to modify your business for enhanced performance. If it's not here, it might not exist.
- **ISA Training Courses –** Anyone can benefit from time with the masters –some 30 specialized programs.

Let **ISA 2002** put you on the fast track to personal and corporate success. Enhanced productivity, increased profitability, and personal pride belong to the winners.

Join the winning team. For more information visit www.isa.org/isa2002/ or call (919) 549-8411.

ISA–The Instrumentation, Systems, and Automation Society

Register Free at www.isa.org/isa2002/
Enter Passcode P12351

The New ISANetwork!

Your Internet gateway to the best in instrumentation, systems, and automation information has been undergoing some major changes over the last few months — all designed to make it an even more valuable resource for your travels through the wired world!

The newly developed ISANetwork broadens the already expansive information base that you've come to expect from ISA. Thanks to your feedback, the site's resources have been rearranged to give you a user-friendly look and feel. The new home page offers several ways for you to browse the world of instrumentation, systems, and automation information:

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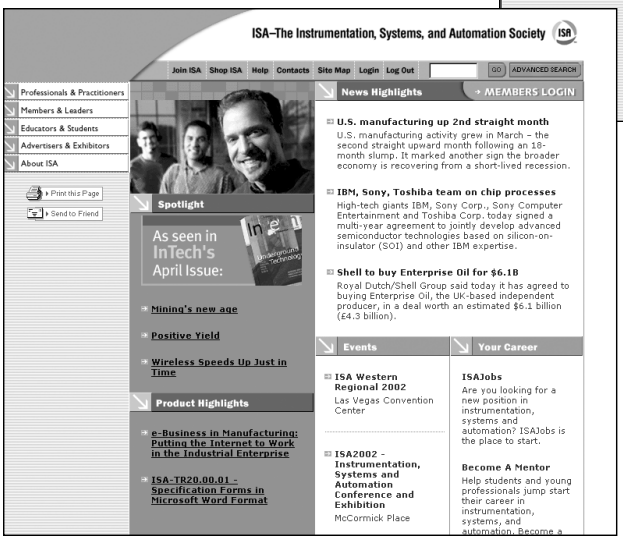

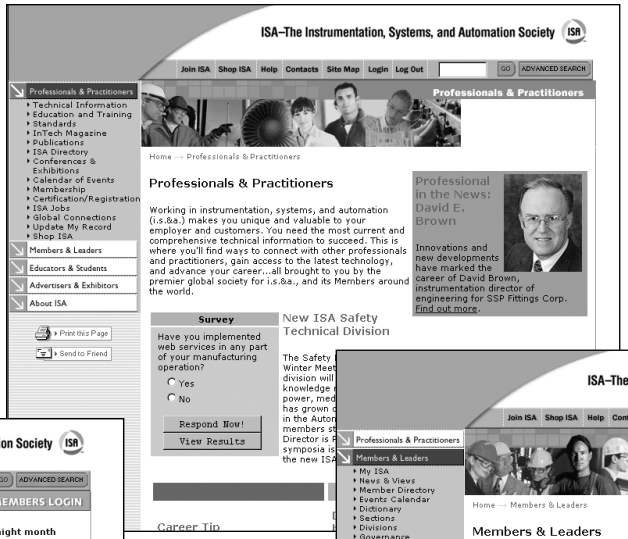

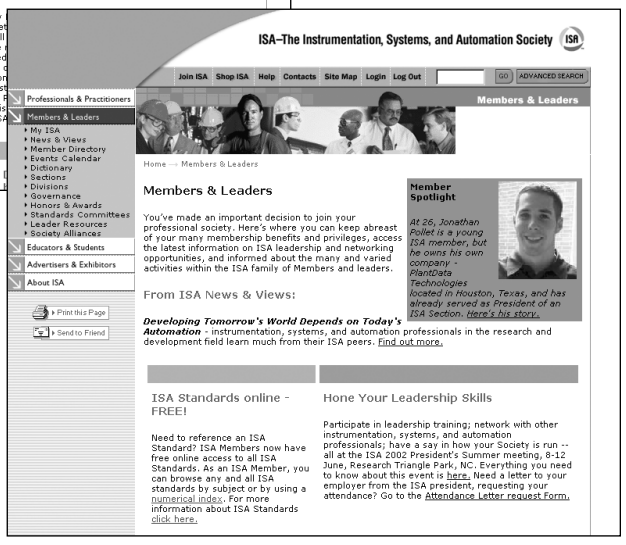

A PC-BASED SCADA SYSTEM FOR A WASTEWATER TREATMENT PLANT

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KEYWORDS

SCADA, PC-Based, Computers, Softlogic

ABSTRACT

This presentation describes the new SCADA system in use at the Hockanum River WPCF in Manchester, CT since April 2000. The old DCS system was installed in 1990 which was no longer supported by the manufacturer in 1995. We needed to install a new system that would not be obsolete in 5-6 years and provide lower operational and maintenance costs. Requirements of the new system were an open platform for all levels, PC –based, remote access, easily maintained and familiarity for the operational staff.

The new system utilizes a standard HMI found in most treatment plants but replaces the PLC with PC-based controls or Softlogic. The HMI software is FIX Dynamics and the softlogic product is Paradym-31. There are 3 Softlogic Nodes and two SCADA nodes communicating over a Fast Ethernet on a redundant Fiber optic backbone. FIX Dynamics WebServer provides Internet access to the wastewater plant as well as the water plant.

The PC-Based systems is being used in “mission critical” environment and is performing as expected by the designer. The database for the I/O and alarms are globally distributed to the network, requiring reduced maintenance on the system.

INTRODUCTION

One area of concern for the Town has been the need to maintain existing staffing levels and provide increasing levels of treatment. This can be accomplished with modern SCADA systems. We have implemented the latest technology to provide cost effective monitoring of the treatment plant and pump stations without the need for expensive proprietary hardware and software.

The following pages will provide information of a PC-Based System installed at the Hockanum River Water Pollution Control Facility (WPCF) in Manchester, CT. This will include a plant overview, new system requirements, selection of a PC-Based Architecture, software and hardware architecture, system components, project costs and information, system overview and logic diagrams.

PLANT OVERVIEW

The Hockanum River WPCF is and Advanced Waste Treatment Plant which was upgraded in 1992. The plant is capable of treating 8.20 MGD. The SCADA system installed at that time was a Fisher & Porter (F&P) DCS 5000 system. It contained approximately 1000 physical I/O points. The communications with 4 Distributed Control Units (DCU) was accomplished via a passive Encoded Ethernet Fiber Optic Highway. Construction Costs for the system in 1992 was ~$1.09M as priced by the general contract. In 1996, it was determined that the system needed to be upgraded due to waning support for the system by the manufacturer. A similar system was installed in the Town of Manchester Globe Hollow Water Plant in 1983 (Bristol Babcock UCS-3000) and this equipment was experiencing a variety of problems with less than ten years of operation.

Both systems contained proprietary hardware and software. They were costly to maintain and the expertise required for programming and upgrades was in the hands of the respective companies. The department wanted to a system that would have more universal support and low maintenance costs. The F&P System is shown in Figure I. The system did not have any redundancy for failures. The first level of backup was local control at control stations at each DCU. The 2nd and final level of control was full manual at the individual devices. There were Y2K issues with the F&P System, and these could only be addressed with a replacement of the hardware and the software.

NEW SYSTEM REQUIREMENTS

Table I shows the requirements for a new system at the HRWPCF. These characteristics were necessary from first hand experience at both facilities. Each one was of equal importance to the department that would not allow for a single requirement to carry a higher factor. This set of attributes was to be applied to the hardware and the software. This included the HMI, PLC or PC and the peripheral devices. The hardware needed to have some redundancy at the control room level. This would allow for continued operation from one central location in the event of hardware failure.

SELECTION OF A PC-Based ARCHITECTURE

There were three types of systems that were considered for this project. They were PLCs, DCS and PC-Based or Softlogic systems. After considerable research on each of these, a PC-Based Architecture was selected for this project. This system would meet all the requirements as listed in Table I and those of the operators. The staff wanted a system that was familiar and easy to program. Parts would need to be available locally and the Operating System (OS) needed to be supported by the Information Systems Department. These criteria are summarized in Table II.

SCADA SYSTEM ARCHITECTURE

The project would need to be bid and a set of specifications was developed for this type of system. There was not another type of system used in a treatment plant at the time and this required the development of original bid specifications. The specifics are shown in Table III. This requirement for the software was complied from two manufacturers of PC-Based software being used by the industrial sector at the time. This list is extensive and would not allow for the introduction of software that required add-on boards or a non-HAL (Hardware Abstraction Layer) accessing system. There was a need to produce a system that used the best attributes of PCs and PLC/DCS based systems.

The hardware specifications were developed from experience with the two existing systems and from visitations at recently converted plants. The equipment would need to be configurable and replaceable by the IS Department and familiar to the operators.

SCADA SYSTEM COMPONENTS

The actual system components that were selected are listed in Table IV. The software and hardware were bid as separate contracts to take advantage of direct purchase costs. The integrator selected for project would not need to purchase this from the suppliers, but was still responsible for the system as a whole. The software selected had been in production for three years and was supplied by a international firm. The integrator had worked with this type of software (Steeplechase) and this was a requirement to be selected for this project.

PROJECT COSTS AND INFORMATION

The project costs are shown in Table V. The estimate to replace the F&P DCS-5000 with a System Six was $250,000. This did not include replacement of the DCUs, but upgrades for TCP/IP access. Replacement of each of these units to the latest model would have been $50,000 each. This would have added $200,000 to the cost of the project.

The project was started in July of 1999. The anticipated startup of the new system was November 1999. Due to hardware issues with the I/O and training of the Integrators Staff on the software, the actual startup did not take place until March 2000. The system was to be replaced before Y2K, but this did not take place. The backup plan for the old system was to change the year to 1972, which corresponded to the same date and day for 2000. This was accomplished in late December 1999 (Date set to December 1971) and provided the necessary time to program the system and reduce Y2K issues. The final system overview is shown in Figure II.

CONCLUSION

The system has been operational for 15 months. There has only been one major problem with the system. 2 weeks after startup, one of the PCs was crashing at least once per day for a period of 4 days. The unit was removed from service and a spare installed and started up. The problem occurred during daily backups of the system. The failures were due to a problem with one of the 64 megabyte SIMMS. IS was able detect the failure and provide us with a reason for the PC problems. Other than this problem, there have not been any other unscheduled shutdowns of any of the PCs in the system. The PCs are not industrial grade and this will allow us to easily replace them in 3.5 years.

The staff, except for projects that would require more than 30 man-hours handles the software changes at the plant. The Integrator for the project handles these.

ACKNOWLEDGEMENTS

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TABLE I-NEW SYSTEM REQUIREMENTS

- Low Maintenance Costs
- Easy Programming
- Parts availability not limited to one manufacturer
- Open Architecture
- Common Communications Protocol
- Reliable system over a number of years
- Low replacement costs on a regular schedule (5 yr.)
- Compatibility over life of system with future upgrades

TABLE II-SELECTION OF PC-BASED ARCHITECTURE

- All Requirements in Table I
- Familiarity with PCs
- Parts available Locally
- Easy Software Programming
- Windows NT Operating System
- Reliable Equipment

TABLE III-SCADA SYST EM ARCHITECTURE

♦ SOFTWARE SPECIFICATIONS

- Windows NT 4.0 SP4 Operating System
- IEC1131-3 (61131-3) Standard for Control Software -SFC, LL & FBD
- Real Time Capability - HRTOS to 100 us
- Intellution FIX Dynamics (Water Treatment to be Upgraded)
- OPC Compliant
- ODBC Compatibility
- Full Client/Server Architecture Integration
- Full SAC Integration Security System
- Full Cross-reference to allow users to identify all programs and routines using I/O tags.
- User Defined Function Blocks in C.
- Integrate multiple tag lists to allow multiple users to develop simultaneously.
- Peer to Peer Networking Scheme over TCP/IP
- Snap to Grid of program elements
- Outputs follow logic flow and make or break as in standard logic circuits
- WIN911 Option for MMI on SCADA Nodes
- Auto-recognition of Nodes when reconnected for any interruption of the network
- No interruption of data point during MMI update or development
- Fault Detection of all Loops as to loss of signal
- All alarms conditional
- Software changes shall be downloadable from any node
- Expandability of the system
- Redundancy of the SCADA nodes:
  - Primary node
  - Secondary node
- Modbus RTU Communications Protocol for I/O and VFDs
- User Based Security System
- Dial-in Capabilities to all Software Functions
- Survive NT “Blue Screen of Death”
- Software Program Resides in Processor Memory

♦ HARDWARE SPECIFICATIONS

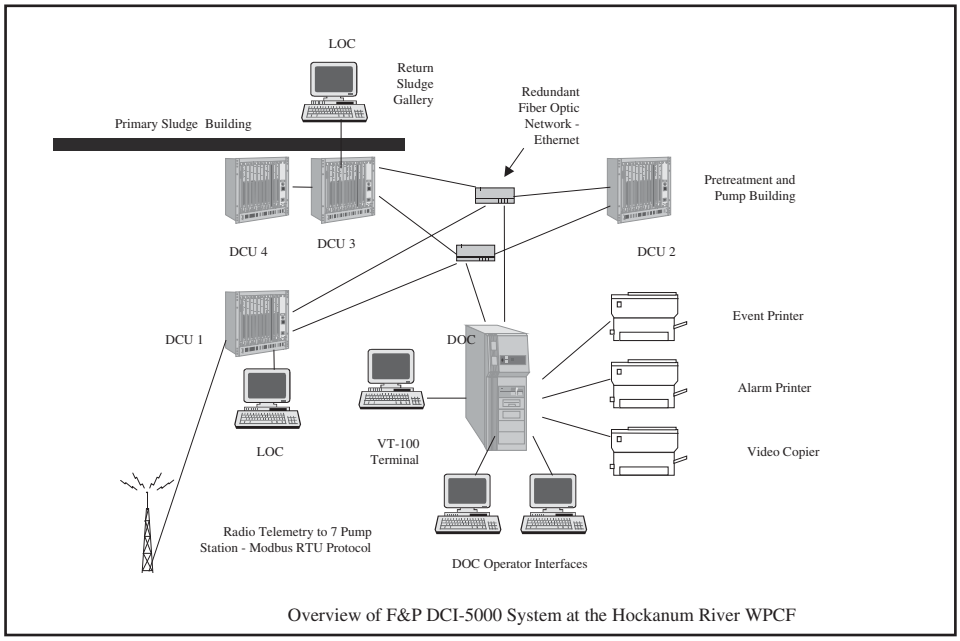
- Redundant SCADA Nodes in Main Control Room
- Ethernet Fiber Optic Network - Redundant
- Modbus RTU Mode for I/O Communications
- Connection to TCP/IP WAN (Token Ring) via Fiber router
- 2 Dot Matrix Printers (Alarm and Status)
- UPS for all PCs
- Inkjet Printer for Graphics
- Laptops for Remote Communications
- Two Wire Fieldbus network (Modbus)
- Link to Existing Pump Station Radio Telemetry
- New Fiber Optic Cabling

TABLE IV-SCADA SYSTEM COMPONENTS

- SOFTWARE
- Intellution I-Fix Dynamics (HMI)
- Intellution Paradym-31 (Softlogic)
- Intellution FIX Web Server (Monitor Only)
- Specter WIN-911 Software (Alarm Dial Out)
- Symantec PC-Anywhere (Remote Downloads)
- HARDWARE
- Micron Pentium-II 450 MHz PCs
- Dell Insperion Pentium-II 333 MHz Laptops
- Hitachi 21 inch Monitors
- WAGO 2pt I/O
- HP Deskjet Printer
- Okidata Printers
- Bestpower UPS
- CISCO Fiber Router
- CISCO Fiber Switch
- Codenoll Media Converter
- NetOptics Redundant Port Selector

TABLE V-PROJECT COSTS AND INFORMATION

- COSTS
- Hardware - $100,058
- Software - $ 62,821
- Integration - $166,420
- Training - $ 9,275
- Contingency - $ 15,926
- Total Cost - $354,500
- INFORMATION
- Direct Purchase of Hardware, Software and Training
- Integrator Responsible for System Integration
- Reduced Hardware and Software Costs by $50,000
- Installation & Startup – March - May, 2000
- Integrator-Morris Controls, Bristol, CT



Overview of F&P DCI-5000 System at the Hockanum River WPCF

FIGURE I – F&P DCI-5000 SYSTEM

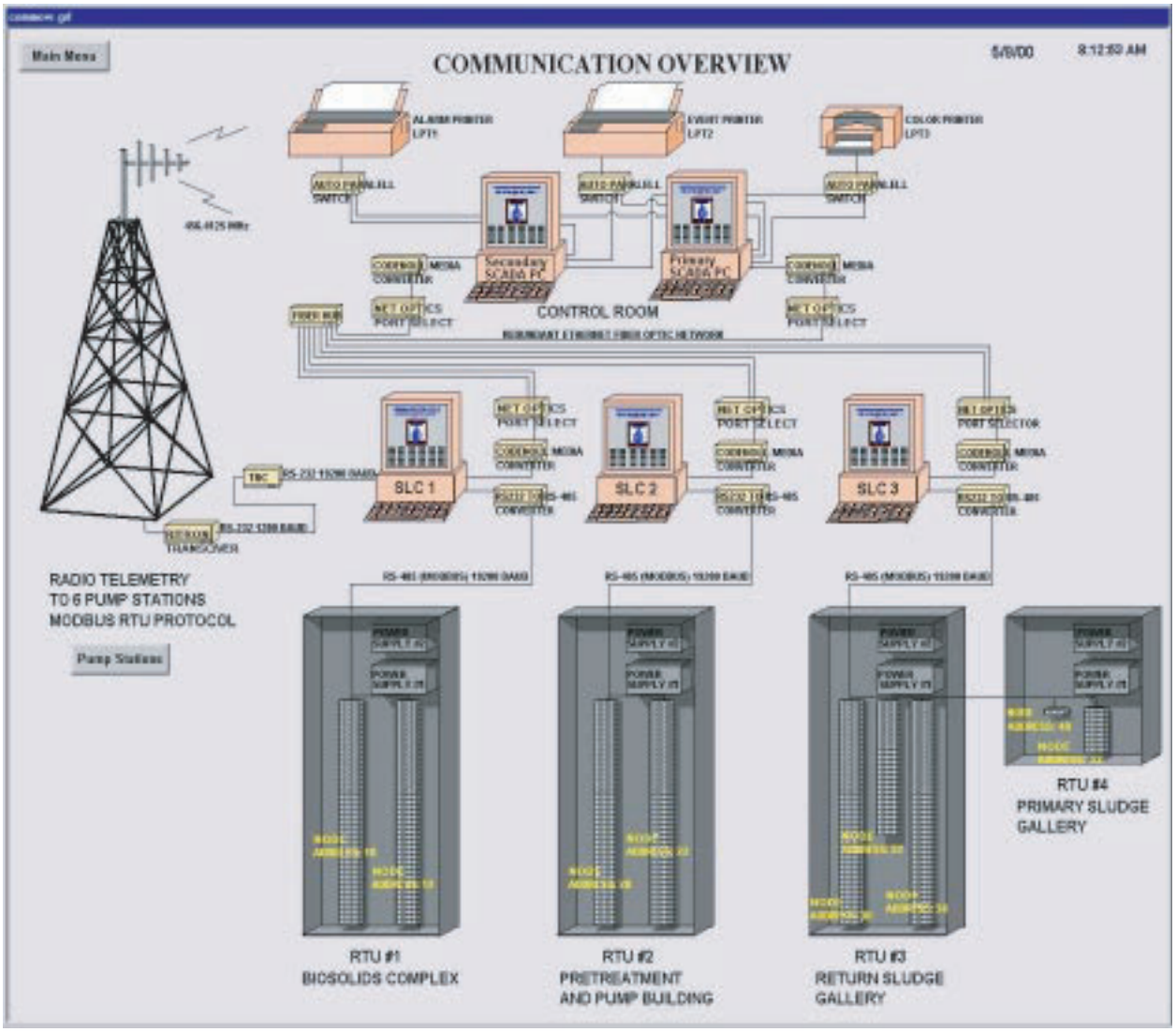


FIGURE II – FINAL SYSTEM OVERVIEW

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