

On the Water Front

Rocky Mountain Water Quality Analysts Association

Second Quarter 2012

In-line Instrumentation

By Michelle Ryerson and David Hudgins, MWRD

Everyone's talking about it...in-line instrumentation. Why? I recently shadowed David Hudgins, In-line Instrument Specialist at Metro Wastewater (Metro), to find out what's up with in-line instrumentation.

The biggest shock...quantity. The Metro District (District) uses 48 in-line instruments to perform 78 different analyses with more instruments to come after upgrades and the Northern Treatment Plant expansion. Why so many?

As many of you know, Metro processes an average of 140 million gallons of wastewater per day. From primary clarifiers, aeration basins with a CaRRB process, to secondary clarifiers and disinfection, the sampling points for process control, plant efficiency, and regulatory monitoring are numerous. With all of this functioning 24/7, there was a need to create a position to manage all of the in-line instrumentation. That's where David comes in.

When he started a year ago, David's assignment was to set up and coordinate the program. A year later, he performs calibrations, manages the maintenance program, validates data and sets up instrumentation for special studies.

In addition to these regular duties, he chairs an interdepartmental team. Staff involved in the In-line Instrumentation Program include members from Maintenance, Information Services (IS), Laboratory, Operations, and Engineering. Engineering decides where the instruments will be the most beneficial. Electricians from Maintenance help keep a portion of them running. IS ensures the data is transmitted to the appropriate databases properly. The lab assists with calibration and quality control, and Operations ultimately uses the data to adjust processes all over the plant to maximize treatment and minimize energy use.

The instruments range in complexity and cost. Simple instruments with a single sensor may cost a few hundred dollars while a complex instrument with



David Hudgins, Metro Wastewater, poses with some of their in-line instruments.

multiple sensors may be upwards of \$200,000.

Many different makes and models are used including:

- [Cerlic](#) and [Hach](#) meters for pH and TSS
- [ATI](#) for chlorine and sulfite residuals
- [E&H](#) for NH₃, pH NO₃, and TSS
- [S::can](#) for Nitrate, COD and TSS
- [ChemScan](#) for NO₃, NH₃, ortho P, and NO₂

Most of the in-line instrumentation locations are in the secondary and effluent processes. Some are submersed allowing reading directly at the meter and others are immersed in pipes or sample is pumped to nearby analyzers. All the data goes to a central database where charts and graphs can be created for current status, trending, and other data analysis.

To help manage the information, an [Continued on Page 7](#)

Table of Contents

Water in Liberia.....	2
Quagmire's Corner.....	3
Dissolved Oxygen Method.....	4
NELPW.....	4
Analyst of the Year Winner.....	5
In-Line Instrumentation.....	7

My Trip Back Home: A Story of Water in the Nation of Liberia



By Nat Biah

I am originally from Liberia and came to the United States in 1983 as a student at Columbia University. At that time, a friend asked me to come to Denver and I've been here ever since.

A few years ago I took a trip back to my home country of Liberia. Having been a part of the RMWQAA and water community for many years, people often asked me about water in Liberia. Before I explain the water, I must explain the political history because they are ultimately intertwined.



Liberia, the oldest republic on the north-west part of Africa, was established by freed slaves, mostly from the Virginias and the Carolinas around 1821. On July 26, 1847, independence was declared. Of all African countries, Liberia has had the greatest US influence. The Constitution and the flag were modeled after the US.

Many foreign businesses operated in the country including US firms (Firestone with the largest rubber plantation, Uniroyal, BF Goodrich & Bethlehem Steele) and three major European mining companies. There were also traders from Lebanon, Syria, and India. The two major universities flourished with both local and foreign students as did the many technical high schools focusing on developing career skills. Basic water and sewage treatment was available in the major metropolitan cities. In 1982, all of this changed. The 20-year civil war began, and Liberia suffered great loss of life and spirit.

In April 1983, the Liberian President, Mr. William R. Tolbert, was overthrown and assassinated over an increase in the price of a bag of rice—the staple food of Liberia. More accurately, the main cause of unrest was over the disparagement of lives between the 'haves and the have nots' – the 99% vs the 1%. The civil war escalated into tribal conflicts mostly between the Mano tribe and the Krahn tribe.

Then, in about 1985, Mr. Charles Taylor entered the

conflict. Most Liberians thought he was going to restore peace, but instead he escalated the violence to neighboring countries (Sierra Leone, Guinea, and the Ivory Coast). Taylor and his rebel soldiers entered villages, abducted boys and girls, drugged them, and trained them to be killers. The girls, some as young as 10 years old were used as sex slaves for the rebels. In 2005, Taylor was finally removed from power and indicted for crimes against humanity. His offenses included murder, rape, sexual slavery, recruiting child soldiers, forced amputations and pillage.

After the ousting of Taylor, Mrs. Ellen Sirleaf was elected President. She began major reconstruction projects in the country, but it will take many years to return to the democratic nation Liberia once was.

Liberia is situated on the same tropical belt as Hawaii and the Amazon jungle of Brazil. The country has two seasons: the rainy season from June to November and the dry season from late November to May. Due to an annual rainfall of 163 inches, the country has many full rivers and tributaries. The temperatures range from 72-100°F with 30% -78% humidity.

During the civil war, most of the water and wastewater treatment plants were destroyed by the rebels. Most of the basins were bombed and some had human bodies floating in them. With help from United Nations Development Program and the Chinese and German governments, most of these facilities are being restored little by little. In the meantime, many individuals have their own private wells for drinking water and ground containers to collect human waste. Currently 98% of the homes still do not have running water or sewage facilities. As a result, the government set up substations for people to fill containers with water free-of-charge. From these stations, some individuals earn their living by supplying various homes, offices, and businesses with water for their personal use. Besides delivering these jugs of water, there are street vendors who sell ice water in a sandwich bags. In a 100° heat, you will be tempted to drink the water or use the ice—but is it safe?

Continued on Page 6



Images of child soldiers, slaves, and refugees in an abandoned hospital.

Quagmire's

C o r n e r



I'm a new parent and my baby is sick. Could it be the water?

Last quarter, our favorite analyst Quagmire talked about what he does to protect his drinking water well. He is now emBARKing on a new adventure as a parent, and has received numerous questions from human parents wanting to know more about drinking water and the health of their babies. Here's what he learned to answer the questions about human babies:

[Quagmire's Legalese to CMB \(cover my booty\)](#)

If the puppy (oh yeah, you call them babies...this terminology may be hard for me to remember) is throwing up, has diarrhea or a fever, schedule an appointment with a doctor. If they have bloody diarrhea, hurry to the emergency room or urgent care to have the baby tested. The Disease Specialists tell me that if the diarrhea is bloody, then it's bacterial...don't let the doctor tell you that it's viral. Ask for an enteric screen, which is a series done on fecal matter to test for GI issues (*E.coli*, salmonella, campylobacter, etc.).

If you are low on funds and want to avoid a trip to the Emergency Room, call Colorado's 24-Hour Nurse Advice Line at 1-800-283-3221. This is an important precaution. You can also call a Disease Investigation Specialist at your local health department to help investigate the cause.

[My baby is blue & I think it's the water not Dr. Seuss](#)

Despite popular cartoons and children's books, puppies...I mean babies, should not change colors. Nitrate will displace the oxygen in the blood and turn them blue. Go to the hospital immediately for oxygen treatment.

[My baby gets sick every time she drinks the water](#)

Even though little ones get sick for a variety of reasons—their siblings kiss them, they lick the floor, they put everything in their mouths, water may still

be the source. Try switching the water source. If the baby appears to get better when the parents use a different water source, then continue using the new water (i.e. bottled water) until your drinking water has been ruled out as the reason for the illness. To rule out the water as the cause, call your water provider. Many times, water providers will test the water for free as they want to discover any contaminants and protect the water supply.

[I've heard chlorine is bad for tender baby tummies](#)

If the baby's tummy is upset and the stools haven't changed, it might be colic or it might be the chlorine in the water. Filter the water using a charcoal filter i.e. Brita or attached to the kitchen faucet. This type of filter removes chlorine and the baby should start to smile at feeding time again. Just remember that filters need to be changed regularly (usually every 3 months) or they can become a breeding ground for bacteria.

[Aren't there bacteria and pathogens in the water?](#)

A backflow event may have occurred that allowed bacteria to enter a water system that is normally bacteria-free. Example: the neighbor's dog (*not me...I pick up after myself*) pooped on the sprinkler head and a low pressure event allowed the feces to enter the water supply. Garbage disposals are also notorious for backflow events. Install a backflow device to prevent these random events from occurring. If you suspect bacteria or another pathogen, test for coliform. Coliform is an indicator bacteria and is usually present when there's a pathogen present. You can also test for turbidity. Really turbid water can hide pathogens. Testing for specific viruses, bacteria, and/or protozoa is expensive and difficult to sample. Do not waste the money unless you have a diagnosis from your doctor.

[Something's in the water that I can't taste or see](#)

Many other contaminants can cause damage (i.e. kidney, cancer, loss of fingernails, etc.) after long-term exposure i.e. more than 30 years drinking lots and lots of contaminated water. These impacts may be noticed as birth defects, but typically they are not noticed in a baby. To get an idea of what has or has not been found in your water, look at the Consumer Confidence Report (CCR) or Annual Water Quality Report from your water provider. If the baby is sensitive to something, like metals, use a charcoal filter. It'll remove most metals and the baby will be fine.

[Resources for lab rats](#)

Cheat sheet for common complaints:

<http://www.pnws-awwa.org/files/ccg.pdf>

List of drinking water contaminants and their health effects:

<http://water.epa.gov/drink/contaminants/index.cfm>

National Environmental Laboratory Professionals Week

Why should people care about laboratorians? After all, it's the results that are important. Well, guess what? We provide the results that play a key role in water and wastewater treatment as well as environmental monitoring for protection and remediation. Laboratorians across the globe ensure that water is safe to drink, wastewater is treated, the right kind of bugs are in the water for stream health, and regulations are still appropriate.

Laboratorians aren't the best at tooting their own horn, so the Association of Public Health Laboratories (APHL) must do it for them. Through a cooperative agreement with EPA, APHL proposed the **establishment of a National Environmental Laboratory Professionals Week (NELPW)**. The first NELPW was held in April of 2012, but if you would like information and support in planning your celebration next year, contact Megan Weil Latshaw, Director, Environmental Health Programs for APHL, at 240-485-2768 or at megan.latshaw@aphl.org.

Top 10 Reasons to Appreciate a Rocky Mountain Water Quality Analyst:

- 10: They eat leftovers.
- 9: They are ethical...no dry labs ever!
- 8: They know not to drink the lab juice.
- 7: They protect the public not just individuals.
- 6: They know how to be styling in safety goggles.
- 5: They are a voice for the environment.
- 4: They have access to 100% pure ethanol.
- 3: They protect the regulated entity.
- 2: They know acid burns are better than tattoos
- 1: They get it done!

Thank you for the work you do every day to protect people from environmental threats!



For the most accurate and defensible proficiency testing results.

www.eraqc.com



What are you doing to celebrate water this year? How about a tour for RMWQAA members? This way you can use the really hard words that lose the elementary students.

If interested, contact Michelle or Hope at newsletter@rmwqaa.org.

Dissolved Oxygen Method Approved for Clean and Dirty Water

As of April 17th, 2012, the EPA has approved a new method for the measurement of Dissolved Oxygen in clean and dirty water applications. The method is Hach 10360 and applies to reporting of DO in NPDES permitted outfalls. The method can also be used for determining Biochemical Oxygen Demand (BOD) and Carbonaceous Biochemical Oxygen Demand (cBOD).

The luminescent dissolved oxygen (LDO) method utilizes technology pioneered by Hach in 2003. Luminescent technology eliminates the need for membranes, significantly cutting down on the maintenance and cleaning required to measure DO and BOD using traditional methods.

The Hach Method 10360 can be used for regulatory compliance reporting. Laboratories can reference the federal register (40 CFR Part 136) when conducting method certification in their labs. Some states have already approved this method for reporting, but this approval by the EPA is for the official federal register.

Summit Scientific is Your local representative for the following lab systems:

Lachat Instruments - Flow Injection Analyzers and MICRO DIST rapid distillation system.

Radiometer Analytical - Autotitration Systems plus pH, ISE and Conductivity meters.

Nippon Instruments - Dedicated Mercury Analyzer. Low-cost manual systems to full automation offering all EPA Hg methods.

Teledyne Tekmar - Purge & Trap System + TOC Analyzers

Zumatrix LIMS - Entry Level LIMS to Full Featured Systems

Mark Orr 303-973-8184 mark@summitsci.com

2012 Analyst of the Year



RMWQAA President Stephen Ellis presents Ginger Wynne with the 2012 Analyst of the year award.

The 2012 Analyst of the Year goes to Ginger Wynne, Chemist at the City of Ft. Collins Water Pollution Control Laboratory. Ginger has been with the city for 21 years and has been an active member of RMWQAA for most of those years. She has performed a number of analyses in the lab from Low Level Mercury by EPA 1631 to Microscopic Examination for process control.

For the past year, Ginger has spent countless hours troubleshooting Low Level (LL) Hg instrumentation and methodologies and even gave a talk about her experiences at the Water Quality Symposium in April. Ginger also provides LL Hg analytical services and expertise to other government and private labs. Ginger's dedication to the troubleshooting process and pursuit of "perfection" has significantly improved ability to meet the City of Fort Collins regulatory requirements as well as customers/projects expectations.

Ginger also serves on the Triple Bottom Line committee of the 21st Century Utility for the City of Fort Collins. This group looks at strategies to improve the utility's sustainable efforts by looking at the environmental, social, and financial impacts of major decisions. This committee has been involved with developing a scorecard/matrix to help raise the level of awareness in these three areas of sustainability. Ginger is also involved with sustainability efforts by the City of Fort Collins Utilities.

Congratulations to Ginger for all her hard work!



Drinking Water Certified

Organics (SOC/VOC)
DBP (THM/HAA, TOC/Aik)
Nitrate/Nitrite Nitrogen
Copper and Lead
Fluoride
Total Coliform
Metals by ICP-MS & AA

Wastewater

BOD, TSS, Ammonia-N
NO₂-N, NO₃-N, & TKN
Coliform-Total, Fecal, E. coli
Metals by ICP-MS & AA
Biosolids- Soils Analysis, 503
Regs, Fecal Coliform
DMROA Participant

The RMWQAA Annual Scholarship Application

2012/2013 can be found at:

www.rmwwqa.org

To qualify:

- You must be enrolled in a 2yr or a 4yr college or university for study related to the water environment profession.
- You must submit an application and essay by the **July 31, 2012** deadline.

Stay Tuned for:

- **Sampling Workshop by USGS**
 - **Analyst Certification Exams**
- Both to be offered this Fall.**

wibby
environmental

New!

Biosolids QC and PT Standards

- Metals, Nutrients, Anions and Solids (Volatile/Total)
- PT studies available January, April, July & October
- QC standards in stock for immediate shipment

303-940-0033 www.wibby.com sales@wibby.com

...Liberia continued

Continued from Page 2

Fortunately for the country and water treatment, the ecosystem has remained strong. All the farming is subsistence i.e. rice. The farmers can't afford to buy fertilizers, pesticides, and herbicides for their crops; hence the surface water is not contaminated with these chemicals. Since most of the source water is surface water, the major problem for water treatment is evaporation of the lakes and lagoons during the dry season.



Workers preparing filter media.

One of 4 resuscitated sedimentation basins

For those drinking treated water, the chlorine concentration is 2-3 mg/L depending on the location and the turbidity is about 5 NTU. Compared to the raw water consumed by some people, 5 NTU is safe. Unfortunately, there is no biological laboratory to use to test for various microbial pathogens.

When I arrived at the village to see the older members of my family, I thought to myself how strong and adaptable our immune systems can be. Instead of a dug outhouse (latrine) for human excrement, a little clearing on the outskirts of the village is used for bathing and toileting. These facilities are subsequently built upstream for each family group. Just imagine how many toilets would be upstream for a village with 2-3,000 people?

About two or three miles from the village is the river where the people get their drinking water. This same river is used by the young ones to swim and the adults to do their laundry. And when it rains? You guessed it, human waste washes right into the same river.

As the temperature increases during the hot summer, the current weakens and the river dries up. This is a perfect time for breeding tropical worms like plasmodium (malaria causing parasite), filarial, and schistos. It is also the perfect time for the infections of tape worms, ring worms and round worms.

As the US continues to focus on common water issues like *E. coli* and salmonella that can cause stomach gastrointestinal illness in normally healthy



Villagers doing laundry in the river

people, I think about all the waterborne pathogens they deal with back home. Among other disease causing agents, there are worms that can reside in skin, eyes, and deeper tissue. Filarial worms settle around the stomach, lungs and heart. There are eight species of filarial worms that can infect humans. These include lymphatic parasites that can cause elephantiasis (swelling in extremities), tissue invaders like loa loa (eyeworm), onchocerciasis (river blindness), streptocerca (roundworm) and *Dracunculus medinensis* (guinea worm). Additionally, Schistosomes are fluke worms that infect human blood vessels, which come from snails that contaminate fresh water. All of these, and countless others, are considered NTDs (Neglected Tropical Diseases) that are easily treated or prevented in developed nations, but neglected by those in underdeveloped nations who do not have access to medical care.

Because of the increase in infant mortality and the prevalence of infectious and diarrhetic diseases among the villagers, the government has launched a major health campaign throughout the country to educate these villagers about common sanitation.

With some financial help from major donors in the US and Europe, the Liberian government has built five major regional hospitals and some nursing schools for prenatal and primary care. Perhaps within the next five to ten years, the country might regain her glorious day and provide good drinking water and sewage treatment for her citizens. In the meantime, if you visit Liberia, please do not drink the water from the street vendors no matter how hot the temperature might be.

Photos courtesy of the History Department at the University of Liberia and personal photos by Nat Biah, and his nephew.



Woman and others selling bags of ice and jugs of water. The center picture shows a water substation where street vendors get the water.

In-line Instrumentation



An example of a multi-parameter in-line instrument used at the Metro District.

Continued from Page 1

In-line Instrument Library was created on the District's Intranet and contains all the OEM operation manuals, SOP's, maintenance logs, calibration logs, audit sample results, and spare parts lists.

Access to the In-line Instrument Library is key to the In-line Instrument Program. As chair of the team, David strives to keep everyone involved and stresses teamwork is essential. The team meets at least every other month and more often as needed.

The instruments do cost money to purchase and maintain, but the benefits both monetary and staff time far outweigh the costs. As we all know the laboratory is great and cannot be replaced, but they rarely are able to provide real-time data by using approved testing methods for NPDES permits. Real-time analyzers allows for real-time monitoring so adjustments can be made before more serious problems develop.

Another very important advantage to having in-line instruments is energy savings. The Metro District team spearheaded a project to see if ammonia data could be used to set aeration levels. In a recent JTAC presentation, Perry Holland explained how the Metro District is able to save up to \$500,000 per year by monitoring the NH₃ levels in the aeration basins which is the largest use of power for the District.

Sure, they're fast, but how well do they work? The District used these instruments in special studies to make decisions about whether to use ISE in-line



800-576-5690
www.RT-Corp.com
sales@RT-Corp.com
Laramie, WY

Your Source for:

- Proficiency Tests
- QC Standards
- Microbiological Standards
- Certified Reference Materials



First Choice for Quality™

instrumentation in other parts of the plant. One of the key questions was: Do chloramines affect the performance of the ISE based NH₃ instrument?

Figure 1 shows NH₃-N results for the Chlorine Contact Chamber effluent from an ion selective electrode (ISE) based instrument and a colorimetric based instrument (both are in-line instruments). The yellow line shows concurrent total chlorine residuals. It is quickly apparent that the two different instruments track in a comparable manner. Also observed was the total Cl₂ residual and NH₃ peaks at different times and that the concentration of NH₃ is not effected by the change in concentration of Cl₂. This gives strong evidence that chloramines are detected by the in-line instruments and supports the conclusion that total Cl₂ residual and the production of chloramines do not affect the performance of the ISE sensor. Other Cl₂ spiking studies showed no change in NH₃ concentration as the level of Cl₂ was increased to 2 mg/L. For practical purposes, the ISE results match the colorimetric results very well and meet the criteria for process control.

In-line instrumentation may be right for you if you need to make decisions quickly or have high energy costs. For more information about the Metro District's In-line Instrumentation Program, please contact David Hudgins, In-Line Instrument Specialist at 303-286-3322 or by email at dhudgins@mwr.dst.co.us.

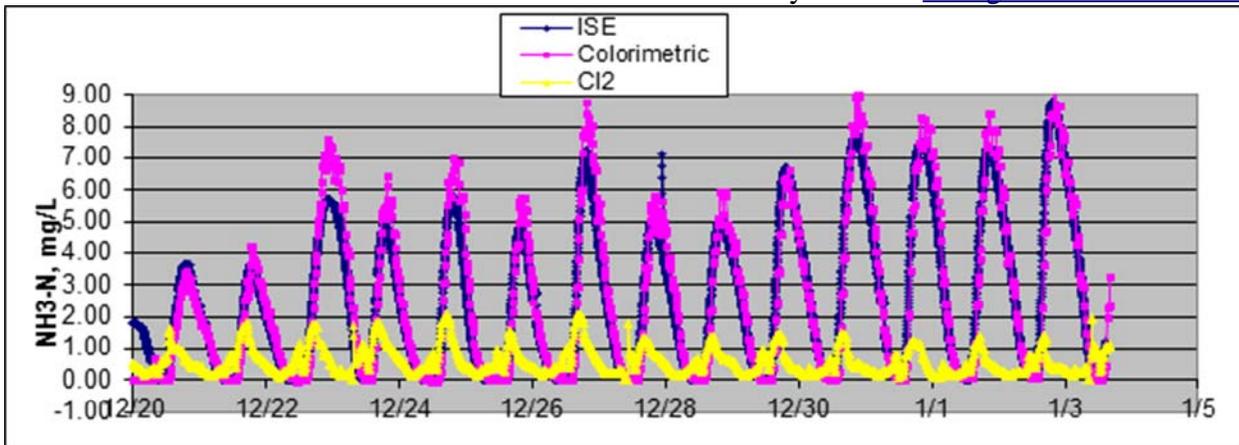


Figure 1 Two-week trending of NH₃-N in the Chlorine Contact Chamber using Ion-Selective Electrode, Colorimetric, and Chlorine

RMWQAA
PO BOX 29407
Thornton, CO 80229-0407

RMWQAA BOARD MEMBERS

President - Stephen Ellis
president@rmwqaa.org

Vice President/Conference
Adele Rucker - vp@rmwqaa.org

Secretary - Sue MacDonald
secretary@rmwqaa.org

Treasurer - Lesa Julian
treasurer@rmwqaa.org

Website - Heather Waters
website@rmwqaa.org

Database - Dawn Cowell
database@rmwqaa.org



RMWQAA
PO BOX 29407
Thornton, CO 80229-0407

WWW.RMWQAA.ORG

Certification - Adele Rucker
certification@rmwqaa.org

Vendor Chair - Mike Schoenberg
advertising@rmwqaa.org

Education - Phil Russell
education@rmwqaa.org

Scholarship - Brian Donahue
scholarship@rmwqaa.org

Newsletter

Michelle Ryerson
Hope Dalton
Kathy Wagner
Natalie Love
newsletter@rmwqaa.org