

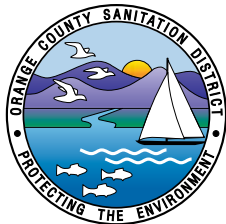
ENVIRONMENTAL ENGINEER & SCIENTIST

SPECIAL

2016 Summary of Events
and Activities



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FEATURES

Quarterly Periodical of
The American Academy of Environmental Engineers and Scientists®

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Content Editor, News, Current Events & Careers

Advertising, Production, and Design
Yolanda Moulden

Address all communications on editorial, business and other matters to:

Editor-in-Chief,
Environmental Engineer and Scientist®
American Academy of Environmental Engineers and Scientists®
147 Old Solomons Island Road, Suite 303
Annapolis, Maryland 21401
410-266-3311

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Take the Challenge and Do More

Finally, as I look out my window drafting this final President's Page for the fall edition of the Academy's Journal, I see the fall foliage has come (it was near perfect for our fall Board of Trustees' meeting and Technical Conference in Cazenovia) and gone. Now it is time to prepare for winter by detailing and mulching flower beds, last minute mowing, raking leaves, harvesting the last goodies from the vegetable garden, and finally collecting and splitting wood for the maple syrup season coming up in March! As I finished the harvest season, it is time to reflect back on the past year to review the numerous accomplishments of the Academy: active committee work, increase in applications for Board certifications, excellent project awards for our E3S, distinguished honorees for various AAEEES awards, high renewal rate for certification, and the outstanding Technical Conference and Board of Trustees meeting in Cazenovia!

As you may recall from the past three President's Pages, I have focused on to "Be the Best of the Best." We need to encourage the younger generation of engineers and scientists to step up to the plate, be heard, and provide the leadership to help solve our pressing environmental and infrastructure needs, including protecting the sugar maple tree!

I would like to report on the success of the AAEEES sponsored Technical Conference held in Cazenovia the day before our Board meeting ... and to thank the Board members that attended. The title of the conference was "Program and Plant Performance Improvements with Emphasis on Energy Efficiency and Sustainability." We had a total of 84 attendees, including 17 college students and five professors from Clarkson University, Cornell University, SUNY-ESF,

Wilkes University and Colgate University. Feedback was very positive and so much that I have formed a small committee of four to plan for another Technical Conference to be held in Cazenovia on October 12, 2017 (thank you Mike Selna for challenging me to do this). It appears the formula for success is:

"I learned more in one day from the speakers [practitioners] than in one week of classes."

**Gus Walker
Junior — SUNY-ESF.**





“Feedback was very positive and so much that I have formed a small committee of four to plan for another Technical Conference to be held in Cazenovia on October 12, 2017.

- select most of the speakers from local government, authorities, state agencies, etc.
- obtain prior approval of one New York State PDH for each 50-minute presentation – suggest five to six PDHs
- invite local college students (hopefully from our student chapters) and professors to attend at a low cost or no cost (sponsorships)

We provided an extra-long lunch break with box lunches to foster conversation and mentoring between the students and the practitioners. See photo on previous page of Peter Radosta, Howard Lafever, and Professor Stefan Grimberg with the Clarkson students.

One outcome from this conference is that Peter Radosta, P.E., BCEE, is going to speak with students at Clarkson and Colgate; Wayne McFarland, P.E., BCEE, and myself are going to speak to the Cornell student group at the end of November. I am so excited about this outcome that I want to challenge all of you to start up a technical workshop or seminar in your local area. The Seminar & Workshop Committee, co-chaired by Sharon Yin (714-593-7243), would like to assist you ... and/or get involved in a local student chapter or start one. Help is available from the Student & Young Professionals Committee, Chair Nick Rose (612-670-5882).

Based on the roll call at our recent Board of Trustees meeting, I know most of you are mentoring students and young professional in your own way, but please take the challenge and do more ... “Just Do It!”



In closing, I would like to give thanks to GHD and Michael Tamblin, Northeast Operating Center Manager, for supporting my 14 years as a Trustee and this year as President. As I have one year left as Past President, I look forward to working with 2017 President Bob Williams, President-Elect Hunter Nolan, and Vice President Kristin Morico.

And lastly, a thank you to my wife, Lynde, who has wholeheartedly supported my volunteer work with the Academy.

Howard

P.S. A special thanks to our staff that make the President's volunteer job much easier. ☺

Program and Plant Performance Improvements with Emphasis on Energy Efficiency and Sustainability




THURSDAY, OCTOBER 20, 2016 | HAMPTON INN & SUITES | CAZENOVIA, NY

The American Academy of Environmental Engineers & Scientists (AAEES) will be hosting a one-day technical conference in Cazenovia, New York in conjunction with the Academy's Board of Trustees Meeting the following day. The selected speakers represent the "Best of the Best" professionals from Central New York in their environmental specialties of water and wastewater. Attendees will hear about the proven and state-of-the-art technologies and concepts to maximize performance and improve energy efficiencies and sustainability. **6 NYS-approved PDHs offered (1 for each session)**

Time		Session	Presenter(s)
8:00 – 8:25	25 min	Registration and Coffee	
8:25 – 8:30	5 min	Welcome	 Howard LaFever, PE BCEE President AAEES
8:30 – 9:30	60 min	Energy Efficiencies and Sustainable Practices at Onondaga County Owned Facilities (1 PDH)	 Michael Lannon, PE Deputy Commissioner Onondaga County Department of Water Environment Protection (WEP)  Dan Jean Operations Superintendent Onondaga County Department of Water Environment Protection (WEP)
9:30 – 10:30	60 min	Water Treatment Plant Process Improvements for Water Quality Efficiency and Waste Minimization (1 PDH)	 Dick Goodney, PE Director of Engineering Mohawk Valley Water Authority (MVWA)  Phil Tangorra Director of Water Quality Mohawk Valley Water Authority (MVWA)
10:30 – 10:45	15 min	Coffee Break	
10:45 – 11:45	60 min	Design Concepts for New Egg Shape Anaerobic Digesters/ Co-Generation (1 PDH)	 Ryan Fisher, PE BCEE Project Manager GHD Consulting Services Inc. (GHD)

Program and Plant Performance Improvements with Emphasis on Energy Efficiency and Sustainability

THURSDAY, OCTOBER 20, 2016 | HAMPTON INN & SUITES | CAZENOVIA, NY

Time		Session	Presenter(s)
11:45 – 1:00	75 min	Lunch and Networking Students from SUNY-ESF, Cornell, Syracuse University, and Colgate will be invited to join us in a networking opportunity.	
1:00 – 2:00	60 min	Emerging Role of Nano Technology Application to Water and Wastewater (1 PDH)	 Dr. Cornelius (Neil) Murphy Senior Fellow State University of New York College of Environmental Science and Forestry (SUNY-ESF)
2:00 – 3:00	60 min	OCWA Efficiency Improvements from Source to Customers (1 PDH)	 Andrew Weiss, PE Executive Engineer Onondaga County Water Authority (OCWA)
3:00 – 4:00	60 min	Achieving Net Zero Energy at a Wastewater Treatment Plant (1 PDH)	 Dan Ramer Chief Operator City of Ithaca Ithaca Area Wastewater Treatment Plant
4:00 – 4:05	5 min	Summary and Adjournment	Howard LaFever

DATES TO REMEMBER

- **February 1, 2017** - Entries are due for the 2017 Excellence in Environmental Engineering and Science Competition. Entry forms can be found here: <http://www.aees.org/e3scompetition.php>
- **February 1, 2017** - Reservation forms for the 2017 Kappe Lecturer are due. Go to <http://www.aees.org/kappelecturer.php> for more information.
- **February 2, 2017** at 12:00 pm – 1:30 pm ET, Webinar discussing Leadership in Environmental Engineering – “A Tale of Two Journeys.” To register for this FREE event, go to <http://bit.ly/AAEESLeadershipWebinar>
- **March 1, 2017** - Entries are due for the 2017 Environmental Communications Awards. Entry forms can be found at <http://www.aees.org/environmentalcommunicationsawards.php>
- **April 13, 2017**, AAEES E3S Awards Luncheon and Conference, National Press Club, Washington, DC. Additional details forthcoming.
- **April 14, 2017**, AAEES Spring Board of Trustees Meeting. Additional details forthcoming.
- **May 8, 2017**, AAEES's 9th Annual Breakfast at NJWEA's Conference. For registration or exhibitor information, visit www.njwea.org.
- **May 9, 2017**, AAEES's 8th Annual Workshop (with TCHs, PDHs and CEUs); includes breakfast and/or lunch at NJWEA's Conference, Atlantic City, NJ; For registration or exhibitor information, visit www.njwea.org.

Help Us Grow the Academy – Refer a Colleague for Certification

As a member of AAEEES, you are part of a growing number of environmental professionals who have gone the extra mile to become Board Certified. We all have our reasons for putting in the time and effort to achieve this milestone, but there is no doubt that we saw value in gaining Board Certified status. In addition to the personal aspects of becoming certified, many of us also think of it as a responsibility to the community we live and work in, a responsibility that encompasses optimizing the environmental solutions we develop and maximizing the benefits to be derived from our work.

Running parallel to the communities that we serve as environmental engineers and scientists is membership in the virtual and intellectual "community" that is represented by the Academy. The Academy thrives on the passion and professionalism embodied by our members. We are all in charge of building this community by continually identifying and recruiting talented individuals to join us.

That is why we are sending you this note. We need your help in finding the right people and directing them to us so we can begin the certification process with them. Can we ask that you take a few minutes to think about your staff and colleagues in the context of the Academy? Are there people whose body of work, technical expertise, professional demeanor, and energy levels makes them outstanding candidates for certification?

We know they are out there. Now we need you to take the first step by recommending them to us. Tell us who the star players are on your team and we will work to recognize them with the same measure of excellence that you have achieved.

The annual application cycle ends March 31.

Start compiling your list of qualified candidates now.
For assistance, go to: <http://www.aaees.org/members-recruitment.php>.

The logo features a large, stylized letter 'A' in a blue serif font. To its right, the word 'AMERICAN' is written in a smaller, blue, all-caps sans-serif font, and the word 'ACADEMY' is written in a larger, blue, all-caps serif font. Below this, the text 'OF ENVIRONMENTAL ENGINEERS & SCIENTISTS®' is written in a small, blue, all-caps sans-serif font. Further down, the address '147 Old Solomons Island Road, Suite 303 Annapolis, MD 21401' and phone/fax numbers '410.266.3311, FAX: 410.266.7653' are listed in a blue sans-serif font, followed by the website URL 'http://www.aaees.org'.

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Momentous Events

Sometimes the most significant things are those that are a little noticed when they first happen. It's like the tree falling in the forest; does anyone hear it if there is no one nearby to receive the energy waves that our ears convert into the cognitive event that we call sound?

We may have just experienced one of those 'trees falling' moments at the Academy. While we were busy preparing for, and tending to, our prescheduled slate of annual activities such as the Excellence in Environmental Engineering and Science Conference, growing our list of student chapters, ramping up our early career professionals program, and managing and promoting our core specialty certification program for environmental engineering and environmental science, we were also engaged in the process of planting seeds. What I'm referring to is having a series of ideas that are being pursued because they have such excellent potential even though they are far from being current mainstream activities. We carefully nurture these concepts because they may become major elements of the Academy's future. But for now, for whatever reason, these are the items that we keep on the back burner.

A few years ago, one of these back burner items was the concept of the Academy doing a specialty certification for environmental scientists. There was interest, but there was no structured effort at pursuing that interest until someone (or a group of someones) stepped forward and declared that it was time to get this done. Better yet, the group followed up their declaration with action to determine and define what it would take to create an environmental science certification program that would be the equivalent of the existing Academy program of specialty certification in environmental engineering. It took a couple of years and the work of a dedicated group of volun-

teers to make it happen. But as you know, the Academy now has an environmental science program with certification in ten specialties. What started as a back burner activity morphed over time to where the idea became part of the core activities of the Academy. We now have over one hundred board certified environmental scientists as members of the Academy community.

However, there is one piece of the puzzle that has been missing on the environmental science side, a relationship with ABET. As you probably know, ABET used to be known as the accreditation board for engineering and technology, but now just goes by the acronym ABET. As its name implies, ABET is the organization that accredits college and university educational programs in specific areas of interest in engineering, technology, science, and beyond. Accreditation is a more technically rigorous term for basic quality control. To earn an ABET accreditation an institution of higher learning is required to meet certain benchmarks with respect to the content of a program, and with respect to the outcomes of the program as indicated by its graduates' ability to apply what they have learned in class to a career as a practicing engineer.

The Academy's connection to ABET is that we are the 'lead society' for the ABET program in environmental engineering and technology. What this means is that we work closely with ABET to establish the criteria for evaluating a university's environmental engineering program. We do this by reviewing the curriculum and



“By teaming up with organizations such as the Academy, ABET is tapping the knowledge accumulated by the ‘best of the best’ through their many years of experience in a given program area.

the various aspects of the instructional program to ensure that it minimally meets, and hopefully exceeds, benchmarks for what is an accreditation-worthy program.

As a lead society, we also have the responsibility for providing what are known as program evaluators. These are people who have an extensive track record in the programs being evaluated who are chosen by the Academy to carry out on-site activities that include facility inspections as well as interviews with administrators, faculty, and students. In this context, the Academy is the ultimate authority on what it takes to construct and deliver an academic experience that will lead to a college or university earning the ABET ‘seal of approval’, an accredited program in environmental engineering.

As you can imagine, the emphasis on the accreditation experience is all about ensuring that the program being evaluated keeps up with evolving technologies, evolving instructional methods, and the demands of potential employers who want to be sure that they are getting the best possible candidates when they are looking to add to their staff.

That’s why the lead society role is so important to the overall outcome of the ABET program and activities. By teaming up with organizations such as the Academy, ABET is tapping the knowledge accumulated by the ‘best of the best’ through their many years of experience in a given program area. The simplest way to explain the operating paradigm is to say that while ABET is in charge of providing the evaluative framework and processes, the Academy and other lead societies are in charge of providing the knowledge, garnered through experience, that goes into determining what constitutes an acceptable program.

So with all this is a rather lengthy preamble, and in recognition of our use of the tree falling in the forest analogy, the Academy leadership and staff are pleased to inform our membership that we have been selected to serve as the lead society for ABET’s efforts to establish an environmental science accreditation program. In truth, we have been talking about doing this for several years now, but the pieces of the puzzle did not quite fit together until quite recently. So the environmental science tree has indeed fallen, but it was heard by only a few people.

Part of the deliberate pace of progress revolved around the fact that the Academy was several steps ahead of ABET on the environmental science side of the world. In fact, the Academy launched its program to develop a specialty certification in environmental science about five years ago. As you may know, our first group of specialty certifications in environmental science were awarded in 2013. And as you can well imagine, the process for identifying and structuring the ten different specialties that candidates can apply for in the Academy’s environmental science certification program took a great deal of work and investment of time by the Academy and the volunteers

who assisted in the effort. It was a milestone achievement; one that put the Academy into a strong leadership position across a broader swath of the environmental sector.

The challenge for the Academy, ABET, and other potential partners in this effort will be addressing the need to define what comprises environmental science. Unlike engineering, the science side of the coin appears to be far less bounded. Engineers are all about building things and making sure that they work as intended. Environmental science is like any other science. It’s practitioners want to explore the area outside the boundaries in the never-ending search for clues about how to make things work better or how to bring a fundamental science breakthrough from the lab bench to a real world solution.

Part of this is reflected in the names of the environmental science programs that are currently being offered at some of the schools who already have an environmental engineering program. The University of Maryland has an environmental engineering program and also offers programs in ‘environmental science and policy’ and ‘environmental science and technology.’ The University of Illinois, another school with an environmental engineering program, also offers an environmental science degree in ‘environmental and natural resource sciences’. The environmental engineering program at the University of Nebraska offers a major in ‘environmental restoration sciences’. This interesting mix of programs and curricula is a telling indicator for the need to have an effort such as that being mounted by the Academy and ABET. If we don’t do this, then we may well find ourselves in a world where environmental science programs use the same terminology for very different components. It’s easy to see how that could happen using just the few examples cited above.

Failure to reach agreement on what comprises an acceptable environmental science program that can be accredited by ABET will create a host of problems. One of the obvious ones is the role that participation in the an accredited program has for employers who are looking for their next group of new hires. Imagine yourself looking to hire an environmental science graduate and having candidates from the three schools cited above. There really is no telling what basic skill set you are going to be hiring when you make a decision based upon just the names of the programs. This puts the onus on the employers to do more work to find out what environmental qualifications the candidates actually have. This just adds an unnecessary layer of complexity to staffing decisions.

Without an accredited program those on the other side of the hiring coin - the new graduates - have their own set of problems. Without the assurance of an accreditation, graduates of an environmental science program do not have the ability to tell a potential employer that the core curriculum of the program they were in met

“Without the assurance of an accreditation, graduates of an environmental science program do not have the ability to tell a potential employer that the core curriculum of the program they were in met all of the curricular requirements of the accrediting body.

all of the curricular requirements of the accrediting body. This is a very valuable shortcut to a positive solution for the graduate, and for the employer for that matter.


The Academy and its members have extensive experience in the field of accreditation. Teaming up with ABET on this effort is a great place for the Academy to be. It enables us to work with ABET and with other professional colleagues to define what we see as the fundamental requirements for what the educational community can call environmental science program. The field is wide open at this time and that is creating some negative impacts that accreditation goes a long way to solving.

We are just getting this effort geared up and have yet to accomplish anything directly related to the topic. Besides agreeing that environmental science accreditation is a topic that needs to be addressed. There are a lot of discussions that need to be held. There are myriad program considerations that need to be mapped out and considered. There are also more than a few existing college programs in environmental science that need to be identified and characterized.

At this point, there are clearly many more unknowns than knowns. However, we do have a good handle on what needs to happen, as well as a good handle on how to get that done. Best of all, we have the Academy in the lead on driving the process and driving the decision-making regarding the components that will be attached to the process. We are in the highly preferential position of being able to ensure that an accreditation-worthy environmental science program



reflects the needs of environmental practitioners in all aspects of the environmental profession going forward.

We very much look forward to working with the entire Academy community in developing the solutions that will become invaluable to the next generation of environmental professionals as the field continues to grow and evolve. Feel free to give us a call or send us a note if you have any questions. Or better yet, let us know if you would like to become a participant in our ABET-related activities in developing this evolving accreditation program. 



ABET is working to change the world by setting standards of excellence in education, ensuring tomorrow's innovators receive the proper education today.

We are now accrediting programs in Environmental Science. Visit www.ABET.org/EES to learn more about gaining the confidence of being ABET-accredited.





2016 ANNUAL MEETING

The 2016 Annual Meeting of the Board of Trustees was held at the Hampton Inn & Suites, Cazenovia, New York, October 19-21, 2016.

The festivities kicked off with the Welcome Dinner on Wednesday evening, October 19, which was held at the historic Lincklaen House.

The Technical Conference - **Program and Plant Performance Improvements with Emphasis on Energy Efficiency and Sustainability** was held on Thursday, October 20, followed by the President's Reception and Installation Banquet.

The Board of Trustees Meeting was held on October 21. Two guest members were included: David M. Gaddis, Trustee-at-Large-Elect and Wayne McFarland, luncheon speaker. Mr. McFarland's topic, **Engineering Ethics - Ethical Decisions**, spearheaded a lengthy discussion on the water crisis in Flint, Michigan.

Also attending were Burk Kalweit, AAEES Executive Director, Sammi Olmo, Manager Special Projects, Joyce Downen, Executive Assistant and Yolanda Moulden, Production Manager. Highlights of the meeting include:

Approved AAEECB Board

- ☉ Robert Williams, Chair
- ☉ Lamont Curtis, Vice Chair
- ☉ Jeanette Brown
- ☉ Christian Davies-Venn
- ☉ Hunter Nolen
- ☉ Wendy Wert
- ☉ Cecil Lue-Hing

Approved AAESCB Board

- ☉ James Mihelcic, Chair
- ☉ James Patterson, Vice Chair
- ☉ Michael Kavanaugh
- ☉ Robert Schoenberger
- ☉ James Clarke
- ☉ Brian Flynn
- ☉ Benson Pair

2017 Individual Award Recipients

Recipients of the 2017 individual awards, which will be presented at the upcoming AAEEES Awards Luncheon, are:

- ☉ Stanley E. Kappe Award - **Merlyn Hough**
- ☉ Edward J. Cleary Award - **Sudhir Murthy**
- ☉ Gordon Maskew Fair Award - **Stephen Hickox**
- ☉ Honorary Member Award - **George Hawkins**
- ☉ International Honorary Member Award - **Marcos vonSperling and Eran Friedler**





New Officers and Trustees

Congratulations to the 2017 Officers and Trustees who were installed during the Annual Meeting October 20 and take office January 1, 2017:

- ☉ **Robert C. Williams**, President
- ☉ **C. Hunter Nolen**, President-Elect
- ☉ **Kristin Morico**, Vice President
- ☉ **Dan Oerther**, Treasurer; and
- ☉ **Howard B. LaFever**, Past President.

Trustees serving their second three-year term are:

- ☉ **R. Benson Pair**, representing AIChE;
- ☉ **Wendy Wert**, Trustee-at-Large.

Trustees serving their first three-year term:

- ☉ **Jeffrey H. Greenfield**, Trustee-at-Large and
- ☉ **David M. Gaddis** serving a two-year term as Trustee-at-Large vacated by Kristin Morico.

AAEES WEST COAST EVENT

AAEES held its annual West Coast Panel Discussion on October 13, 2016. The topic of the discussion, which was held at Metropolitan Water District of Southern California, was **Are We Ready for Climate Change? Come Ask SoCal Experts**. The panel included:

- **Gordon Johnson, P.E., BCEE**, Chief Engineer
- **Dr. Jeremy Pal**, Professor of Civil Engineering and Environmental Science, Loyola Marymount University (LMU)
- **Sarah Bartlett**, MWD Resource Specialist, Water Resource Management Group

➤ **Lee Alexanderson, P.E.**, Civil Engineer, County of Los Angeles Department of Public Works
For organization and making this event such a success, AAEES would like to thank:

- **Wendy Wert, P.E., BCEE**, Environmental Engineer, Sanitation Districts of Los Angeles County
- **Sharon Yin, P.E., BCEE**, Engineering Planning/Senior Engineer, Orange County Sanitation District
- **Benita Lynn Horn, M.B.A.**, MWD External Affairs/Education Programs Unit



Academy News, continued on page 20

MEMBER NEWS

AWARDS AND RECOGNITION

2016 WEF Fellows Recipients

The WEF Fellows Recognition Program recognizes distinguished accomplishments and contributions of individuals who have made an impact in the global water environment in a variety of disciplines. The WEF Board of Trustees approved several individuals as the 2016 group of WEF Fellows, including the following AAEEES board certified individuals:

- **Dr. Charles Bott, P.E., BCEE**, Hampton Roads Sanitation District. Dr. Bott has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2007.
- **Phillip Feeney, P.E., BCEE**, Brown and Caldwell (Retired). Mr. Feeney is a Life member and has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1980.
- **C. Dale Jacobson, P.E., BCEE, D.WRE, F.ASCE**, DD Consulting, LLC. Dr. Jacobson is a Life member and has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1988.
- **Dr. Samuel Jeyanayagam, P.E., BCEE**, CH2M. Dr. Jeyanayagam has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1999.
- **Liliana Maldonado, P.E., BCEE**, DC Water & Sewer Authority. Ms. Maldonado has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2003.
- **Dr. James Mihelcic, BCEEM**, University of South Florida. Dr. Mihelcic has been a Board Certified Environmental Engineering Member in General Environmental Engineering since 2008.

- **Karen Pallansch, P.E., BCEE**, Alex Renew Enterprises. Ms. Pallansch has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2000.
- **Ralph “Rusty” Schroedel, Jr., P.E., BCEE**, AECOM. Mr. Schroedel has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1995.
- **Dr. Art Umble, P.E., BCEE**, MWH Global. Dr. Umble has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2002.
- **Dr. Thomas Wilson, P.E., BCEE**, Thomas E. Wilson Environmental Engineers LLC. Dr. Wilson is a Life member and has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1982.

Dr. Daniel B. Oerther, P.E., BCEE, was announced as an Honorary Fellow of the American Academy of Nursing. Dr. Oerther was recognized for his combined efforts with nurses, physicians, and other professions to focus on his interventions on water, sanitation, nutrition and food safety. His international efforts have brought clean drinking water, sanitation, and access to health care to more than 100,000 villages in Guatemala, India, Kenya, and Tanzania. Dr. Oerther has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2005.

C. Ronald (Ron) Lovan, P.E., BCEE, was elected as the 64th Chairman of The Ohio River Valley Water Sanitation Commission (ORSANCO) in July. Mr. Lovan has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2005.

IN MEMORIAM

Nicholas Julian Bartilucci (1931 - 2016)



Nicholas Julian Bartilucci of Laurel Hollow, NY died on July 17, 2016 at age 85 after a full, honorable and faith-filled life. Beloved husband of Joan (nee Ostrowski) for 62 years. Loving father of Lisa (Robert) Rooney, Mark (Becky Quinn) and Paul (Helene). Cherished grandfather of Bryan (Paula), Kaitlyn, Madelyne, Kristyn Rooney and Philip, Elizabeth, Olivia, Lilly and Isabella Bartilucci. Dearest great-grandfather of Emily Rooney. Loving brother of Eleanor Free and the late Catherine Fioraliso. He valued his family above all else.

Nicholas graduated from Manhattan College and New York University with degrees in Civil Engineering. He served in the US Army in the Panama Canal Zone and continued his association with the

military through the American Legion and the Korean War Veterans Association.

A devout Catholic, Nick was a parishioner of St. Edward the Confessor R.C. Church, Syosset for 52 years. He served as Eucharistic Minister, Usher and consultant to the parish on numerous projects.

He was a member of the Knights of Columbus and Legatus. Nicholas was proud of his Italian heritage and was a member of the Sons of Italy and was a Knight in the Savoy Orders. He took great pride in wine making and the caring for and cultivating of his great-grandfather's fig tree, passing down the traditions to his sons and grandsons. He enjoyed contributing to the community and was on the board of the Cold Spring Harbor Laboratory and the Cold Spring Harbor Whaling Museum.

Nicholas was one of the founding partners of Dvirka and Bartilucci Consulting Engineers, Woodbury, NY. His professional experi-

ence spanned over 60 years in civil and environmental engineering. Nick was a Commissioner of the Jericho Water District for over 45 years. He served as chairman or director of numerous professional organizations and societies and was a consultant to the Environmental Engineering Department at Manhattan College. His professional awards were numerous, including "Engineer of the Year" in 1986 from the Nassau County Chapter of the NY State Society of Professional Engineers, the 2001 Life Time Achievement Award from the Long Island Chapter of the NY Water Environment Association, and the 2003 Outstanding Professional Engineer in Management Award by the NY State Society of Professional Engineers.

Nicholas Bartilucci was an AAEEES Life Member and had been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1979.

CAPT Frank Arundell Bell, Jr. (1926 - 2016)



CAPT Frank bid farewell to this world on Monday, May 23, 2016, at the age of 89. He was born in Dallas, TX. He had two sisters, Betty Bell Tatman and Barbara Bell. His father, Frank A. Bell, Sr., was born and raised in Liverpool, England and his mother, Alice Adams Bell, was born in Cleburne, TX. He is survived by his wife, Jennifer Lowery-Bell, J.D., his sons Frank Bell, Russell Bell, Randell Bell and his nephew George Pete Tatman in Dallas, TX. His stepchildren are LCDR Reneé Payne Baggott, Ph.D., Warren Payne and William Payne, and his two grandchildren, Olivia Rose and David Patrick Baggott.

Frank completed high school at North Dallas High. Frank was in the ROTC at Tulane University where he received his BS in Civil Engineering and then was commissioned in the U. S. Navy during WWII. He then joined the United States Public Health Service and later received his Master's Degree in Chemistry from the University of Cincinnati. In his early years, he ran for the Bethesda Maryland School Board.

Frank received many honors and certificates as a professional engineer at the Environmental Protection Agency where he later retired. He spent his last years working in the senior program at the National Caucus & Center on Black Aging, Inc. as a Health Scientist at the EPA Office one day a week in Washington, DC until May 19, 2016.

Frank lived a full and glorious life.

Mr. Bell had been an AAEEES Life Member and had been a Board Certified Environmental Engineer in Air Pollution Control since 1964.

Robert Leighton "Bob" Nichols (1926-2015)



Robert "Bob" Leighton Nichols, 88, died Friday, May 8, 2015.

Bob was born June 24, 1926, in Amarillo, Texas to Marvin C. and Ethel N. Nichols. He grew up in Fort Worth and loved to visit his grandmother, Cora Curtis Nichols, in Denton with his older brother, Jim. When he was 16, Bob enrolled at Texas A&M University, where he earned both bachelor's and master's degrees in civil engineering.

He met the kind, beautiful and smart Frances Hardison in Amarillo, and they courted for several years while she pursued her degree

in music at Texas Wesleyan University. They married June 8, 1948, at her parents' home in Eunice, N.M., embarking on a lifelong partnership filled with love.

Over the next seven years, Bob and Frances had four children, Bobby Jr., Eileen, Bill and Mike, raising them first in Fort Worth and then on a farm near Chisholm, Texas. Losing Bobby in a motorcycle accident the week before he was to enter college was the greatest tragedy Bob and Frances were to face together. From this tragedy the Bobby Nichols Scholarship Foundation began, this foundation benefits graduates of Terrell High. He was an active member of the Chisholm United Methodist Church.

Bob was a successful engineer, working at Freese and Nichols, Inc., in various roles, including President, from 1948 until his death. He was born into the profession. "We have pictures of us boys (Bob and his brother, Jim) climbing up on the riprap" at the dams his father engineered, Bob once said. "That was the beginning of my interest in engineering. I grew up in it. I didn't know there was any other way to make a living."

At Freese and Nichols, he was responsible for the coordination of many large-scale, multi-discipline and multi-consultant projects, including water and wastewater treatment plants, railroads and master drainage plans. He recognized early in his career the importance of engineering for a healthy environment he was an environmental engineer before that specialty was common. He was active in many professional organizations, including the National Society of Professional Engineers (President, 1978-79; NSPE Award, 1989) and Texas Society of Professional Engineers (President, 1965-66). Bob served for many years on the Texas A&M Civil Engineering Advisory Board. In recognition of his commitment to professional excellence; Freese and Nichols established the Robert L. Nichols Professional Service Award. This award is given annually to the employee who best exemplifies the dedication to professional service and development Bob demonstrated throughout his career.

Bob was an active community member both in Texas and in Webb City, Missouri, where he moved in 1991. He was a lifelong supporter of the Boy Scouts of America (BSA) and served the BSA Longhorn Council of North Texas as President (1989-1993) and chaired its Long Range Planning Committee. In Missouri, he served the BSA Ozark Trails Council as President (1998-2000) and led its Learning for Life Council. In 2011, the Ozark Trails Council awarded Bob the Trail of Honor-Path of Lifetime Service Award for his 30-plus years of dedication to scouting and the community.

In Webb City, he helped reinvigorate the Chamber of Commerce as volunteer Executive Director. Bob served on the Webb City Council and headed fundraising efforts for the Webb City Public Library expansion. Bob helped organize a successful drive to secure adequate funding for public schools in the area. He received the 2004 Friend of Education Award from the Southwest Region of the Missouri State Teachers Association. He was a driving force behind the Tri-State Water Resource Coalition and the Environmental Task Force of Jasper and Newton Counties. He was a member of the Fort Worth Rotary Club, Webb City-Carl Junction Rotary Club, Webb City Area Chamber of Commerce, Joplin Area Chamber of Commerce, Central United Methodist Church of Webb City, as well as other local, state and national organizations. He was honored by the Webb City R-7 Foundation as Distinguished Citizen of the Year in 2007.

Doing the right thing was the Bob Nichols way. If he saw a problem, he found a solution, if a thing needed doing; he made sure it was done. He was a national leader in ethics in engineering and served as chair of the National Institute for Engineering Ethics and of the NSPE Board of Ethical Review. When the Missouri-American Water Co. released a study showing that Southwest Missouri water resources might be threatened in the future, he led a call for action. When public schools needed support, he helped organize a broad based group to secure that support. Bob was a planner and organizer and anyone who agreed to take on a part of one of his projects could expect follow-up calls and emails until that task was accomplished. He was generous, giving his time and money to many good causes, often over and above that which was requested.

Most important in Bob's life was family. For the past five years, he was Frances' devoted caregiver as Alzheimer's robbed her of her memory and her ability to care for herself. He was the proud grandfather to six grandchildren, Alex Nichols (Elizabeth), Austin, Texas, Cora Nichols (Emmanuelle Svartz), Perth, Australia, Bobby Nichols, Fort Worth, Texas, Emily Richardson (Christopher Smith), Indianapolis, Ind., Matthew Nichols, Webb City, Mo., Erica Wilson (Jeremy), Arlington, Texas; and two great-grandchildren, Madeleine and Josephine Svartz-Nichols. He had countless other kinfolk, including Frances' family, the Hardisons. He often said that marrying into the Hardison family was one of the best things he ever did.

Bob was an avid traveler, often visited family and friends or vacationed alongside them. He went to Antarctica with his granddaughter Cora when he was 80 and she was 30. They were both visiting their seventh continent. Scotland was a favorite destination. He went dozens of times, usually timing the visit so he could attend the Tattoo in Edinburgh. He was looking forward to another trip to Scotland this summer, going with his granddaughter Emily and her husband. Always the planner, he often would send emails while waiting for his plane to leave, lining up the next trip.

When call forwarding became common, his family and friends never knew where their call might find him - in New Mexico visiting family, on the east coast visiting friends, in Springfield on Boy Scout business, in Texas on Freese and Nichols business or in China seeing the Three Gorges Dam.

Survivors: Wife, Frances; his brother, Jim Nichols and wife, Billie; children, Eileen and Phil of Webb City, Mo., Bill and T.J. of Arlington, Texas, and Mike and Ana of Austin, Texas; his six grandchildren; his two great-grandchildren; and many other relatives and friends.

Bob Nichols was an AAEEES Life Member and had been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1977.

Robert L. White, P.E., BCEE (1924 - 2016)

Distinguished engineer, WWII veteran, and beloved husband, father, grandfather, and great grandfather Robert "Bob" White, 92, passed away on October 24th surrounded by his family.

Robert was born to Benjamin Horton White and Dorothea D. (née Wenrich) White in Los Angeles in 1924. In 1943, after enrolling at UCLA, he joined the U.S. Navy, in which he served as an Aviation Machinist Mate 3rd Class and later an Ensign aboard the USS Presidio in the Pacific. After three years and four months on active duty he was released to inactive duty in the USNR, which later promoted him to Lt. (jg). He went on to earn his BS in Civil Engineering from

UC Berkeley in 1948, the year in which he married Lois Adele Sharp. Robert then worked for several public engineering organizations, including the East Bay Municipal Utility District, the California State Division of Highways, the City of Los Angeles and the City of Burbank. In 1958 he received his MS in Civil Engineering from USC, where he was a Senior Lecturer from that year until 1966.

From 1962 to 1966 he was the City Engineer of the City of Burbank. In 1966 he joined Engineering-Science, Inc. (ES), ranked among the top 50 engineering companies in the US, where he held positions including Executive VP, Chairman of the Board, President, and CEO. After the sale of ES to the Parsons Corporation, one of the world's largest engineering construction firms, Robert was appointed Senior Vice President and General Manager of the Systems Division, as well as to the Board of Directors of the Ralph M. Parsons Company. Robert went to found, co-found and lead R.L. White & Associates, Inc.; US-top-100-ranked Planet Pacific, Inc.; and Conservtech Holdings, Inc.

As well as being licensed to practice engineering in 39 states and D.C., Robert was a member of the American Academy of Environmental Engineering, the American Society of Civil Engineers, the Water Environment Federation and the American Water Works Association. He was the recipient of the Water Pollution Control Association's Arthur Sidney Bedell Award and USC's Distinguished Civil Engineering Alumnus Award, as well as the author of numerous publications and technical papers.

During his 51 years of professional engineering practice he traveled extensively, leading projects in many Asian, Middle Eastern, and Latin American countries. After retirement he managed the family agricultural business, wrote his memoirs, traveled with Lois, and spent countless hours corresponding with, mentoring, and accompanying friends and family. Robert is survived by his wife, Lois Adele; children Benton, Craig, Douglas, Valerie, Janine and Susan; 12 grandchildren, and one great granddaughter.

Donations may be made to the Robert L. White undergraduate scholarship for civil engineering at UC Berkeley.

Mr. White was an AAEEES Life Member and had been a Board Certified Environmental Engineer in Sanitary Engineering since 1972. ☒

SHINING THE SPOTLIGHT ON YOU

The Academy has special features on its website and in electronic and print publications in recognition of you, **the Academy's honored professionals**. Send your submissions to YMoulden@aaees.org:

Volunteer of the Month

Part of the Academy's success lies with the selfless work of its members. Do you know of a member that always goes above and beyond? Then send a 350-word nomination for **Volunteer of the Month**.

Side Tracks

Interested in knowing about the extracurricular activities of your fellow Academy members? Or do you have fun (or possibly funny) stories you'd like to share? *Side Tracks* is intended to provide a vehicle for learning about the outside interests of your colleagues.

The 2017 Kappe Lecturer



Danny D. Reible, Ph.D., P.E., BCEE

Donovan Maddox Distinguished Engineering Chair
Texas Tech University
Lubbock, Texas

<http://www.depts.ttu.edu/ceweb/groups/reiblesgroup/>

Dr. Danny D. Reible is the Donovan Maddox Distinguished Engineering Chair at Texas Tech University. He was previously the Bettie Margaret Smith Chair of Environmental Health Engineering in the Department of Civil, Architectural and Environmental Engineering and the Director of the Center for Research in Water Resources at the University of Texas in Austin.

Dr. Reible holds a Ph.D. in Chemical Engineering from the California Institute of Technology, and is a Board Certified Environmental Engineer, a Professional Engineer (Louisiana), and was elected to the National Academy of Engineering in 2005 for the “development of widely used approaches for the management of contaminated sediments”.

His research is focused on the fate, transport, and management of contaminants in the environment and the sustainable management of water resources. The research has been applied to the management of a number of large contaminated sites including sites such as Portland Harbor, OR, Hudson River, NY, and the Fox River, WI.

Dr. Reible has authored or edited six books and more than 150 journal articles and book chapters. Dr. Danny D. Reible is the Donovan Maddox Distinguished Engineering Chair at Texas Tech University. He was previously the Bettie Margaret Smith Chair of Environmental Health Engineering in the Department of Civil, Architectural and Environmental Engineering and the Director of the Center for Research in Water Resources at the University of Texas in Austin.

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The Kappe Lecture Series was inaugurated by the Academy in 1989 to share the knowledge of today’s practitioners with tomorrow’s environmental engineers and scientists. It is an annually recurring series of lectures presented on college campuses during the Fall academic term. This focus enables it to complement the lecture series sponsored by the Association of Environmental Engineering & Science Professors which brings renowned research engineers to universities in the Spring term.


From among those universities expressing interest, the Awards Committee typically selects up to ten host universities. If you are interested in hosting the Kappe Lecturer, go to <http://www.aees.org/kappelecturer.php>

This program was inspired by a grant from the estate of Stanley E. Kappe, P.E., BCEE, who served as the Academy’s Executive Director from 1971 to 1981. This grant funded an endowment which is used, in conjunction with fees from participating universities, to reimburse the lecturer’s travel costs and pay incidental program expenses.

Stanley E. Kappe, P.E., BCEE, a successful environmental engineer, believed he owed a debt to the profession that rewarded him so well. During his life, he gave of himself to his university and to his profession through countless hours of volunteer activity.

He graduated from Pennsylvania State University in 1930 with a bachelor’s degree in sanitary engineering. He served with the Pennsylvania State Health Department and the U.S. Army Corps of Engineers before joining the Chicago Pump Company as its Eastern Regional Manager in 1935. In 1945, he founded Kappe Associates, Inc., a water supply and wastewater equipment company headquartered in Rockville, Maryland, and continued as its Chief Executive Officer until his death in 1986.

His peers recognized his contributions to the profession by numerous awards, including the AWWA Fuller Award, the WPCF Arthur Sidney Bedell Award, the WPCAP Ted Moses and Ted Haseltine Awards, and the AAEE Gordon Maskew Fair Award. In 1985, Pennsylvania State University named him Outstanding Engineer Alumnus.

Stanley E. Kappe was an activist member and leader in several national and Chesapeake region professional societies. 

Abstracts of Lectures Offered

Sustaining Water Availability in Rural Communities: Expanding Use of Poor Quality Waters

Water is critical, not only to meet personal water needs, but to support a healthy economy and to meet the challenges of food for an ever growing world population. Increased climate variability and conflicting demands for water requires us to fundamentally rethink how we should manage our limited groundwater and surface water resources so that energy production and economic vitality does not come at the cost of potable water availability, food security and environmental quality.

Much of the recent research has focused on securing water for large urban centers. While the challenges facing large urban centers are significant, these communities typically have much greater resources to address their problems than small communities and rural areas where water security challenges are equally serious. Particularly challenging is water for agriculture and agricultural communities which receive important but limited economic benefits from water and therefore are hard pressed to support expensive solutions. Further stressing rural and agricultural water sources in some areas is intensive water use for energy development such as oil and gas production. Water systems in rural and small urban communities are also less resilient to both human and natural factors.


These issues will be explored using the example of the southern high plains emphasizing cost-effective solutions for the water challenges facing rural and agricultural areas and to support water-intensive industry in such areas. The primary focus will be on taking advantage of poor quality water including saline and brackish waters to supplement conventional water resources. Energy production, and the extraction of petroleum and other minerals, use enormous amounts of water but much of this demand could be met with poor

quality waters including brackish groundwater and produced water. Brackish waters could also be employed for agriculture and agricultural communities to extend conventional water resources. Cost-effective approaches for use of these waters will be explored and challenges to their implementation identified. More effective exploitation of these poor quality waters can protect potable and near-potable waters for human consumption and food production and help sustain rural and agricultural communities.

Managing Water Quality through Innovations in Sediment Assessment and Remediation

As we have improved our ability to treat and control wastewater effluents, contaminants that have accumulated in the sediments as a legacy of past practices are now posing risks to the overlying water. We have historically managed sediments strictly on the basis of the total inventory of contaminants in the sediments but the environmental risks due to sediments are instead largely associated with the mobility and availability of those contaminants. Sediment contaminants, including hydrophobic organics such as PAHs and PCBs and metals such as mercury, are influenced by a variety of physical, chemical and biological processes that limit their availability and control their mobility and fate. Assessment and remedial approaches must directly address the availability and mobility of contaminants to be effective and efficient. These processes and their implications for the effective management of sediments will be summarized.

Recent advances in in-situ passive sampling has helped measure directly the available and mobile forms of both organic and inorganic contaminants and better assess the potential risks of the sediments. Passive sampling of hydrophobic organic contaminants is generally accomplished by insertion of sorbing phases that equilibrate over time with the typically low in-situ available concentration in the interstitial waters. A rate-based sampler is typically employed for inorganic contaminants. The use, interpretation and limitations of these devices will be evaluated and compared to other approaches for monitoring exposure and risk to contaminated sediments.

In-situ remedial approaches that directly address the available and mobile forms provide a cost-effective approach to managing sediment contaminants. These approaches include sediment capping and treatments using sorbing amendments. These are increasingly being used in the sediment environment to eliminate the high cost and negative consequences of traditional removal approaches. Passive sampling also provides opportunities for monitoring the performance of these approaches. Recent experiences in the design, implementation and performance of these remedial methods will be discussed. The potential benefits to selected large sediment remedial programs currently in progress will be emphasized. 

Education

- B.S., Chemical Engineering, Lamar University, 1977
- M.S., Chemical Engineering, Caltech, 1979
- Ph.D., Chemical Engineering, Caltech, 1982

Professional Associations

- American Academy of Environmental Engineers and Scientists (AAEES)
- American Association of Environmental Engineering & Science Professors (AEESP)
- American Institute of Chemical Engineers (AIChE)
- American Society of Civil Engineers (ASCE)
- National Academy of Engineering (NAE)

PANEL DISCUSSION: THE ENVIRONMENTAL IMPACT OF OUR NEXT PRESIDENT

The President-elect, Donald J. Trump, will have a large impact on Environmental regulations, policy, laws, litigation and enforcement over the next four years.

The local Austin chapter of the Air and Waste Management Association (AWMA) in conjunction with AAEEES has assembled a knowledgeable and distinguished panel of environmental policy experts to discuss the probable direction that our new President will take. The panel:

- **David Eaton**, Professor-Natural Resources Policy Studies, LBJ School, University of Texas, Austin
- **Asher Price**, Environmental Reporter, Austin-American Statesman

➤ **Steve Minick**, Vice President-Government Affairs, Texas Association of Business

➤ **Brian Flynn**, Moderator, Board Certified Environmental Engineer

This one hour panel discussion was held at the University of Texas at Austin on November 17, 2016. It consists of statements by each of the three panelists, followed by questions from the audience. The panelists answers are very interesting and illuminating.


This video is a must-see item for every environmental professional who is curious about the direction of environmental policy in the next four years in the United States.

The video has been posted to aaees.org and to our YouTube channel, <https://www.youtube.com/AAEESdotORG>.

2017 ENVIRONMENTAL ENGINEERING AND SCIENCE RESOURCE GUIDEBOOK - SIGN UP FOR YOUR LISTING

The Academy invites you to sign up for a listing in the 2017 *Environmental Engineering and Science Resource Guidebook*. We are releasing the Guidebook in both electronic and print format to make this year's edition easier to use and easier to distribute to individuals and organizations looking to connect with environmental specialists. We are expanding the content that each listing receives – enabling web links in the e-version and providing more room to post information on your specialties in both versions. We expect to print and distribute

the new publication more widely than we have in the past, with a special focus on outreach at the trade events and conferences we attend during the year. We are also planning an expanded role for the Guidebook in making federal, state, and local agencies aware of the capabilities of our members in helping deal with current environmental engineering needs.

Ask your organization to reserve its space by February 15, 2017. It's great exposure for a low cost. For details, email JSOlmo@aaees.org. 



ENVIRONMENTAL ENGINEERING AND SCIENCE FOUNDATION LAUNCHES PLANNED GIVING PROGRAM

As part of its effort to continue to grow its ability to promote environmental engineering and science, the Environmental Engineering and Science Foundation has launched a planned giving program.

Making the announcement was the Foundation's Chairman, Dr. Cecil Lue Hing, P.E., BCEE. "We have gone this route in order to do a better job of meeting our organizational mandate, and to make it easy for our donors to make a gift of any size to the Foundation," stated Lue Hing.

"Our mission is to promote advancement of environmental practice, including education, in the engineering disciplines as well as environmental science."

"We know there are many people who are prepared to provide support to our mission as a way of giving back to the profession that has provided them the opportunity to do interesting, meaningful work, as well as the opportunity to do well financially," Lue Hing observed. "But we have not done a very good job of making giving easy for them. The planned giving program is our way of remedying that situation."

"We invite anyone with an interest in environmental engineering and science to take a look at our planned giving website at: www.eesfoundation.org/plannedgiving/. We have put a lot of work into building a program that accommodates different styles of giving and gifts of varying sizes," continued Lue Hing. "We can now support people making a series of small monthly contributions. Similarly, we can also support people who are looking to include donations to the Foundation as part of their estate planning and the larger size of bequests such giving typically involves," stated Lue Hing.

"However, the most important element of our planned giving program is that it should do a much better job of generating donations that we will turn into expanding support for the advancement of environmental practice, including environmental engineering and science education programs.

"The environmental education field is competing with a host of other academic disciplines to attract the best and brightest; the students who will be the next generation of leaders in the field they choose. Our job is to make sure they consider an environmental engineering or science career. That is why I am very enthusiastic about the prospects for the planned giving program and what we expect it will do," concluded Lue Hing.

Find out more at <http://www.eesfoundation.org/plannedgiving/>. Please forward inquiries to: info@eesfoundation.org. Or call 410.266.3390.

2016 Summary MEMBER ACTIVITY REPORT

Establishing More Student Chapters

Growing the Patrons Program

Holding the Sustainability Summit

AAEES – Celebrating 60 Years of Service to the Community of Environmental Professionals

2015 marked the 60th anniversary of the founding of the organization that evolved to become the Academy. To celebrate, we held a special event emphasizing the Academy's story and recalling where Academy members have played an integral role in both recognizing and developing solutions for significant environmental issues. There was a congratulatory spirit

about the event, however, a sobering note was also sounded. While there is a great history built by the Academy and its members, we cannot lose sight of the fact that the challenges facing environmental professionals now are as daunting as any that were faced in the past 60 years.



A Note from AAEES 2017 President Robert C. Williams, P.E., BCEE



As your colleague in the American Academy of Environmental Engineers and Scientists, I am honored to have been chosen to be President for 2017. This is my 25th year in the Academy and there have been many changes since 1992. I'm certain we are in for many new challenges, and even more changes, as result of the 2016 Elections; although as of this writing those are all unknowns. I did appreciate the heightened focus the elections brought to our Nation's environmental infrastructure needs. One would hope that such recognition of the problem is the first step in growing our ability to develop and fund solutions.

Whatever the future may hold, we know that each of you will continue to play a role in advancing the practice of environmental engineering and science. We will continue to work on growing the Academy's visibility and strengthening our outreach so we can better serve as your resource. You can be sure we will continue to emphasize that Board certification is a mark of distinction that stakeholders can trust.

Board Certified professionals demonstrate the quality of an organization's workforce (e.g., "We hire BCEEs and BCESs, we hire the best!"). And, certification reduces the concern of clients and the public of whom to hire, and can serve as a positive differentiator in evaluating project teams. You already realize these values of being Board Certified, but we want others to be aware as well. Toward that end, we encourage you to include the BCEE, BCEEM, or BCES designation after your name in your email signatures and on business cards and other correspondence. You worked hard to earn these designations, don't be reluctant to use them.

Our goal is for engineering consultants and industry who strive to be the best to help us promote the value of certification to their employees. We hope that clients who demand the best in environmental engineering and science services, will recognize and require those who work on their projects to be Board Certified. And, we rely on all of you to encourage others you know to become Board Certified - to attain that distinction of which you are proud!

We remind you to check out the AAEES Web site, it is one of your resources! There you can find updates on AAEES activities and emerging environmental issues. You can also create your own private Online Profile where you may renew your certification, update your information, purchase Academy products and services, search for other members demographically in the Individual Directory, and more. To log in, visit www.aees.org.

I'm looking forward to a great year for the Academy and for all of you.

Best wishes,

A handwritten signature in black ink, appearing to read "R. Williams". The signature is fluid and cursive, with a long horizontal line extending to the right.

Committee and Staff Accomplishments

Academy volunteerism is being maintained at impressively high levels. This means that, put quite simply, the Academy is YOUR organization. We rely on the over 300 members who are serving as volunteers on over 25 committees and work groups to craft the programs and activities that provide maximum value to you. The Academy's officers and members serving on committees, with the support of Academy staff, work

diligently to assure that we are meeting our members' needs. If you are interested in participating, step up and give us a call and let us know which area or areas you would like to work in. **You are needed, and there is a place for you.** Beyond committee work, you can also be an ambassador for the Academy every time you give a presentation – just mention AAEES and what it means to you.

Rolling out the Patrons Program

As noted above, the American Academy of Environmental Engineers and Scientists (AAEES – aaees.org) has been in existence for 60 years, credentialing professionals in environmental engineering and science, educating the public about the value of environmental systems, working with the ABET (the Accreditation Board for Engineering and Technology) as the Lead Society in the accreditation of about 80 college and university Environmental Engineering programs, and providing recognition for noteworthy projects and programs in the annual Excellence in Environmental Engineering and Science competition.

To sustain the Academy's programs and enhance their effectiveness, the Academy created the **Patrons Program** in late 2015 as a new model for fiscal support. Participation is offered in three categories: Corporate/Consulting firms, Public Agency/Government organizations, and Academic institutions.

The **Patrons Program** umbrella is far-reaching. Its intent is to have our sponsors effectively co-brand with the Academy for everything that it does in outreach to members, other environmental organizations and practitioners, and the general public.

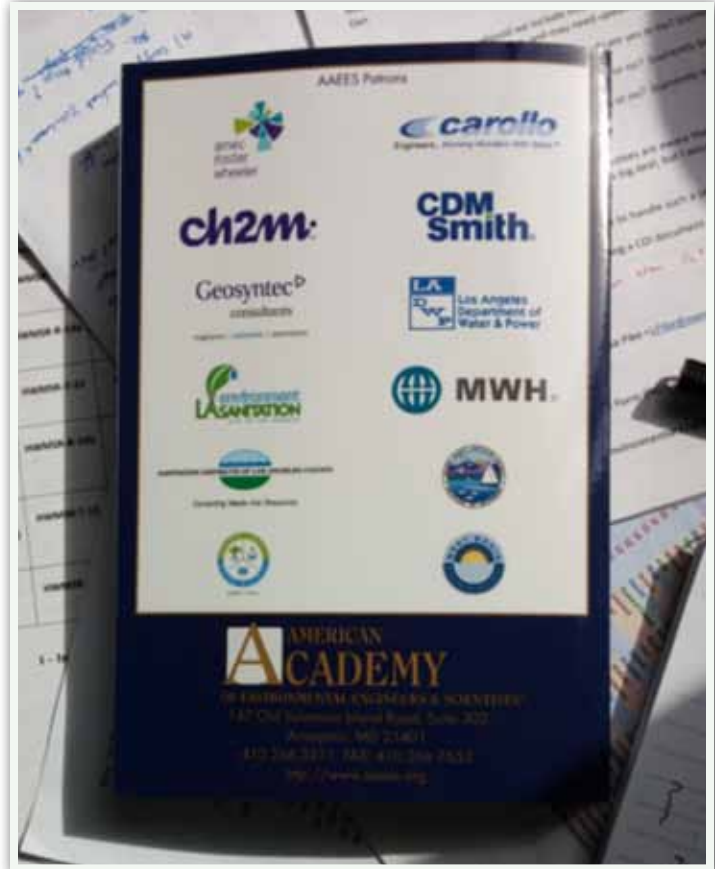
The list below is a summary of the major **Patrons Program** elements that participants receive.

- Featured recognition of **Patrons** on the AAEES website with a direct link to the **Patron's** website.
- Oral and visual recognition (signage/logo) at all AAEES events.
- Prominent Signage/Logo recognition in *Who's Who in Environmental Engineering and Science*.
- Prominent Signage/Logo recognition in the *Environmental Engineering and Science Resource Guidebook*.
- A listing in the *Environmental Engineering and Science Resource Guidebook*, featuring the **Patron** organization's Board Certified staff and its overall capabilities, at no-charge.

Other Academy Accomplishments in 2015-2016

ABET Evaluations

Thanks to the countless hours spent by Academy ABET evaluators, there are now 80 university programs accredited in Environmental Engineering and 5 accredited in environmental engineering technology. The Academy is also working with ABET to lay the groundwork for the creation of new accreditations for environmental science programs. This activity is being created as a first step in ensuring that there is



- Two complimentary tickets to the annual Excellence in Environmental Engineering and Science Awards Conference, and Luncheon (E3S) in Washington, DC in April.
- Two complimentary entries for the E3S competition.
- Waiver of certification application and examination fees for a **Patron's** employees.
- Prominent Signage/Logo recognition in the *Environmental Engineer and Scientist* quarterly magazine.

The **Patrons Program** is much more effective in providing consistent recognition for our **Patrons**. Wherever the Academy goes, and wherever Academy materials appear, those of its **Patrons** will also appear.

a solid and consistent foundation underpinning the curricula and academic rigor of environmental science. We look forward to working with our colleagues at ABET and in the ABET community to meet this challenge.



A new role for the Academy at ABET - Academy Selected as the Lead Society for ABET Environmental Science Program

Reaching the culmination of efforts that go back for several years, the Academy was approved by the ABET Applied Science Area Delegation (the part of the ABET Board of Delegates that oversees work of the Applied Science Accreditation Commission) as the lead professional society for the accreditation of environmental science programs. The ABET staff were confident in their finding that, based on the Academy's long track record of performance in support of ABET's environmental engineering program, AAEEES is capable of the task. A key factor in making this determination was that the Academy has already spent considerable effort in creating its own certification program for environmental scientists. With this foundation to

build on, the ABET Applied Science Area Delegation determined that the Academy is the logical and appropriate society to lead accreditation of environmental science programs in the US and in such programs around the world.

This is a significant development for the AAEEES as it places the Academy in a position of determining the structure and content of environmental engineering and environmental science programs. Or put another way, it means that the Academy will be positioned to reflect the needs of its membership and Patrons in determining the knowledge that will be required to earn a college degree in environmental engineering or environmental science.

2016 Excellence in Environmental Engineering and Science Luncheon and Conference: Presenting the Best of the Best

The annual E3S event was focused on developing solutions that do more than just overcome technical challenges. The annual conference and associated luncheon showcased the award winning projects, and also highlighted the increased role that multi-disciplinary approaches play in designing and implementing meaningful, game-changing projects. What is becoming apparent is that our profession can no longer get by on just technical solutions. Instead, the work we do is increasingly regarded in the context of societal impacts, both positive and negative. Gone are the days in which project boundaries and objectives are driven by a small project team of engineers and other direct stakeholders. The state of the art now includes an evaluation that is multi-faceted and frequently inter-generational. That adds to the challenge, yet also adds to the rewarding feeling when it all comes together at the project's completion.

This theme was reinforced by our keynote speaker, Dr. Domenico Grasso, Provost of the University of Delaware who is also an Academy member, having earned his BCEE in 2004. His presentation, entitled *The Future's Not What It Used to Be*, reinforced the notion that we cannot expect to solve future problems effectively and efficiently by using the tools and methods that were first deployed during the time period when the EPA was being formed. Environmental practitioners need



to be thinking in new ways and borrowing liberally from other disciplines to find ways to remove the traditional boundaries between research and implementation. His presentation can be downloaded at the Academy's Web site by following this link: www.aaees.org/.

Award winners presented their projects in a technical conference setting in the morning before the awards luncheon and in the afternoon following the luncheon address. Nearly 150 people attended the event at the National Press Club in Washington D.C. This is a truly unique forum that spans the spectrum from large to small projects, from large to small organizations, and from all environmental disciplines. We suggest that you make your plans now to attend next year!!

Adding a Fall Event to Complement the E3S in April - Creating and Hosting the Sustainability Summit

Attaining a Sustainable Wet Infrastructure for Southern California

The Academy assembled the leadership of the largest public water agencies in the Southern California area for a one-day Summit. The session was designed to provide perspective and insight on the issues being faced in meeting current and

expected future demands on the existing and planned water infrastructure. This one-of-a-kind event enabled attendees to learn about the strategies that these agencies are employing in addressing the limitations that the current 500 year drought is



imposing on Southern California and its ability to meet water demands. More importantly, the speakers also focused on the options available for defining a ‘new normal’, and what that means for planning, designing, and building a water infrastructure that will accommodate their evolving reality.

There were close to 150 attendees and speakers at the summit. It was a valuable lesson in the Academy’s ability to stage a unique event that built on the foundation of knowledge, and the industry leadership, that its Board Certified members provide. The entire set of speaker presentations is available for downloading at the Academy’s web site. Follow this link: www.aees.org/.

Following the success of the Sustainability Summit in California, the Academy staged a similar event at an East Coast location this fall. The title of the Technical Conference was, “*Program and Plant Performance Improvements with an Emphasis on Energy Efficiency and Sustainability.*” The AAEES sponsored event was held in Cazenovia, NY the day before our Board of Trustees meeting. We had a total of 84 attendees, including college students and their professors from

nearby Clarkson University, Cornell University, SUNY-ESF, Wilkes University and Colgate University. The rest of the audience consisted of local government staff, people from local authorities, state agencies personnel, etc., and a contingent of people from their consulting partners and colleagues.

Feedback was very positive, so much so that planning is under way for another Technical Conference to be held in Cazenovia in October next year. The lessons learned from this activity serve as a guidepost for others to consider in staging a similar event in their geography. The formula for success is:

- select speakers from local government, authorities, state agencies, etc. and other stakeholders in the topic being addressed
- obtain prior approval from the relevant state licensing authority for attendees to earn one PDH for each 50-minute presentation – suggest making 5 or 6 PDHs available
- invite local college students (hopefully from local AAEES student chapters) and professors to attend at a low cost or no cost (actively recruit sponsorships for students.)

Student Chapters

There are now 22 AAEES chapters operating in the US and abroad, including a Chapter in Saudi Arabia. There are also over 800 student members participating in the program. Our focus for the year was on determining the program elements that would provide the most value for the student chapters and for the Academy. In addition to meeting the students’ academic needs, we also want to give Academy members the opportunity to interact with our students at the local level. Revising the program in this way is expected to yield substantial benefits in professional development for the students, as well as building networking and mentoring opportunities for Academy members.



Johns Hopkins University AAEES Student Chapter

Early Career/Young Professionals Program

The Academy is in the initial stages of establishing a young professionals program. The intent of the program is to enable early career professionals to maintain a connection to the Academy during the time period between when they first graduate from college and when they are eligible to apply for certification by the Academy. The program will feature components that target the areas that we have been told are the most important to our target audience.

The first of these is simply reinforcing career selection knowledge of the environmental engineering and science field through participation in Academy activities such as workshops and webinars. The second is to introduce a very strong element

of networking and relationship building. We plan to establish mentoring relationships between our early career professionals and established Academy members. We also plan to have the recent graduates serve as mentors to our student chapters. We see that as one of the most important pieces of information that college students are continually seeking – what is it like to work in their chosen field and where are the best job opportunities? The third element of our young professionals program is a focus on content. We are working on ways to establish a structure of webinars and other similar programs that will serve to keep our audience aware of important developments in the field.

AAEES RFP Language Initiative

The Academy is continuing its work to have requesting public agencies structure RFPs to encourage proposers to list board-certified environmental engineers and scientists on their project teams. This is not a requirement to have board-certified practitioners on the project team. Rather, it is simply a re-

quest by the RFP issuing agency to have proposal respondents identify those project team members who are board-certified by AAEES. Board Certification is a meaningful professional differentiator and we are encouraging agencies to make use of this distinction as they evaluate consulting teams.

Social Media


We are continuing our efforts to integrate social media into the promotional program we are building for the Academy. We are working with a number of our partners to determine ways we can create meaningful social engagements at the professional level. We are all facing the issue of information overload, so

our target is to reduce the quantity to the extent possible while simultaneously increasing the quality of the items that we post. Stay tuned as we launch various initiatives in this ongoing effort. And don't forget to 'like' us on our Facebook page and also check out what we are doing on Linked In.

Webinars

The Academy launched its first webinar series during 2014 with results that fell short of what we had been looking for. During 2015, we worked on adjusting our program to make webinars an integral part of the student chapters and our Young Professionals offering and related activities. Just as we are looking to make better use of social media, we are looking for ways to take those things that are unique and special to the Academy and convert those into useful content and the foundation of unique educational experiences. We want to make this approach successful for both our membership and for those who fit within our public education mission. Our webinar series aims to bring our E3S Conference to a wider audience. We have been working with our E3S award winners to tell the story of their award winning projects and expect that we can

develop an audience for these sessions that draws upon interest from all elements of the environmental community.

Our special emphasis will be on reaching out to the memberships of ASME, AIChE, AWMA, APHA, ASEE, AWWA and SWANA. These are all organizations that have an active webinar program. We are working with these partners to make them aware of the state of the art in environmental solutions development. We have some great stories to tell. We are looking forward to making a broad cross section of the public aware of the impacts that environmental engineering and science have on their current and future lives. If you would like to participate with us in this effort, feel free to give us a call. We look forward to working with you to improve the quality and the value of the Academy's programs. 

Instructions to Contributors

PURPOSE AND SCOPE

Environmental Engineer and Scientist: Applied Research and Practice is a peer-reviewed journal focused on practical research and useful case studies related to the multi-disciplinary field of environmental engineering. The journal strives to publish useful papers emphasizing technical, real-world detail. Practical reports, interesting designs and evaluations of engineering processes and systems are examples of appropriate topics. Papers relating to all environmental engineering specialties will be considered.

MANUSCRIPT REQUIREMENTS

Manuscripts should be submitted electronically in Word format to the Editor and Assistant Editor.

Herb Ward, Ph.D., P.E., BCEE
Editor e-mail: wardch@rice.edu

Yolanda Moulden
Assistant Editor e-mail: YMoulden@aaees.org

REVIEW PROCESS

All papers submitted to the journal are subject to critical peer review by three referees, who have special expertise in a particular subject. The Editor will have final authority over a paper's suitability for publication.

CATEGORIES

Papers may be submitted in the following areas:

Applied Research

Original work presented with careful attention to objectives, experimental design, objective data analysis, and reference to the literature. Practical implications should be discussed.

Review

Broad coverage of an environmental engineering application or a related practice with critical summary of other investigators' or practitioners' work.

Practical Notes

Novel methods that the author(s) have found to be sufficiently successful and worth recommending.

Case Studies

Recently completed projects or studies in progress that emphasize novel approaches or significant results.

Design/Operation

Conceptual or physical design or operation of engineering systems based on new models or techniques.

Management

Papers describing novel approaches to problems in environmental management, or to the global, sustainability or business aspects of environmental engineering.

Abstract

An abstract of up to 200 words should be provided, including a statement of the problem, method of study, results, and conclusions. References, tables, and figures should not be cited in the abstract. Up to six key words or terms should be included for use by referencing sources.

Photographic Consents

A letter of consent must accompany all photographs of persons in which the possibility of identification exists. It is not sufficient to cover the eyes to mask identity.

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In Situ pH Adjustment with Colloidal $Mg(OH)_2$

Robert C. Borden¹, Yenjung Sean Lai², Jody Overmeyer³, Bilgen Yuncu¹, and Jeffrey P. Allen⁴

ABSTRACT

Aquifer pH has a major influence on the effectiveness of a variety of in situ remediation processes including enhanced reductive dechlorination (ERD) and metals immobilization. In this paper, we describe the development and testing of a new process for adjusting aquifer pH using colloidal $Mg(OH)_2$. $Mg(OH)_2$ has a number of advantages for use as a base to adjust aquifer pH including large number of OH^- equivalents per Kg material, dissolves slowly providing a long-lasting alkalinity source, and does not result in the excessively high pH values associated with other more soluble bases. Laboratory studies showed that transport of plain $Mg(OH)_2$ through a column packed with sand was very limited with some clogging observed. In contrast, a proprietary formulation of $Mg(OH)_2$ (CoBupH-Mg™) was rapidly transported through the column with 82% of the added alkalinity discharged in the column effluent and no loss of permeability. A large scale injection of CoBupH-Mg was effective in raising aquifer pH to near 7 in most wells at nine months after injection.

INTRODUCTION

Aquifer pH has a major influence on the effectiveness of a variety of in situ remediation processes including enhanced reductive dechlorination (ERD) and metals immobilization. In this paper, we describe the development and testing of a new process for adjusting aquifer pH using colloidal $Mg(OH)_2$.

ERD is commonly used to treat chlorinated solvents and related contaminants in groundwater by providing a fermentable organic substrate as electron donor and carbon source to stimulate microbially mediated reductive dechlorination (AFCEE, NFESC, and ESTCP 2004, ITRC 2008, Stroo et al. 2014). During ERD of chlorinated ethenes, perchloroethene (PCE, or tetrachloroethene) is sequentially reduced to trichloroethene (TCE), dichloroethene (primarily the *cis*-1,2 DCE isomer), vinyl chloride (VC) and finally ethene, removing one chlorine atom at a time, replacing it with a hydrogen atom, and in the process releasing hydrochloric acid (HCl) to solution (Vogel and McCarty 1985, Mohn and Tiedje 1992). However, dechlorinating bacteria appear to be particularly sensitive to pH with dechlorination of DCE and VC to ethene inhibited below a pH of 6 (Rowlands 2004, Vainberg et al. 2006, Eaddy 2008).

Changes in pH also have a major influence on the transport of heavy metals. Many common metals (Cd, Cu, Hg, Ni, Pb, Zn) are more soluble at low pH and will be released to solution as dissolved cations. These metals can be strongly retained by surface complexation on Fe and Al oxyhydroxides (Kent et al. 2000, 2007, Parkhurst et al. 2003). However, the surface charge of many hydroxide minerals varies as a function of pH. At a pH below the Point of Zero Charge (PZC), the mineral surfaces have a net positive charge and cation sorption is weak. As the pH rises, the concentration of protons (H^+) on mineral surfaces declines and these surfaces

take on a net negative charge, enhancing cation retention (Bradbury and Baeyens 1997, Dixit and Hering, 2003). As a result, increasing aquifer pH can greatly reduce heavy metals mobility in the subsurface (Bethke 2006, Truex et al. 2011).

Aquifer pH is a function of a variety of factors including ambient pH, acidity released during in situ remediation processes, natural buffering processes, and acid or base addition. In humid areas, leaching by rainfall combined with carbonic acid (H_2CO_3) produced in the soil leaches out base cations (Na^+ , K^+ , Ca^{2+} , Mg^{2+}) gradually acidifying the soil. During ERD, HCl is produced from dechlorination and H_2CO_3 is produced from substrate fermentation. Natural buffering processes include reduction of nitrate (NO_3^-), sulfate (SO_4^{2-}), and iron hydroxides ($Fe(OH)_3$), carbonate dissolution, and proton exchange with aluminum and iron oxides and aluminosilicates.

When present, naturally occurring calcium carbonate ($CaCO_3$) can neutralize some acidity, in the process releasing bicarbonate ion (HCO_3^-) and carbonic acid (H_2CO_3). Above the water table, H_2CO_3 can degas as CO_2 , removing acidity from the water. However below the water table, CO_2 may not be able to degas, causing a buildup of HCO_3^- . Eventually, $CaCO_3$ dissolution stops as the groundwater becomes saturated with $CaCO_3$ (Robinson et al. 2009). If $CaCO_3$ does not dissolve, it is not effective in buffering pH.

Proton (H^+) sorption to Fe and Al oxyhydroxides and clay minerals can have a major impact on pH. H^+ sorbs strongly to surface complexation sites, so surface complexation reactions can strongly buffer pH, absorbing large amounts of H^+ as the solution pH declines and releasing the H^+ back to solution as the pH rises (Davis and Kent 1990, Davis et al. 1998). This strong buffer can reduce the pH decline in many systems, but can also greatly increase the amount of base required to increase aquifer pH.

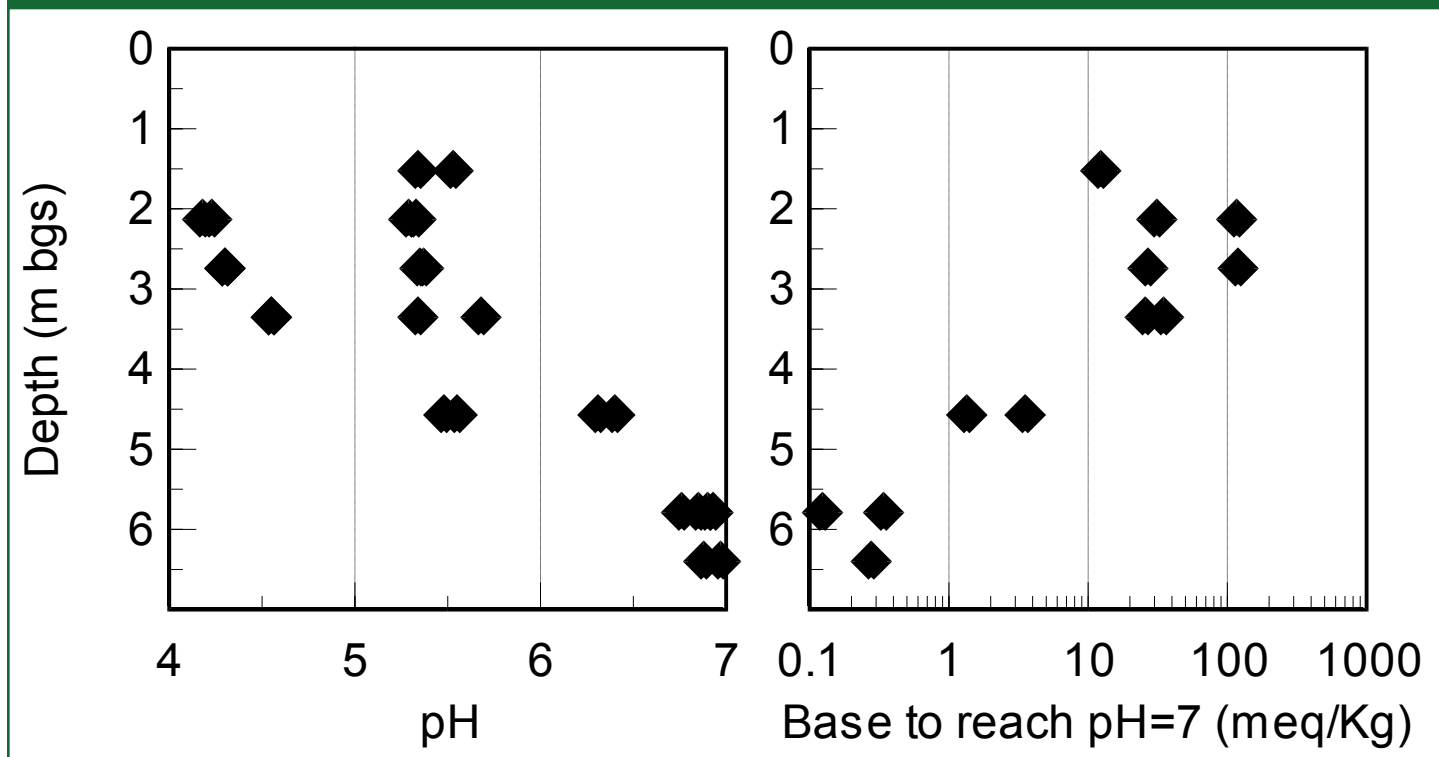
¹ Solutions-IES, Inc. Raleigh, NC 27607

² Biodesign Institute, Arizona State University, Tempe, AZ

³ Pittsburgh Paint and Glass, Pittsburgh, PA

⁴ Eaton Corporation, Cleveland, OH

Figure 1. pH and base required to reach pH=7 versus depth in aquifer material samples.



FIELD DEMONSTRATION

An inadvertent release of solvents at an industrial facility in eastern North Carolina has resulted in contamination of a shallow red silty-clay layer that extends from 0 to 3-5 m below ground surface (bgs). Underlying the silty-clay is a semi-confined sand and gravel aquifer with up to 100 mg/L of PCE. Groundwater at the site is naturally acidic with ambient pH in the range of 5 to 6. However, groundwater in the eastern portion of the site has a pH less than 4 due to a sulfuric acid plume that has migrated onto the site from upgradient.

As discussed above, low pH can inhibit reductive dechlorination. To successfully bioremediate the aquifer, the pH would need to be raised to a range appropriate for ERD. During site characterization, continuous soil cores were collected near the edge of the sulfuric acid plume (pH= 3.9-4.2). Each sample was analyzed for ambient pH. Selected samples were analyzed to determine the amount of alkaline material required to adjust aquifer pH. Samples were homogenized and then 5 g subsamples were distributed into different containers with 15 mL deionized (DI) water and varying amounts of 0.05 N NaOH. After equilibrating for 7 days, the pH was measured and plotted versus amount of base added. Initial pH and amount of base required to reach pH = 7 are plotted vs depth in Figure 1. Samples from the shallow silty-clay were acidic (pH < 6) with a large base demand (10 – 100 meq OH⁻/Kg) due to the high proton (H⁺) exchange capacity of the silts and clays. In the sand and gravel aquifer (5-7 m bgs), the pH is closer to neutral and base demand varies from 0.1 - 0.3 meq/Kg.

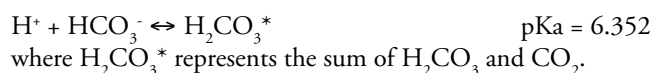
Using the results shown in Figure 1, a design loading of 0.3 meq OH⁻ per Kg dry aquifer material was selected for the western por-

tion of the site where ambient pH is closer to neutral (2,500 m²). In the eastern portion of the site impacted by the sulfuric acid plume (3,700 m²), a base loading of 1.2 meq/Kg was selected. This loading is lower than would be required based on the results in Figure 1. However, the designers were concerned about potentially adding too much base, resulting in an excessively high pH that could inhibit biological activity. A decision was made to use a lower amount of base, and add more in the future if needed. Assuming a saturated thickness of 8 m and bulk density of 2,000 Kg/m³, approximately 62,300 eq of alkali would be required to adjust aquifer pH to a desirable level.

ALKALI ADDITION

62,300 eq NaOH and KOH provide a large number of OH⁻ eq per Kg and are very soluble so only small volumes of base are required to raise the aquifer pH. However, concentrated solutions of NaOH and KOH have pH > 13 which is inhibitory to bacteria, would expose workers to safety hazards, and can partially dissolve aluminosilicates.

Na₂CO₃ and NaHCO₃ are also relatively soluble. However, the amount of H⁺ consumed per mole varies as a function of pH. Between pH 5 and 8 (Stumm and Morgan 1981),



Under closed conditions (below water table where CO₂ cannot degas), NaHCO₃ and Na₂CO₃ disassociate to H₂CO₃^{*} and HCO₃⁻ (bicarbonate), consuming protons (H⁺) by the following reactions.

Table 1. Characteristics of common alkaline materials used for pH control.

Base	Formula	MW	OH ⁻ released at pH = 7		Alkali Required *	Solubility	Solution Volume**	Saturated solution pH
		g/mole	eq/mole	eq/Kg	Kg	g/L	L	
Caustic Soda	NaOH	40.1	1	25.0	2,500	1,100	2,300	>13
Caustic Potash	KOH	56.1	1	17.8	3,500	1,200	2,900	>13
Soda Ash	Na ₂ CO ₃	106	1.18	11.2	5,600	300	19,000	~11.7
Baking Soda	NaHCO ₃	84	0.18	2.2	28,000	78	365,000	~8.3
Hydrated Lime	Ca(OH) ₂	74.1	2	27.0	2,300	1.85	NA***	>12
Milk of Magnesia	Mg(OH) ₂	58.3	2	34.3	1,800	0.01	NA	~10.3

* Alkali required to raise aquifer pH to neutral

** Volume of saturated solution required to raise aquifer pH to neutral

*** NA - not applicable, base is insoluble

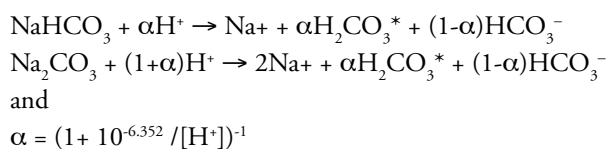
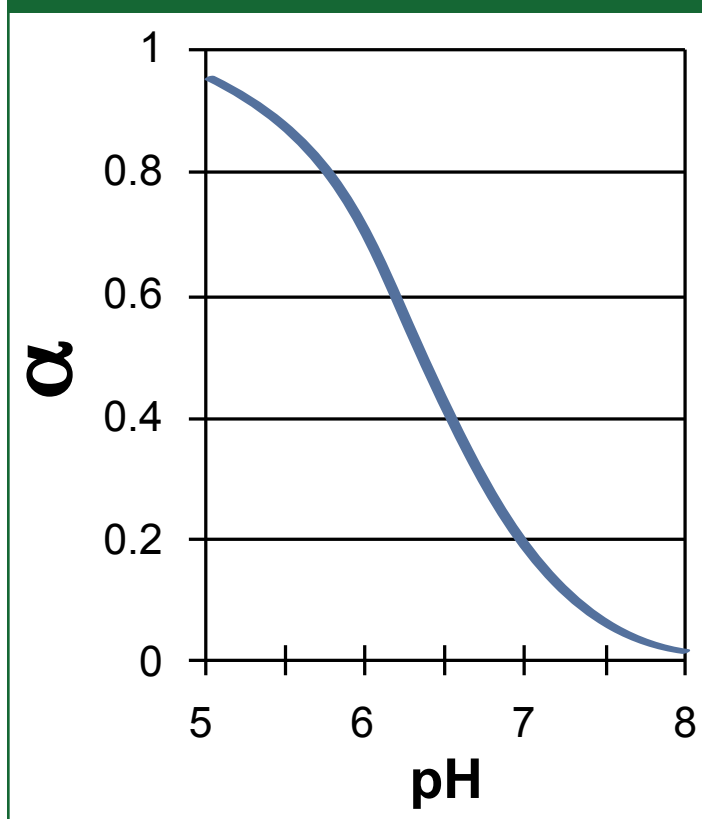
Figure 2. Variation in alpha (α) with pH.

Figure 2 shows the variation in α as a function of pH. At pH = 6, $\alpha = 0.69$ so 0.69 moles of H⁺ are consumed per mole of NaHCO₃

and 1.69 moles of H⁺ consumed per mole of Na₂CO₃. However at pH = 7, $\alpha = 0.18$ so only 0.18 moles of H⁺ are consumed per mole of NaHCO₃ and 1.18 moles of H⁺ consumed per mole of Na₂CO₃. As a result, bicarbonates and carbonates are relatively effective at raising the pH to 6. However these materials provide less alkalinity per unit mass at pH = 7, increasing the amount of material required.

Ca(OH)₂ and Mg(OH)₂ provide large amounts of OH⁻ per Kg and pH values are not excessive. However, these materials have a low aqueous solubility, make them more difficult to distribute in the subsurface.

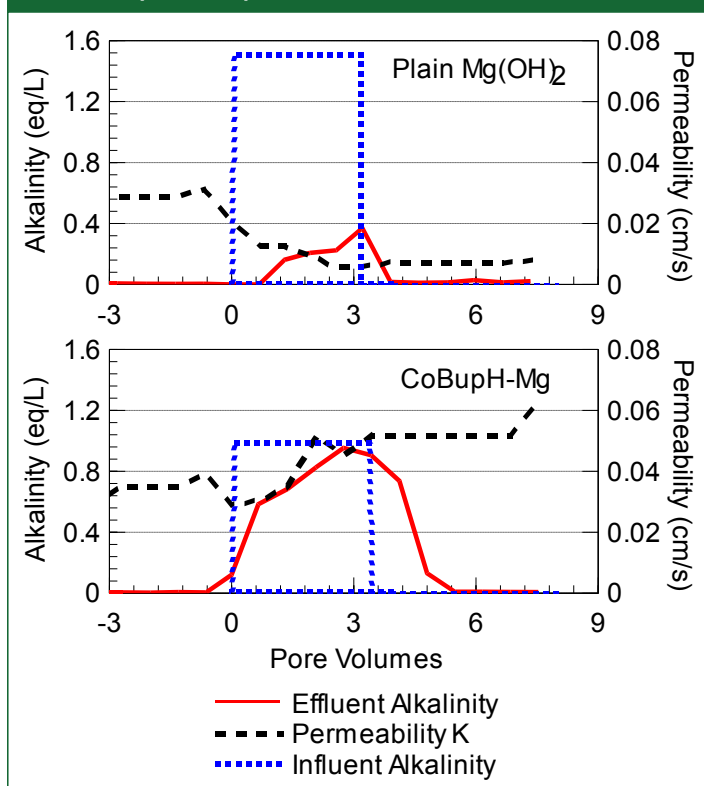
DEVELOPMENT OF COLLOIDAL Mg(OH)₂

Mg(OH)₂ has a number of advantages for use as a base to adjust aquifer pH. Mg(OH)₂ has a relatively low pKa (approximately 10.5, Takeno 2005) and dissolves slowly providing a long-lasting alkalinity source that does not result in the excessively high pH values associated with other, more soluble bases. However, distributing colloidal Mg(OH)₂ can be challenging. Mg(OH)₂ has a net positive charge under typical aquifer conditions (zeta potential of Mg(OH)₂ = + 25 mV at pH = 10; Pokrovky and Schott 2004). As a result, untreated colloidal Mg(OH)₂ is expected to be strongly retained by negatively charged aquifer sediments.

Laboratory column experiments were conducted to evaluate the transport and retention of colloidal Mg(OH)₂ (D₅₀ = 0.8 μm, Martin Marietta Magnesia Specialties, LLC, Baltimore, MD) and CoBupH-Mg™, a proprietary formulation of Mg(OH)₂ (D₅₀ < 1 μm) distributed by EOS Remediation, LLC (Raleigh, NC). Columns were 2.5 cm diameter x 28 cm long and wet packed with field sand (D₅₀ = 0.38 mm, D₁₀ = 0.17 mm). Three pore volumes (PV) of deionized (DI) water were flushed through the columns, followed by 3 PV of Mg(OH)₂ suspension and then 5 PV of DI water. Inlet pressure and flow rate were monitored and used to estimate the variation in permeability with time.

Transport of plain Mg(OH)₂ through the column was very limited (Figure 3). Effluent alkalinity reached a maximum of 24% of

Figure 3. Transport of plain $Mg(OH)_2$ and CoBupH-Mg suspensions in laboratory columns packed with sand.



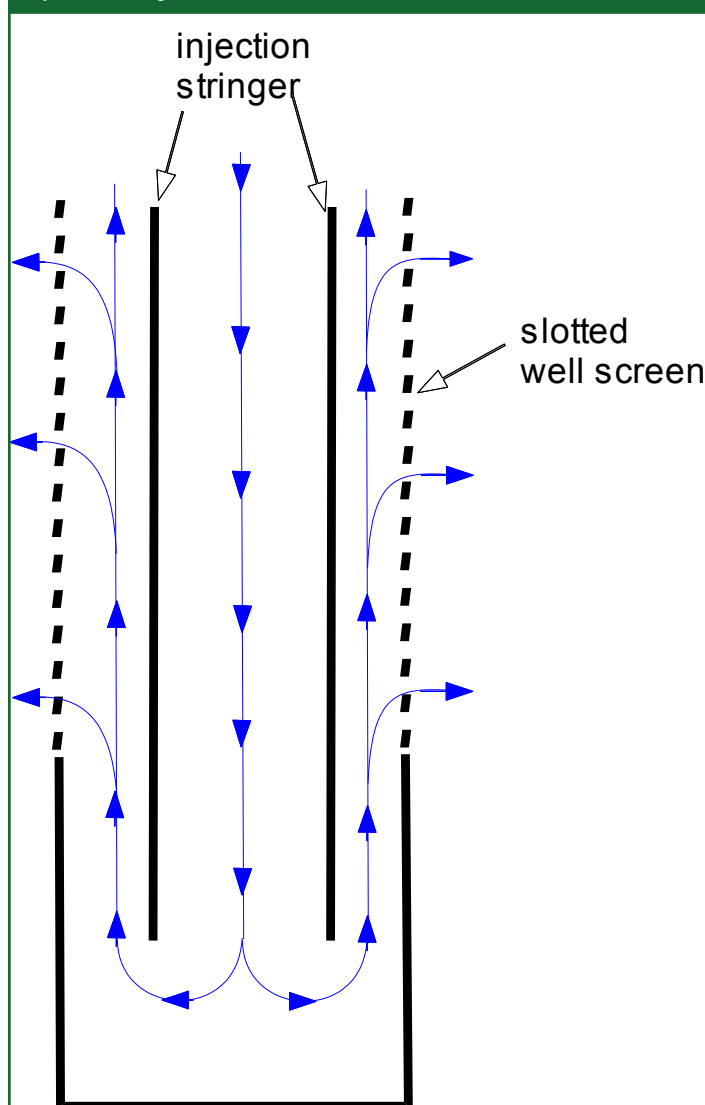
the influent with only 14% of the influent alkalinity transported through the 28 cm long column. Plain $Mg(OH)_2$ injection also resulted in some clogging of the column with the permeability dropping by 75%. In contrast, CoBupH-Mg rapidly broke through in the column effluent with 82% of the added alkalinity discharged in the column effluent. CoBupH-Mg addition also appeared to result in a small increase in permeability. However, this apparent increase is within the margin of error of the experimental measurements.

PARTICLE SETTLING DURING INJECTION

Since $Mg(OH)_2$ particles have a density of 2.2 g/mL, there is a potential for settling at the bottom of injection wells and other flow stagnation points. One approach for limiting settling in the bottom of injection wells is to inject the diluted $Mg(OH)_2$ suspension through a tube or 'stringer' that extends from the ground surface to a short distance above the bottom of the injection well. This arrangement causes the injection fluid to flow upward from the bottom of this well before flowing outward through the injection well screen. By ensuring the upward flow velocity in the annulus between the stringer and the well screen is greater than the particle settling velocity, particle settling in the bottom of the injection well is minimized (Figure 4).

An effective injection stringer for a 2 inch slotted PVC well is shown in Figure 5. Using this assembly, an injection rate of 1 L/min generates an upward flow velocity of 1 cm/s in a 2 inch well which exceeds the settling velocity of $Mg(OH)_2$ particles up to 120 μm in diameter.

Figure 4. Schematic of fluid flow in bottom of well when using an injection stringer.



REMEDICATION SYSTEM

A novel, in-situ remediation approach was developed to address the dissolved PCE that has already reached the confined aquifer and low levels that could enter the aquifer in the future. A network of injection wells were installed with injection locations spaced approximately 10 m on-center throughout the 6,200 m^2 injection area. At each location, separate injection screens were installed from 3 to 6 m, and 7 to 10 m bgs to better control the vertical distribution of injected reagents. Diluted CoBupH-MgTM, extended release substrate (EOS-XRTM), and approximately 10,000 L of chase water were injected in each well to distribute the reagents away from the injection well. EOS-XRTM contains a mixture of easily biodegradable, soluble substrate, traditional emulsified vegetable oil (EVO), and an extended release material designed to slowly release H_2 and acetate for up to 20 years. Several months after buffer and substrate injection, a bioaugmentation culture (BAC-9TM) was added to each well to provide microorganisms capable of complete dechlorination of PCE

Figure 5. Example of injection stringer assembled from (A) 1 inch O.D. HDPE pipe, (B) 1.5 inch O.D. pipe, (C) 1.5" to 2" FERNCO Coupling, (D) barb to male NPT fitting, and (E) camlock.

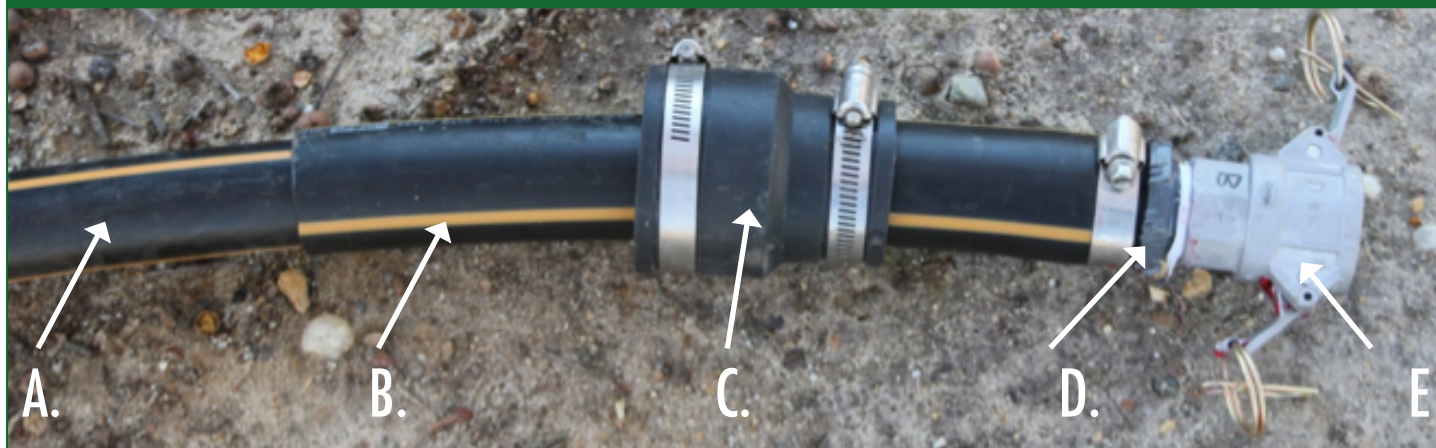
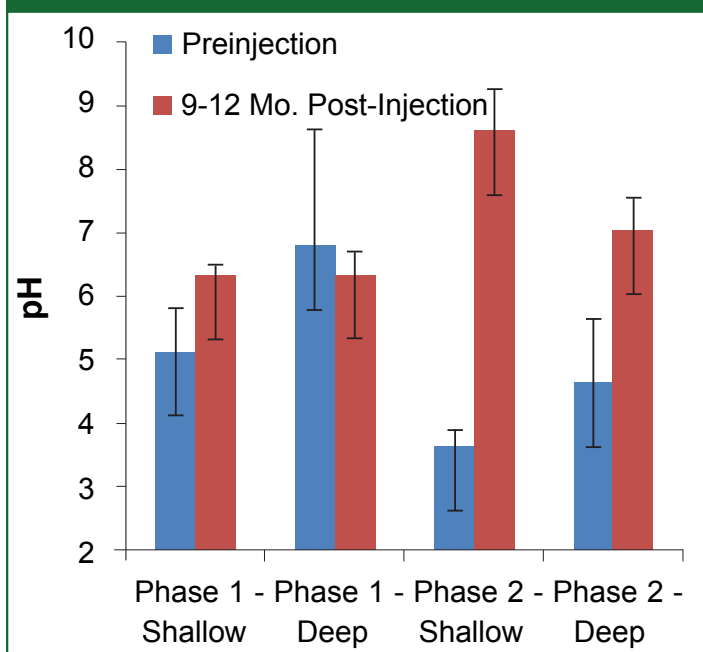


Figure 6. Average pH in injection wells prior to CoBupH-Mg injection and 9-12 months after injection. Error bars are ± 1 standard deviation.



to ethene. The injection process was conducted in two phases, with 30 injection well screens injected at a time with a combined flow rate of up to 150 liters/min.

The amount of CoBupH-Mg injected at each location was varied due to the large variations in pH over the site and base demand with depth. The western portion of the site where the ambient pH in between 4.5 and 6 was treated in Phase I by injecting 5 kg of diluted CoBupH-Mg in the shallow well screens (3- 6 m bgs) and 1 kg in the deep screens (7-10 m). The eastern portion of the site where the pH is less than 4.5 due to the sulfuric acid plume was treated in Phase II by injecting 15.5 kg of diluted CoBupH-Mg in the shallow well screens and 4.7 kg in the deep screens. More CoBupH-Mg was injected in the shallow screens because of the higher proton exchange

capacity of this zone. After completion of injection, there was no evidence of $Mg(OH)_2$ settling in any injection well.

Figure 6 below shows the pH in the shallow and deep Phase I and Phase II injection wells prior to injection, and 9-12 months post-injection. Injection of 5 Kg of CoBupH-Mg in the Phase I shallow wells was effective in raising the pH from 5 to over 6 with no overshoot. However, the small amounts of CoBupH-Mg injected in the deep Phase I wells did not raise the pH. In the Phase II wells, addition of 4.7 Kg of CoBupH-Mg raised the pH from ~4.5 to near 7. However, the larger amounts of CoBupH-Mg injected into the shallow Phase II wells did result in some overshoot with pH in most wells above optimum for bioremediation.

CONCLUSIONS

Low aquifer pH reduces the effectiveness of in situ bioremediation processes. However, large amounts of alkali are required to raise aquifer pH due to the strong buffering provided by proton exchange with aluminum and iron oxides and aluminosilicates. $Mg(OH)_2$ provides a large number of OH^- equivalents per Kg, reducing the amount of material required and dissolves slowly, providing a long-lasting alkalinity source that does not result in the excessively high pH values associated with other more soluble bases. In this project, we applied a novel formulation of colloidal $Mg(OH)_2$ (CoBupH-Mg™) which could be effectively distributed throughout the aquifer. Nine months after $Mg(OH)_2$ addition, the pH of most injection wells was near 7, providing appropriate conditions for microbial growth.

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