

**Transcript of Webinar**

**Community Colleges, Education and the Impending Water Crisis AACC-  
SEED**

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*Transcript By  
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MODERATOR: All right, with that being said, I'm going to turn things over to our moderator today, Todd Cohen. He is a director with the SEED Center. Todd, take it away.

TODD COHEN: Thanks, Brian. Hi, everyone. Good afternoon. Welcome to Community Colleges, Education, and the Impending Water Crisis. We kind of started this conversation of green jobs and education training – what, about five, six years ago nationally we started pick up speed? There was a lot of, sort of, focus, if you recall, around renewables, and weatherization and green construction; very little talk about water. And when I went to green jobs conferences the water was always the thing that was talked about in sort of an empty room, behind closed doors, with no one. And so, five or so years later now, I think that's changed dramatically. It is a major issue, if not the major issue, right now in the clean economy, as we see it – both on the quality/quantity side, and it's probably safe to say that there are probably not enough good education and training programs coming out of community colleges in this area to really feed the industry where it is today and where it's headed.

So that's a focus for today. At the heart, we will be talking about the industry and specific occupations within that. When we're talking about water, what is the landscape? What kind of occupations, skill sets we're really talking about? It is both a technical side – those technicians that'll be installing, repairing very aging infrastructure, but due to this conversation, we'll be – that students really need to learn more about conservation. So regardless of whether you're in a water-quality management program or a business program or an energy-management program, or a nursing program, that really, more – we want those students to walk out of the college with a much clearer understanding of water – it being a limited resource globally – the significant impact that means, and that they'll make some smarter decisions, regardless of whatever profession they choose.

And so that's really what we're going to hit today. We'll also talk about this – we'll talk about a macro level. We'll also talk about it at the difference in regional levels, because where you live, and I'm looking at the list and you folks are from all over the country – water is – the crisis is sort of different, depending on where you are geographically. So we'll hit on all of that.

Before I get into the speakers, let me get a quick thank you to a couple different organizations. So Johnson County Community College's Center of Sustainability – they're a partner of ours – Jay Antle – I'm going to have him come on in a second here. But if you haven't joined – JCCC's got a tight network of college sustainability directors who meet monthly to do some webinars. It's a great group to be a part of. I'm going to have Jay – (you come ?) – in a second, but also, ATEEC, who's the primary speaker today, one of three. And the Advanced Technology Environmental and Energy Center – it's an NSF/ATE center out of Iowa – all things environment, all things energy, if you're not following them and getting their resources at a community college, then I urge you to do so. We'll get from them, too, but they're a co-host, so I wanted to thank them.

Jay, you want to come out and say a couple words?

JAY ANTLE: Sure. Thank you, Todd, and we are – I'm happy to be here. We do these webinars – part of the national sustainability community college system – on a monthly basis,

and we try to keep those talks kind of informal, so if you have any particular topics you'd like to discuss, send me an email. And we also give people a chance to talk about their challenges at a particular colleges – so it's kind of a small, intimate group.

Having hit that we're talking about water, I'm here in Kansas, where, in the eastern part of the state we tend to have a fair amount of water, but where, in the western two-thirds of the state, water is an increasingly strategic problem, whether it be the depletion of the Ogallala Aquifer or whether it be diversion of water for hydraulic fracking. And, of course, with the concerns about climate change, water becomes more and more of an issue.

And I'm a historian by training – an environmental historian – so if any of you want to sort of have a blast from the past, there are people who are now talking about revisiting some of the kind of crazy water diversion schemes from the late 1960s. And so I would encourage you, if you're really wanting to see how some of these plans got almost Frankensteinish, look up something called the North American Water and Power Alliance Plan, which at one point in time wanted to call for the diversion of water from the Yukon River down into the Colorado River basin and on to the Great Plains.

So my hope is that discussions like these in terms of water conservation – both in terms of the technology programs and philosophically, in terms of more general ed. kind of concepts – can lead to better decision-makers as we go forward into an increasingly arid 21st century.

OK, enough of that. Thanks, Todd, for having us here, and look forward to a great presentation.

MR. COHEN: Thanks, Jay. All right – (inaudible) – come out of the American Association of Community Colleges. We're all about supporting the two-year college and educating for the clean economy. Come check us out if you're not a member – we've got 474 colleges that are members of ours. Please, please look to join. It's free.

OK, I going to turn it over to the real experts here. So what we'll do is this: We'll kind of start at a global industry level. And we're lucky to have Christine Radke here, who is technical project manager for the Water Environment Federation. For those of you who don't know Water Environment Federation, they've got a global network of members and really their focus, and Christine's in particular, is around helping water-quality professionals through quality education, training – so she really gets a connect between community college and this particular industry. And so she's going to talk about industry (global levels ?), some of the external factors that are really driving the industry, everything from population growth, to extreme weather that Jay talked about to the really old infrastructure that we're – that we're dealing with right now.

And then we'll kind of drill down a little bit, very macro-level, Dr. Jeremy Packard, associate director for ATEEC, is – will talk about a study that they did, a report on water and some of the occupations that really laid out the – (inaudible) – about water. Some of the – a lot of the occupations, particularly that would be important for community colleges to understand, and more regionally these – the demand for these occupations and skillsets will be happening.

I'd also pay attention there too, because – well, not only is Jeremy going to speak about it, but they've got some things coming up, some conversations around the country, and that I think if you're – this is really something that interests you, you should be a part of that.

And then – and finally, Mike Smith, who is department chair and state – (inaudible) – discipline chair for Colorado and lead faculty on water-quality management program at Red Rocks Community College, Colorado. Mike's been instructor in water-quality management for, what, about 25 years, I think. So he really understands this. He gets this. He's going to show you (and we're going to ?) drill down and talk about the greatest things that the college is doing around water-quality management. But one – but we'll be able to extract from that is: Regardless of whether you have a program in your – at your college or not, or you're thinking about it, but there's some really great concepts there that you should think about embedding into any number of programs. So we'll hit that.

There's a lot of rich information here. So we always get a question: Are you going to have these slides available? They will be available, because we're going to be talking about a lot of deep, rich things here. So the information will be available. Don't worry about that. I'd also urge you – probably mentioned this, but I urge you to ask questions at any point, and we'll hit those at the end where we'll – I'll make sure we leave time for that.

So with that, I'm going to turn it over to Christine. Christine, thanks.

CHRISTINE RADKE: OK, thank you, Todd. As you mentioned, it is a very exciting time for water, so it's a privilege that you've invited WEF to participate in this webinar.

For those who are not familiar with the Water Environment Federation, or WEF, we are a not-for-profit technical and educational organization. We have about 36,000 members, 75 member association across the country. And our members range from water utility personnel – which have administrative managers, operational technicians – environmental civil engineers, academics, trainers, researchers. Basically, we just have folks who are passionate and have a love for the water industry. Through our members, volunteers, and staff, our mission is to provide bold leadership, champion innovation, connect water professionals, and leverage knowledge to support clean and safe water worldwide.

So as mentioned, I'm going to give a little overview of some of the challenges that we're seeing in water and then go into how we're trying to address it and what's still needed to accomplish our goals. So speaking about the challenges: For many years, the water sector has been doing their job, ensuring that we're receiving clean, safe water, and protecting the environment. But in recent years, we're seeing a paradigm shift in water practices due to challenges not foreseen 40 years ago when the U.S. EPA was created and the Clean Water Act and Safe Drinking Water Acts were enacted.

So some of these challenges include external factors out of human control, such as climate change. In recent years we've been seeing increased temperatures in various regions and increased extremities in weather patterns across the nation and even the world, where we're seeing lots of storm events, kind of beyond the 100-year storm which wastewater facilities are

typically designed to accommodate. These high-flow events cause sewer overflows, which can release untreated water into the environment.

We're also seeing increased drought events, which raises concerns about our water supply and the impact it causes on our ecosystems, which harm estuaries and freshwater habitats for fish and birds.

We're also dealing with challenges due to population growth. Increased population of course means increased water consumption, and it doesn't help when some of these areas are experiencing droughts. I'm sure you've seen in recent news that communities in California are encouraging the public to practice water conservation techniques both indoors and outdoors.

With population growth, we also have an increased demand for food and energy, which have driven up the use of phosphorus and nitrogen-based fertilizers and combustion of fossil fuels. Nitrogen overloading causes eutrophication and biodiversity loss from dead zones in estuaries and fresh water systems. It also causes increased greenhouse gas emissions in atmospheric systems and increases acidification and other forms of nitrogen pollution in soils throughout atmospheric deposition. Similarly, excess phosphorus in our waters contributes to toxic algal blooms and eutrophication in aquatic environments.

With increased population, we're also seeing an increase in consumer products that we didn't see 40 years ago. There are new pharmaceuticals and personal care products, which also include wipes as you can see in the right-hand corner, that are now in the market. And maybe it's our own fault, but people are just thinking that toilets are trash cans, so they're making it into the wastewater systems and they're not meant to be flushable, but our conventional wastewater treatment processes aren't designed for these new types of products.

But as I said, the water sector is as much as blame for the challenges. I mean, we buried ourselves. We magically take away our wastewater and provide our clean water at the tap, and you don't even know we're there until you see an increase in your water bill or unless there's something in the news that usually a negative.

So we have an aging infrastructure that needs repair and replacement. In 2013, the American Society of Civil Engineers infrastructure report card gave water and wastewater infrastructure a D. We have water mains and pipes that are over a hundred years old, and there's an estimated 240,000 water main breaks each year in the U.S. Twenty percent of wastewater treatment plants need capital improvements, and 75 percent of drinking water pipes need capital improvements.

Water and wastewater treatment plants also consume a lot of energy. I mean, they run 24/7 after all. Therefore, releasing – we therefore release greenhouse gases which contribute to the climate change issues. So even the processes within our infrastructure at the facilities is a challenge.

And of course, with aging infrastructure, we're also facing the aging workforce. Now, I could put these pictures up of these gentlemen because they're my friends and my mentors. (Laughs.) But – I joke. But as you know, there's a – there was a boom of water professionals when treatment plants started increasing across the countries in the 1970s. But now, these water

professionals are either retired or they're retiring in the next few years. There's a lot of institutional mileage that will be lost, and aside from the aging workforce, I mean, seriously, when's the last time you heard someone say I want a career in water. So not only have we buried the water infrastructure, but we also buried water as a career choice.

Bottom line, the problems that we have to solve now are more complex and more costly than that were faced in the 1970s. The resources to address these challenges are limited. We do not have the suitable funding or legislation that reflects the realities of today's watersheds. But us in the clean water sector, we're optimists, and we're turning these challenges into opportunities.

Now, as I move forward, you'll kind of see I'm mainly focused on wastewater because that's what the Water Environment Federation focuses on. But I think it's going to apply; I mean, water is water, so it applies across the board.

So opportunities. Within the last decade, we've been seeing utilities taking it upon themselves to find ways to address the challenges and to be self-sustainable while still protecting water ecosystems. In 2012, we had a task force of water professionals across the nation, and they developed this document called the Water Resources Utility of the Future, a blueprint for action. I actually have a link at the end of the presentation if you guys want to download.

It's sort of a preamble for where we're going and where we need to go in the water sector. Instead of solely collecting and transporting wastewaters downstream to central treatment plants where water is cleaned to meet permit limits prior to discharge to waterways, the utilities of the future would transform itself into a manager of valuable, recoverable resources, a partner in local economic development and a member of the watershed community seeking to deliver maximum environmental benefits at the least cost to society.

For the next few slides, I will show what utilities can do to reduce costs and increase revenues. But they can also deliver environmental, economic and social benefits both locally and nationally. So we're basically digging out from underground and changing our image of wastewater to resource recovery.

There are some resource recovery practices that are already mainstream. First off, there is reclaimed water or water re-use. I mean, this is basically what wastewater treatment is, right, to make wastewater clean and safe to return to the water bodies. And now, we're taking it a step further and recycling water to satisfy water demands. This includes non-portable purposes such as providing water for landscaping irrigation, golf courses, cooling water for power plants, process water for plants and mills, toilet flushing and construction activities.

Non-portable re-use is starting to be a common practice, and the public is accepting it. But there are a number of utilities using water reclamation for portable purposes such as recharging groundwater aquifers and surface water reservoir (aguamentation ?) Water re-use practices require advanced treatment such as chemical coagulation, filtration and disinfection, and all of these processes are commonly used in drinking water plants.

The other mainstream resource recovery practice is land application of biosolids. So as you may know, biosolids is the term used for treated sewage sludge, and it has to meet EPA pollutant and packaging requirements for land application and surface disposal. They're rich in nutrients and, therefore, make great fertilizer. Some utilities actually sell their biosolids for profit.

Anaerobic digestion is a treatment process used to get sludge to biosolid standards, and methane gas is a bioproduct of this process. Most utilities burn the methane off, but some utilities have found ways to use the methane gas to produce heat, and in many cases, co-generation or generation of electricity.

Renewable energy in waste heat has been groundbreaking for water and wastewater treatment systems. Energy consumption at treatment facilities account for a huge chunk of utilities' operating costs. By producing their own energies – their own energy – utilities can pretty much take themselves off the energy grid, and in some cases, sell the energy back to the grid. There are also utilities that are finding ways to capture methane gas in sewer systems and also collect FOG to feed into the digesters to help the production of biogas. And as some of you may know, fats, oil and greases are problems in the collection system, so this is kind of like a win-win. You're solving a problem but you're also creating a resource.

Energy management isn't traditional knowledge for water management and you don't learn this, I don't think, typically in a water – wastewater treatment course. But this is the wave of the future and it will become mainstream practice for resource recovery facilities. I'd have to say that energy recovery is really what sparked the new paradigm shift, and it's a new way of thinking of how to operate and manage plants.

With stricter nutrient limits on the horizon, utilities are upgrading their facilities to enhance nutrient removal which refines the biological nutrient removal process. But we're finding ways to recover nutrients, in particular, phosphorus and other constituents, directly out of the wastewater systems for commercial use. Phosphorus are problems for systems because they appear in the form of struvite which causes blockages in pipes, and by recovering phosphorus, utilities are getting a product they can sell, but are also reducing phosphorus levels and eliminating the damage for the systems.

There are companies that are even finding ways to extract silver and other metals in the wastewater. The point is utilities are thinking differently at sparking innovation, and as my friend and mentor Julian Sandino says, utilities are no longer in the pollution or elimination business, they're now in the pollution conversion business.

OK, here are some new practices that are making it – making it into the mainstream, especially in urban communities. Green infrastructure is used to manage stormwater, but also to improve urban quality of life more broadly. The beauty of green infrastructure is it is more natural – a more natural watershed treatment and it's also aesthetically pleasing.

And then decentralized wastewater systems is also being integrated in community water management plans. These small community or surface area systems are managed onsite and/or in cluster systems without relying on centralized wastewater systems.

So what's needed? (Bell chimes.) And I think this – I have the three-minute warning here and I'm going to try to get through this. This new way of thinking in the future – and in some cases already, the present – we're kind of – we're actually lacking in the educational component for the water technicians who will be running these facilities. These new opportunities should be added to current curriculum because they will become, as I said, mainstream practices.

Talking to utility managers who have embraced the resource recovery ways of thinking, they need personnel who have the technical knowledge, but they also need personnel to have soft skills and more administrative management knowledge. If utilities are going to have a more open presence to the public, they'd like their personnel to be comfortable speaking to audiences.

And talking to the operations personnel, we're hearing that they would like more blended learning. These personnel are hands-on folks. Classroom is OK, but they really need – they really enjoy learning on-site.

We also need a new skilled and trained workforce that understands these new technologies and processes. These technology advances are getting more complex and we're going to need to find people who can run and who want to run these systems.

But in addition, utilities are going to need to employ marketing and sales teams to sell these resources and to get the public to change their mindset of wastewater. Business backgrounds are going to be needed as well, especially if utilities turn profit on the recoverable processes.

But most of all what's needed is more integrated planning and management. This will need to involve engagement with the public. And we need to work with civic leadership on breaking down barriers in resistance to change. We need to work together with other government departments such as energy, oil and gas, drinking water, transportation, parks and rec, and planning and development. And most of all, we need to work with educational institutions such as the community colleges so we can educate and prepare the water workforce of the future.

That's pretty much all my presentation. This slide here has some resources that you might find interesting.

I'm going to make a seamless plug on the last bullet here, the National Wastewater Systems Operator Apprenticeship Standards. WEF had a team of experts get together and we came up with these standards, which were approved by the Department of Labor's Office of Apprenticeship. It's a total of 4,000 hours over two years with on-the-job learning. And that's about 3,520 hours of work process and 480 hours of related instruction.

And I'm already at the minute warning so here's my contact information if you want to – if you have any questions or anything.

So, Todd, I guess I made it. (Laughs.)

MR. COHEN: You did. Thanks, Christine. I appreciate it.



MS. RADKE: No problem.

MR. COHEN: Good job.

And so, again, everyone we'll save Q&A for the end, but there's no reason you can't post your questions now and get it in the queue.

So thanks, Christine. And let me turn it over to Jeremy.

JEREMY PICKARD: Great. Thanks, Todd. And I really appreciate Christine and – of – presenting the issues that are out there.

One of the things that we do here at our ATEEC center, as we are a national resource center for the National Science Foundation and have been since 1994, one of the things that we're really concerned about is getting products and materials and useful hands into the hands of teachers and faculty and deans at the community college so they can help grow and shape and modify and enhance their programs. The National Science Foundation came to us and asked if we would be interested in expanding what it is that we do on a regular basis and enhance our portfolio of different things that we're up to. We then went after the water field and, no pun intended, but did take a deep dive into water to really take a look at what was the water management field.

And, I'm sorry; it looks like a couple of things aren't quite showing here on the – on the screen. But we have quite a different portfolio. We did a wide variety of things in energy as well as the environmental sector. But we felt like water was important enough and it was trending enough and becoming more of a critical issue that we needed to really focus our energies there and not just have it as a subset of the environment but as a – one of the main things that we are doing. With that, we got together a group of people, a professional forum, with the help of some of our strategic partners, to really go through and define what the water management field was about.

The forum objectives – this was last year. We met out in San Diego, California and we had folks from all across the United States as well as a few participants from Canada. We really wanted to define what the water management field was; create a very solid definition of what the technician was who is working in the water management field; provide a list of occupational categories; and then what are those technician-level occupational titles throughout the nation; and what are some of the job functions that are typically performed by each one of the occupations? And then, finally, what we did is we identified some of the emerging issues and trends in the water management field.

I'm going very briefly take you through this report and show you some of our findings. I will say ahead of time, like Christie has a variety of different things that are available for free download, our ATEEC resource center is just that. We want to be a resource for you so we have hundreds of products that are available, free of download. It's something that you can go on to our website and any of the products that you see up on the screen, as well as many others, are free to you and you can download them at your convenience.

If you would like hard copies of some of the things that you see come across your screen, feel free to get in touch with me and I'd be happy to send some of those out to you.

Our goal is to really make sure that they're in the hands of those who really want to use them. And I know Mike, who's going to be talking a little bit later – they have been using our chart to help recruit students into their water program for quite some time. And so if you'd like to have some, we'd be happy to get that to you.

Our partners on the forum – for the forum were the national PETE association; ABC, that's the Association of Boards of Certification; as well as the Water Environment Federation. We really (drove ?) from business and industry, those were the people we wanted to have in the room.

And, if you'll notice, we didn't have educators there and we did that on purpose. I think sometimes we don't do a good enough job as educators listening to business and industry to find out what it is that they want. And so for these forums, what we want to really make sure we're doing is hearing what's going on in the field currently. And then us, as educators, we need to really take the time to listen and then to hear what they're saying and integrate those things into our programs.

So this is what was a result of that, we came out with a report. Again, you can download that or I can send you a hard copy if you wish. And then on the inside of that report, or I can send it to you as a standalone, we do have a chart that really summarizes the entire report. I'm going to take you through this here in the next few minutes.

So one of the things that we did is we had group discussion. And we really wanted to spend some time defining, what is the water management field? So many times you hear students say, yeah, I'd be interested in going into the water field, but they don't really have a clear understanding of what that means. And then what we wanted to do is take some time to define the water professional occupation as a whole and then go through and create some of those overarching, overarching job categories.

So you can see here on that if you were to download it, I did provide a link. What we have up here is we have, what is the water professional? You can't see it, I go to point here. There you go. We do have, what is a water professional, have a definition here as well as, what is the technician? And I'm going to bring those up here in just a little bit. And so you'll be able to see them a little bit clearer.

So the definition that this group up – came up with is, the water management is a career field that applies the principles of science, math, technology, engineering, communication, economics, management and law to ensure water quality and sustainable managed water as a resource to protect public health and the environment. And so that was kind of our overarching theme that we started to come under. So the water management field encompasses all of these things. And I thought the group did a really good job of defining that.

One of the things that they did was, we usually like to have them define what a water technician is. Because the water field was so broad, they actually didn't like the word technician. They

actually said, we want it – we want it to be more of a water professional. And so water professional applies the knowledge and skills and abilities, perform scientific, technical and managerial, regulatory and communication tasks and responsibilities.

And so once we have defined those two areas, that's where the rest of our information now will fall under pertaining to those two definitions.

As you can see, the next thing that we did then was start to identify what the occupational categories were. And I apologize, this may be a little hard to see on your screen. But I will go to the next slide to make that a little bit bigger.

So what are the different occupational categories within the water management field? The ones that were identified by our group was they felt that administration, engineering, people in the lab, laboratory, plant maintenance, regulations and compliance, wastewater operations, water operations, watershed and runoff control, those were the different main categories within the water management field. And, like I said before, as you can see, those are the ones that are identified here in green right across the top in the red circle.

The step – what they did then is they wanted to break it down into a little bit more refined detail. So I have the main categories there, but what are some of the technician-level job titles and functions within each one of those categories? So we took our group of experts, broke them out into the various expertise that they had in the room because we had a wide range of folks. I believe there's even like 605 years of experience in the room between our 21 participants. And what they did is they got into the pockets of expertise and they started to lay out what those technician-level job titles were and what the functions were of those jobs. And then they came back as a whole and they actually went through and shared what those were.

I'm going to spend just a minute of the time going over one of those. There's no way I have time today to go over all the different job titles that were created here. So I'll just take one section. And this is the wastewater operator section. And, again, I'll highlight that so it's a little bit easier to read.

So within this chart, you can go into – if you want go in as a wastewater operator – wastewater operations, here are the different jobs that they identified within this category. So if somebody had an interest in going into that, and I know they're changing that name a little bit to water reclamation or – I think Christie, you've just called it water reuse. And so these are the different areas that someone could go into.

We also recognize that there are various levels within each one of these jobs. And so you may have a supervisor or a team leader, shift supervisor, within each one of these categories. So that could be broken out into a variety of different levels within that.

But we feel like this is very helpful for a student, if they're looking to go into this field. It gives them kind of an idea of where they're going, what it is that they want to do, and then they can have at least an idea of the different jobs that are available. I know out of Red Rocks Community College, this is exactly how Mike and his staff out there use it when they're showing

students the variety of different paths or career tracks they can take as they're going to go into this field, and so these are all broken down according to the different job categories that are on our chart.

The last thing that we did was, we took a little bit of time and we broke down each one of these job titles. So again, I showed you the wastewater one; now, like, I'm going to go into a little bit more depth for one specific job title within the wastewater. And this is a screenshot of our report, and so you would go in and let's say you wanted to be an instrumentation technician. This is actually going to go in – the report is going to tell you all the different types of things that you potentially will do as an instrumentation technician in the field. So it's plant operator, process control operator. And this gives a student a very good idea of what it is that they're going to be getting into, and so they can kind of have an idea of the career track that they're heading down.

It also gives community colleges and deans and faculty an idea of what are some of the things we need to make sure we're including in our programs as we're creating them and developing them and making sure that we have all those areas covered when it is – when we come up with our curriculum for the community colleges.

Last thing that we did, then, was we went through and we identified some of the emerging issues and future trends pertaining to this field. There was a long list of administration ones, and then we also identified quite a few in outreach, sustainability, technology and training. And again, that's nothing that I'm going to – want to read to you, but they are different areas that are identified in the water field. This is very helpful to take a look at where things are headed in this field, because like Todd said, just five years ago it wasn't something that everybody was talking about. It was something that was kind of very – whispering around about, not that they were keeping a secret; it just wasn't on the forefront of what are the issues. And I think right now it is very quickly moving there because of the lack of technicians that we have in the pipeline who will be replacing those who will be exiting, as well as for a variety of different things that Christine mentioned in her presentation as well.

MR. COHEN: Hey, Jeremy, I'm so sorry to interrupt you, but could – before you move that slide, the previous slide –

MR. PICKARD: Yeah.

MR. COHEN: – can you just – the sustainability stuff – could you just spend a second on that? It's hard to see it, but what are some of the things in there?

MR. PICKARD: Sure, and so some of the things are:

A plan for system sustainability and resiliency. Water professionals need to be more aware of production of greenhouse gases from various treatment processes, and that's one of the things, again, Christine touched on, on how they're figuring out ways to capture some of that and reduce that.

Promote energy efficiency and plant optimization.

Consider graywater systems.

Consider reclaimed water, direct and indirect water reuse, and manage nonpoint source pollution.

And so those are the categories that are underneath sustainability that were identified by our group.

MR. COHEN: Great. Thanks.

MR. PICKARD: Yeah, good question.

So again, we did this about a year ago, went back to NSF and said, hey, we have an idea as well. We think that the water issues throughout the United States are different enough that if we can go to a variety of different places, we need to have regional water conversations and start to identify what are those water issues throughout the United States.

And so currently we're in the process of going to these six different locations. The ones that have been completed – we did one here at Eastern Iowa Community Colleges in Iowa. We just finished up one at Red Rocks Community College, out at Mike's shop, a couple weeks ago. And here at the first part of May and end of May we'll be doing the other four: Central Carolina Technical College, Bristol Community College, Lane (County) Community College and Cuyamaca College down in Southern California.

And so what we'll then do is we'll create and (generate up for ?) and really start to identify what are those issues pertaining to water regionally that folks from around the nation could then take a look at their region of the country and start to identify and come up with those.

I will say that the two we've hosted already have been unbelievable. The people that have been in the room have been real solid professionals, a lot of expertise, and are really in touch with what's going on with all the water issues from around the nation.

Couple other things that we have – and I would encourage you, if you have a water program – on our [ateec.org](http://ateec.org) website, what we are trying to do for students is we're trying to give them a place to go where if they do want to enter a school or they do want to get some education, that they can actually go and see all the different water programs that are available throughout the United States. And so if you have a water program, I would really encourage you to go onto our website and make sure that your water program is represented there.

The other thing it does is it doesn't just give generic information; it actually takes the students and utilizes links to go directly to your program and put people in contact with either a director or faculty member who can advise the student into a program. And so we try to maintain that and keep that up to date. And so if that's something that you're interested in checking out, please do, and if your school for some reason does not happen to be on there, please let us know. I'll be glad to put that on there for you.

The other thing that we're doing is we're also growing our number of resources that we have to offer – again, these are completely free for download – and we're growing these pertaining to water and all the water issues that we're coming up against.

We're in the process right now of taking another step, and that's actually to start to train the faculty that are currently teaching. We have a grant that's going in here very shortly to be able to do – I'm not sure yet if it's going to be a week or two-week-long – training session for faculty members who are teaching in the water and wastewater programs. And so we want to be able to do that, host that, provide some of the latest and greatest research that's coming out of our research institutions and get that into the hands of the community college faculty who are training up our next technicians. And so that's going to be something that we're going to be looking at and doing here in the future as well.

Looks like that's – I'm at the end of my slide. I would like to thank you. And anybody who's on here, I will try to provide you with my information, but [ateec.org](http://ateec.org) – you can definitely get (ahold of ?) us. If you see anything on here that really interests you or is something that you would like to hand out or pass out or use for recruiting, we'd be happy to provide that you to you. Again, everything is free download on our website, but I'd be – also be happy to send you hard copies as well.

So, Todd, I'll turn it back over to you and you can introduce Mike.

MR. COHEN: Great. Thanks, Jeremy.

Yes, Mike. You're up, man.

MIKE SMITH: Well, good afternoon, everyone, and thank you for participating in this nice webinar we've got to talk about some very hot topics.

And just to review, I mean, (to present ?) – the two previous presenters have really hit some of the significant issues head-on. Conservation is clearly one of them. Better source management is another one that we're very, very active in and needing to pursue and certainly get very, very good at. And then of course our retiring workforce is a major issue.

The American Society of Sanitary Engineers – (inaudible) – per what Christine had referenced earlier – gives the overall industry a D. They're a much more lenient grader than I am, and being an instructor, I (view ?) this more in the neighborhood of an F minus simply because we've been very, very lax. In fact, we've kind of taken recruitment completely off the table.

Then we're kind of focused on the conservation side of the discussion as well and what we needed to be doing to kind of plan for the future, to try to come up with a replacement workforce for the existing people that are walking out the door with all their knowledge and experience, which is quite valuable to us.

When you look at the status of the industry as a whole, it depends really on what part of the country you're at in terms of how you would identify some of your priorities. And I'd kind – you being familiar with the Western half of the United States and certainly very, very acclimated to Colorado and its shortcomings, we look at things just a little bit differently. And certainly when you look at how we interact with the environment, clearly this is an environmentally based industry and we can't do much to control the environment, but we can do an awful lot to control our environmental development. And that – those kind of strategies truly need to be on the front of the table when you're having discussions and certainly setting up some sort of strategic planning to be able to implement some sort of correct action – corrective action plan or some sort of remedial response in order to address some of these issues that we're dealing with.

In the case of building a program or trying to actually make yourself somehow integrated with what the industry needs are, what I've done is, I've identified different areas and I've kind of grouped them, because they – they're all independent, but yet you can solve them with a simple strategy, which is you actually map them out and group them in specific areas.

So the first thing I want to talk about is the retiring workforce – you know, basically, our employment needs. There's a couple issues associated with it, and of course coming out of a very severe recession, that's also kind of enhancing the problem. With the retiring workforce, these people are skilled. And one thing that we – that we solicit openly in this particular program is that once you enter this industry, very often (sic) do people leave it by choice. They don't typically want to actually navigate out of it, for a variety of reasons. I mean, it's recession-proof. It's not going to be outsourced. It's a science industry, so it captivates your interest. And realistically, no two days are the same. So it really keeps people around. They might navigate in and out of it, and move to other elements or other areas within the industry, but they truly don't leave.

That's a wonderful thing, but it's also a curse, because once these people have navigated through the entire industry, they are well-skilled, well-educated, and when they leave, they are leaving riches – I mean, volumes – of information that we sorely need. And when you have a lot of them leaving at the same time, clearly that's going to directly impact this industry in a very negative way. Having a group of people coming out of the recession that were in the wrong place at the wrong time and put themselves in an unemployment situation – they don't have time to wait for an extensive educational pathway to be able to get re-employed.

So if you really develop an educational program, or certainly, implement something that the industry needs, you've got to be mindful that this group of people – they certainly have a skillset that might be welcomed and might be needed in the industry, but they need fast-track education. They don't have time for a full-blown degree or a very extensive educational plan. They need something that's going to actually get them employed fairly quickly.

And another thing, too, is that this industry – and I could speak for my peers – and certainly, my own history is that this industry, historically, was a men's club. I mean, I hate to say that so candidly, but that's really what it was. You know, it's changing now, but one thing that we are focused on, particularly here at Red Rocks, is introducing a diversity into the employment workforce. There are benefits to having a very diversified workforce, and you certainly want to take advantage of that.

Women are certainly being sought after. They bring a unique skillset into this industry that previously was unrecognized. In fact, it wasn't even welcomed at a stage. And now – (inaudible) – are seeing a shift in that. So we don't ever want to close doors to just saying, this is a men's type jobs. It's not. This is for anybody who has an interest in science, and we need to be very, very open about that.

Then we look at our supply issues and our conservation strategies, and, you know, with drought, certainly, we cannot control that, but we are doing a very critical job about source management. I mean, I can say that across the country. Here in the western half of the United States, it's a lot more severe than it is in the eastern half of the United States.

We rely heavily, here in Colorado, on our snowpack, and Colorado is in a very unique situation because our waters – all of our waters are – fall in the form of precipitation leaves the state. Absolutely nothing comes back into the state. And so consequently, we are tied (to a ?) series of (compacts ?) which forces us to allow a certain volume of outflow to fly in any one of our watersheds and actually leave the state untouched, which certainly limits the amount that we can actually develop ourselves in terms of expanding Denver, or any of the communities along the front range.

We're very, very limited in terms of what we can do simply because of our limited water supply. And in the case of reuse and catchment laws, here in Colorado, it is water rights, water rights, water rights. You know, you go to the eastern half of the United States, and that's a very foreign term, but here in Colorado and the western half of the country, this is a very, very active thing that we (state ?), and we're very afraid of it, because it (restricts ?) absolutely everything that we do.

Before the water from a storm cloud even hits the ground, it's owned by somebody, and therefore, we don't even have catchment policies here. We cannot actually have any water rainwater catchment in a private application whatsoever. So we have to be very, very mindful about our limitations to be able to work with the environment from that perspective.

And the last thing is something that Christine kind of talked a little bit about, and that is our aging infrastructure. You know, a lack of prioritization with replacement and upgrading your system has been a very daunting problem for any industry – I'm sorry, any utility across the country. They have misprioritized this replacement protocol, and sadly, it's now catching up to us.

You know, Christine had mentioned that, you know, most of these – (inaudible) – especially on the eastern half of the country are in excess of a hundred years. These things were only designed to last 50 years, and so in which case, now we're operating in the neighborhood of 150 to 200 percent of their intended design, in which case, now we've kind of missed the train here. I mean, we're in a situation now where we can't afford to replace it. The last estimate was \$3 trillion to replace our aging infrastructure with regards to water and wastewater operation.

There's (a ?) utility here anywhere; even combining their funding, they do not have that kind of resources to be able to replace them, so in which case, we're going to need to adopt new technology such as pipebursting and, you know, looking at (translift ?) technology in order to try



to reduce the cost it's actually going to take to be able to replace these pipelines, versus actually true excavation.

The – (inaudible) – they have definitely dropped off the map. They're kind of older; they've not adopted new technology. They've not adopted new technology that has been evolved with regards to chemical applications; there's a lot of evolution that's transpired some new, enhanced chemical processes that have not been adopted yet. Again, kind of an old-school mentality because of an aging workforce, that they want to maintain, this is what we've always done; please don't change it. Don't disrupt the (boat ?). This is what we'll do until I leave.

And sadly, that's the wrong approach, but it's a very stale, it's a very old technology, it's a very – not technology, I mean to say, but a very old practice, and it's very, very – it's a very difficult thing to be able to overcome. So we need to kind of get some of the older people, before they retire, to be open to change.

Excuse me. So when you're going to create a – some sort of a strategy for a way to be able to solve some of these problems, you're going to kind of group these things together in terms of coming up with a strategy to be able to implement them. With our retiring workforce, strictly, that's going to be – or clearly, I should say, that's going to be an educational program. And they need to be designed to be very, very flexible, but yet, at the same time, very rigorous, because you definitely need to teach these people what they're doing, and they need to be somewhat economical. If you're talking about a workforce that came out from an unemployment situation, they don't have a lot of resources to be able to pay for the education that they need to have.

So you certainly don't necessarily want to give them a full-blown degree before they can actually start searching for a job. Need to be very mindful about how that actually works. With our supply issues and our (reuse ?) and our catchment plans, all this is conservation related, and again, this, too, can be mapped out in a very, very good strategy, but again, each place, each state and each area within the United States is going to have a different approach to this.

You know, here in the United States, we operate off of compacts, and that really ties us into how we have to allow our (shell pack ?) to leave the state. These need to be revisited, and a lot of these western states – you know, California, Nevada, Arizona – they're going to need to be taught how to actually work with new, enhanced catchment basins in order to be able to catch their own storm flows before it (leads ?) into the ocean, where it now – all of a sudden, it's very, very expensive to be able to retreat it and bring it back into our system. From enhancing our catchment strategies, different applications – certainly, water conservation practices need to be implemented not only into the professional arena for education, but also the general public. They too need to be educated.

And then, of course, our aging infrastructure with regards to treatment of efficiencies and our – replacing pipelines and so forth – things along those lines. Again, utilities have a lot of skillsets, and where we're – (inaudible) – utility here locally that has really adopted some great technology using, basically, pipe bursting and using a (translift ?) technology plan, and they have been able to actually stay ahead of the curve. Oddly enough, the average age of their entire piping network is only 22 and a half years, which is astounding considering that it's considered a large district, and yet, they're still tied into this national average. But they have been very, very aggressive

about replacing their pipeline using a very efficient, modified technology that actually makes it very, very affordable for them.

So they're actually able to be able to implement this without calling it technical improvement, but nothing more than O&M. So it's a strategy we're trying to adopt here at the program as well as outsource it and distribute that education and knowledge around the country. And this utility is actually playing a very, very viable in actually making sure that that can take place by sharing their knowledge and expertise.

So what can any community college do? And again, if you have a community college and you've got a water control program, a water quality program, you need to be mindful about what's really taking place out there and how you need to be able to navigate it successfully. Anybody can write a curriculum. Anybody can open up a textbook and make a three or four credit class around that textbook and try to make it something that the industry or the – even the – you know, a typical community might want to have as a career option, but that's not necessarily the thing to do.

What you need to be able to do – what we've done is work directly with the industry – you know, get utilities directly involved in what you're going to be doing. All of our faculty members here – for example, all of them are employees in the field today, absolutely every single one of them. So we're connected directly to that utility and bringing that expertise into the classroom so they're able to share fresh information, fresh knowledge, fresh technology.

Another thing, too, is that every state in the country operates off of a certification plan. In other words, you have to have a license in order to work in this industry. If you're going to have a program, it needs to be in sync with that licensing system. And you need to be very mindful about how you actually navigate that. And I'll come back to that in just a second, because you don't really want to teach to the test. That's not only very poor – it's not ethical but it's also not the right thing to do for the students, because all they're learning is how to pass the test. They're not learning how to be able to react in the workplace in a real-world scenario.

And then, of course, you have to address our recruitment problem, and that is – like I said, we get an F-minus. Anywhere in the country – and I know this is a long list here, people, and you are well-represented across the entire country – and think about it for one second for your – amongst yourselves. Have you ever seen a sign soliciting your local water utility and comparing it to another one that might be near where you're actually located? Never.

We get an F-minus in recruitment simply because we stay out of sight, out of mind. We are considered a very, very passive industry, and everything we have is below ground. So typically – the typical, average community member knows nothing about where their water comes from and where it goes when we're done with it. That is a major issue.

One of the things that we're trying to address here in Colorado is, we're very active out in this program, working with local utilities to address this issue directly with the consumer confidence reports. That is a guideline – a mandate that comes from the Safe Drinking Water Act and the revised statutes of the amendments, I should say, that were rewritten back in 1992. This is a report that has to go out to absolutely every single tap – every user in every community that's hooked up to the public water system. Why can't they use that to go ahead and introduce this

industry to somebody who is uneducated to it? Somebody who is actually looking for a particular different career path – something that they may not even have considered? That consumer confidence report has to be published, so it's already into your operation's cost because you have to produce it for federal law, in which case, take advantage of that opportunity. You're mailing it out anyway; put a quick little tag in there about what this industry needs. Help this industry recruit by public education.

Within our program, what we've looked at is we've looked at how, basically, do we direct ourselves to understand and be in sync with what the actual educational need is? And there's basically two different things that we're really, really wrapping ourselves around.

First and foremost is the conservation, the (radius ?), the reclamation and supply technologies. And again, here in Colorado, this is really a priority. We fully understand that our water that we obtain is going to come 100 percent from our snowpack, and it's not consistent. It varies year to year. You know, last year we had 70 percent of average. The year before that, we were 286 percent of average. This year we're back to now having about 126 percent. So this means that we're still going to have somewhat restricted water usage. It's not going to be as bad as it was last year, but keep in mind with compacts that exist here in Colorado, 80 percent of that has to leave our snowpack untouched to other – to outlying states that we no longer have access to. So that really kind of stymies what we can do with our development. So we're definitely connected to that.

The other thing we're very, very mindful of is our youth. And when I say youth, I'm talking about our secondary students. These people have no introduction in the earth science classes about their water and wastewater systems whatsoever. If you ask any 10 fourth-grade students, say, and you survey them, and you ask them, where does your water come from, seven of those 10 are you going to ask you – are going to tell you, the tap. They have no knowledge that it comes from a snowpack or from a well or from a river. They don't understand that. They have not made that connection, and again, because earth science have removed this from their curricula. We're trying to actually get back in sync with that and trying to actually do a lot of youth recruitment simply by education, showing them what the hydrological cycle is and the importance of water conservation and how they directly interact with it.

I want to introduce you guys a little bit to our program, what we do here and how – (inaudible) – we've actually built this program to be able to try to navigate it not only locally, but also nationally.

MR. : Michael, I think if you're going to – let's do this in about 30 seconds, and then we'll give people your contact info – (inaudible) –

MR. SMITH: Absolutely. What we've done here is we've just – (inaudible) – this one particular slide, but it's – what we've done here is we've – (inaudible) – figured out a way to be able to departmentalize what we do. We have our degree program, which is an AES (ph) degree program. We are turning it into a four-year, but we're four or five years away from truly actually implementing that. But we have our international development program, which is basically train the trainer, and then we have our – (inaudible) – program. That's designed for that group of people who need to get in the workforce immediately. And then we've implemented a series of

laboratories to actually get students involved with the hands-on learning, so they're (truly ?) not navigating through textbooks and whatnot.

And then of course we – it was in the program – we do have our very own job placement program. One thing about our program that we pride ourselves on is putting people in the workforce. We don't just educate them and send them out the door; we actually make sure that they get employed and that they are gainfully employed in the right place. And then lastly is our outreach and online education program to be able to share with education nationally.

So I really won't go too much further into our program than that – (inaudible) – like I said, because it kind of talks a lot about our curriculum itself and some of the core programs that we actually have and the length of our elected programs in terms of what we do, so that we have a certificate program. And pretty much like I said, it's designed to be able to be able to build people's portfolios, give them the proper education so they can actually apply it directly into the industry. One thing we do not want to do is have them on the concept that they come into this program and they have to get fully educated with a degree before they're actually job-eligible. That's not the plan at all. The plan here is to get them licensed, and we do that early on, and then eventually they will come back and complete their degree if they so desire. But our job right now is to – basically to fill the workforce itself.

So I hate to kind of cut it short a little bit, but I know that – like I said, I've got one minute left to wrap things up. So – (inaudible) – but the whole program is online, so those of you who are watching the program, there's only a few slides left. You're more than welcome to go ahead and download those and view them on your own. It just gives us more of – gives you a little bit more information about what we do here.

So thank you very much for your attention and the time and the opportunity to speak with you today.

MR. : Great. Thanks, Mike.

And then, Mike, I'm thinking – do we have your contact info? So there you go.

MR. SMITH: Yes, you do.

MR. : Actually, I don't think your email's on there, but we'll send it out with a thank you to this email. We'll send out Mike's contact info so y'all can get in touch with him to get more info on the program.

All right, let me – (inaudible) – just a couple minutes. I've got a few questions, and somebody asked about Christine's contact info, so let me hit that first.

Let me – so I'm going to ask the speakers to answer this very briefly, each one. There's Christine's, by the way. So the first question – I mean, so you're a college. You're just in the – setting something up in water management in some capacity. How do you quantify the need in your local level? Is it – is it labor market info that you're relying on? Is it the partnerships with

utilities? I mean, give me a sense of where folks can go to really try to figure out what the actual quantity of potential opportunities are. Mike, maybe that's best for you. Why don't you give us your, you know, 30-second answer on that.

MR. SMITH: Boy, with regards to, you know, the workforce needs that are out there, if I'm understanding your question correctly, they're all across the board. I mean, the aging workforce that's out there is in every single element of this particular industry, but primarily – (inaudible) –

MR. : (Inaudible) – where do you get it, I guess? Is it – are people relying on the standard labor market information to learn about it? Are they relying on just relationships with their utilities and the community? Where do people – like, how do you – how do you define that?

MR. SMITH: Most of the surveys that we actually reference this from is actually from the American Water Works Association when they do their labor market and job service center reports. Most of that comes from them. And like I said, the aging infrastructure right now is – it's in a pretty scary situation. So (all of it ?) comes from, you know, survey data that's actually been done by national organizations.

MR. : OK, so AWWA.

MR. SMITH: Yes, the American Water Works Association, correct.

MR. : Yep, OK, because I think that's a great resource.

Jeremy, I want to go back to this slide if I can and just touch on the sustainability – the list that I had you read out. I guess the question, if I could have each of you speak to it briefly, is – so this – Jeremy, you mentioned the systems thinking around resiliency. You mentioned knowledge of greenhouse gas emissions, the connection there to water. So the question, I guess, is, Christine, from your side, at a national level, are those similar emerging issues that you're finding from your partners? And then Jeremy, how are you – in your future conversations, how are you integrating that into the conversations? And then Mike, you know, at your end, at actual courses and programs, are you – are those things concepts that you're sprinkling throughout your program, or do you have – you know, are they kind of separate courses or what? Again, got to, again, keep your answers real brief, everyone, but I'd like to hit that.

MS. RADKE: Yes – (cross talk, laughter) – definitely a national thing, and we're all looking at it, sustainability, resiliency, all part of that integrated (water-fed ?) management thinking.

MR. : OK. Jeremy, what about you, on the conversation? You talk about that stuff?

MR. PICKARD: Yeah, and what we're doing is when we go – sometimes they get refined just a little bit, so nationally, depending on the region of the country we're in, you may see a little bit stronger push for one of those areas over another one. And that's really the purpose of why we're going around and doing these national conversations is to try to figure out what are the emerging issues and future trends for your region of the country. And so those get fleshed out

just a little bit more depending on the region that we're in and depending on whether it's a hot topic for that area.

MR. : OK. And then Mike, on your front, in actual – you're teaching the class. I mean, are you – how do you actually bring that stuff into the classroom? Are those – you know, sustainability-related things, greenhouse gases, resiliency, things like that?

MR. SMITH: With those issues, those we actually bring into our lecture program. And the whole concept of sustainability is truly integrated through the program. But yes, we're heavily focused on our elective side of the house, versus our core requirements. The core requirements are focused around what the industry needs in terms of a skilled workforce. With sustainability and some of the green concepts that we're adopting, it's all sprinkled through our elective process. So say, for example, we have a solids management class – (inaudible) – we're actually integrating different technologies, new concepts that's going to – you know, some of them (leave ?) a very minor impact on the environment and yet be very efficient and very effective with their operations.

MR. : Great. And so Mike, you said your stuff's available. I mean, if somebody were to look at it – so we get this question a lot, how do you integrate sustainability into programs like water. If someone were to look at what you've got available online, would they be able to see how some of these – the sustainability concepts are integrated? Is that something that's clear?

MR. SMITH: Absolutely. Yeah, very clear, absolutely.

MR. : OK.

MR. SMITH: Yeah, just go onto the website itself, you know, [www.rccc.edu/wqm](http://www.rccc.edu/wqm), and you'll see how sustainability is just dominant throughout our entire website.

MR. : OK, great.

All right, let me end on this, and I appreciate y'all on the phone here – you know, pass the time a little bit, but this is just rich stuff. So – (inaudible) – career path, as Mike's – you know, you've – what you brought up actually really is sort of – it looks to me like a pathway. But what else have you all seen out there from – maybe from a two-year to even a four-year degree program to a career that's – that looks really good on that career pathway side in water? Have you seen a lot of that? Is that – is it just emerging, or are there things out there? Where do people go to find that?

MR. SMITH: Well, really, again, you know, the whole concept with a career pathway in this industry is going to be based a hundred percent on licensing. How far you want to go within your own personal career will guide your education for sure. There's no way to be able to pass some of these new testing protocols and some of the things that have been adopted through ABC testing, which is now the protocol nationally, as the American Board of Certification – they actually write a nationalized certification testing program. There's no way to be able to pass those tests without some sort of education. Again, there's nothing that really drives a mandate

that you have to have a degree or – whether it be a two-year or a four-year degree program, to be able to work in the industry. That’s not enforced anywhere. It just really depends on how well somebody wants to be paid and how far they want to go in the industry is what’s going to drive their educational desire.

MR. : Got it. And then do you have any relationship at the four-year level around water?

MR. SMITH: Yes, there is. I mean, we’re currently operating with several articulation agreements, one focused on engineering, one focused on the blue – I’m sorry, the white-collar workforce, the financial planning and business management side of operations, another one in, you know, R&D, research and development, primarily focusing on the environmental side. Eventually this program, through legislation – we just got approved to take this to a four-year program, but I’m really not prepared to tell you what that’s going to look like because we need a lot of research to be able to truly map that out to be something that’s really going to benefit the industry, to tell you the truth. And that’s very, very fresh information. That’s only a couple weeks old. And so we’re very, very fresh in trying to do research on this to figure out what that’s going to look like.

MR. : That’s great. I mean, I think people – a lot of people will be interested in what y’all come up with on that front. So keep us – keep us in the loop on that.

MR. SMITH: Absolutely.

MR. : All right – (inaudible) – questions – (inaudible) – but we said we’d keep y’all for an hour. We’re already a little past that. But I want to thank Christine, Jeremy and Mike. Thanks so much for your time. This is great stuff. Slides will be available to get them. And thank you all for being a part of this event. Appreciate it.

MR. PICKARD: Thank you, Todd (sp), for having us.

MS. RADKE: Thanks, Todd (sp).

MR. SMITH: Absolutely. Thank you all participants for listening, and again, thanks for having us, Todd (sp).

(END)