Oklahoma Innovations Radio Show

Air Date: May 16-17, 2015

Guests: **Robert Puls**, Oklahoma Water Survey and University of Oklahoma College of Atmospheric and Geographic Sciences; **Derek Smithee**, Water Quality Programs Division for the Oklahoma Water Resources Board; **Michael Graves**, Garver Engineering

>> From the OCAST Radio Network, this is *Oklahoma Innovations*, a weekly science and technology radio magazine, brought to you as a service of OCAST, the Oklahoma Center for the Advancement of Science and Technology. OCAST is the state's only agency whose sole focus is science and technology. The OCAST mission is to identify and fund promising research and technologies that allow Oklahoma to compete in a global market economy from our own backyard. This program features some of Oklahoma's most gifted scientists, inventors, entrepreneurs, manufacturers, educators and business leaders who all have one common goal: developing technology based economic growth for all Oklahomans. Now, here are your hosts Gary Owen and Tessa North.

[Music]

>> **Gary Owen:** Thank you, Randy. And welcome Oklahoma to another edition of Oklahoma Science and Radio Magazine, Oklahoma Innovations. Gary O.

>> **Tessa North:** And Tessa North.

>> **Gary Owen:** That's right. And Tessa, you have some -- some information for us on the OCAST calendar that you want to get out there to radio land, right.

>> **Tessa North:** We sure do. Over the last couple of months, we've been letting everybody know that opportunities for OCAST funding had arisen and we're actually going to announce all of the awards for all of our programs -- intern, health research, OARS and plant science, on June 16th. So we should have a new batch of winning applicants that we can let you guys know about and if you have applied, you can contact us on June 16th.

>> **Gary Owen:** By the way, speaking of plants, I forgot to mention at the beginning of the program, if you just tuned in, our show this week is going to be talking on the subject of water and the reuse of water. And you're going to get a lot of information that you've probably never heard about water usage in Oklahoma, got some really interesting information and I think you'll find it fascinating.

>> **Tessa North:** Absolutely. Actually, one of the things that I wanted to mention to all of our listeners is that our guests that are here today are going to have a public forum on water reuse on June 18th at the National Weather Center at OU. So that's something that we'll talk a little bit about later on in the show. But if you're interested in possibly finding our more information about registering for the public forum, you can visit oklahomawatersurvey.org to find our more information or get in touch with the sponsors. Also coming up, in the -- in the next few weeks, the 20/2015 ISARRA Conference and if you remember back from a couple of shows ago, that's the International Society for Atmospheric Research using Remotely-piloted Aircraft. That conference will be held at OU on May 20th through the 22nd. So if you're interested in learning more about the use of unmanned aerial systems to investigate the atmosphere, you can contact ISARRA, that's I-S-A-R-R-A.twenty -- that's the number 20 spelled out -- .15 also spelled out

@ou.edu. So that's isarra.twenty.15@ou.edu. And then finally, Tech Trek, OK, which is a really cool week long science and math summer camp designed for girls who are going to be in eighth grade to learn more about STEM and hopefully help them gain some self-confidence in STEM fields, has been scheduled. These workshops are going to take place first at SWOSU in Weatherford, June 7th through the 13th. And then June 14th through the 2th, another conference will be held at TU in Tulsa. So this is an awesome event for young girls who are interested in learning more about science and math. And if you are interested in finding out about how you can get your daughter, sister, cousin, neighbor, friend, whoever, enrolled in this workshop, you can -- you can check out techtrek-ok.aauw.net for more information.

>> **Gary Owen:** I'm glad you -- you're having to say all these big things today instead of me. Wow, that's -- you got a mouthful there.

>> **Tessa North:** That -- that's a lot of acronyms in -- in these --

>> **Gary Owen:** Yeah, I guess so.

>> **Tessa North:** -- contact -- calendar dates.

>> **Gary Owen:** Okay, so what do you have in the world of Oklahoma or I guess, innovations and history? Got a good one this week.

>> **Tessa North:** That's right, so 31 years ago today or this month anyway, a 19 year old University of Texas student began selling computers that he put together himself in his dorm room. By his mid-20's he was the youngest CEO on the Fortune 500 list and today he has a net worth of over $22 million. His name -- Michael Dell and his company, obviously is Dell Computers. So what started as a $1000 investment by a college student in his dorm room turned into a world -- turned him into a world leader in the providing of personal computers. So that's pretty awesome.

>> **Gary Owen:** Pretty awesome. And who does the Oklahoma spotlight fall on this week?

>> **Tessa North:** Today our spotlight is actually on the guest that we had on the radio show a couple of weeks ago, you may remember hearing from Rafal Farjo when he was talking about his company, the Oklahoma City based, ICRO. They have formed a pretty cool collaboration with a company out of Seattle called New Medics [assumed spelling] to facilitate the development of [inaudible] 108, which is a first in class small molecule to treat a number of ophthalmic disorders that lead to blindness including diabetic retinopathy, which I think we are all pretty well familiar with here. So under this agreement, new medics will have access to EyeCRO's eye drops, which are the really cool drops that [inaudible] was talking about that deliver drugs to the front and the back of the eye instead of using the gigantic needle that a lot of people are accustomed to seeing for eye treatments. So ICRO will receive a royalty and new medics will receive a license for exclusive rights to formulate their class of molecules utilizing the my drops platform. So this is really cool because hopefully this collaboration will help to further advance my drop -- the my drops platform into clinical trials, which hopefully means that these less invasive, more affordable drops for ocular diseases can be in the hands of patients much sooner than it originally expected.

>> **Gary Owen:** Awesome stuff, awesome stuff. We're going to switch gears now and talk about our subject this week, water reuse in Oklahoma. It is the topic of upcoming educational outreach forums, where they've already had one and got a couple of more going on at the University of Oklahoma. The meetings are designed to inform the public and to allow people to provide input

for Oklahoma's future water resource planning. Of course, they're going to be talking about waste water recycling, reclamation and reuse -- many options that -- this effects a lot of communities in Oklahoma, particularly a serious issue for those who don't have the resources that many of the metropolitan areas have. And we have three interesting guests who are going to be on the microphone this week. First, Dr. Robert Puls, who is director of the Oklahoma Water Survey and associate professor in the College of Atmospheric and Geographic Sciences at the University of Oklahoma. Now that was a mouthful, eh. And then we have Derek Smithee, he is chief of the Water Quality Programs Division for the Oklahoma Water Resources Board. And our other guest is Michael Graves, he's vice president and strategically claimed water planner for Garver Engineering. This is going to be some interesting, interesting stuff this week. First of all, gentlemen, welcome to the program. I'm going to open the mic up to Dr. Robert Puls. Tell us a little bit about your background quickly if you would, and how you got into this kind of research.

>> **Robert Puls:** Okay, well I got my Ph.D. at the University of Arizona in water science. I worked 25 years for the U.S. Environmental Protection Agency at their research laboratory in Ada, Oklahoma where we did primarily ground water research looking at remediation and protection of those resources. And then in 2012, I retired from EPA and took the position at OU as the director of the Oklahoma Water Survey, which is a new entity at OU joining other surveys there -- the Climatological Survey, the Geological Survey, the Biological Survey and the Archeological Survey.

>> **Gary Owen:** This public forum on water reuse is going to be May 14th at the National Weather Center on the campus at OU from 6 to 8:30 p.m. You've already had one, you got this one and you've also got another one on June 18th. Tell us why you came up with this forum because we know of course, the public has a lot of concerns about water, but tell us how this forum came about.

>> **Robert Puls:** Well, a group of us, the people here on this panel today and others across the state and at the university have been interested in this topic for some time because it's becoming more and more apparent that as we enter a time of extended drought, which climate models project, that we are going to have to manage our water better. And reuse is going to be one of t hose things we're going to have to start looking at to be able to manage our water resources better in the future in the face of severe drought. So the purpose of this forum is to really start to educate the public in particular about water issues here in the state.

>> **Tessa North:** Dr. Puls, you've mentioned that the Oklahoma Water Survey is a newly formed entity, I think many of our listeners may be familiar with the Oklahoma Water Resources Board, which is a different but complimentary agency and all of these sort of work together. Can you talk a little bit about how the water survey is different from the Water Resources Board and possibly how the two interact?

>> **Robert Puls:** So the -- the Water Resources Board, primarily they look at water quality issues and also water quantity issues. So they're the state agency that's primarily responsible for basically keeping track of the water budget in the state and then allocating water to different types of users, whether that's for oil and gas, whether that's for irrigation, thermoelectric power, what have you. But they also have a water quality function as well, but it's -- but it's all more regulatory in nature, whereas the water survey function is really more one of research, education and outreach. So, we see our role as basically, a lot of it is taking the good work that some of the

water agencies here in the state like the Water Resources Board and the USGS do and help to get that information out to the public.

>> **Tessa North:** Okay.

>> **Gary Owen:** All right, Derek, let's get you on the microphone. Now you -- you obviously have got a pretty lengthy background here. Tell us a little about you.

>> **Derek Smithee:** Well, I started believe it or not, I don't know I've become an old man, but I started 31 years ago at the State Health Department, transferred to the Water Board in 1987 doing water quality standards work and actually, April the 19th, 1995, the day of the bombing, people may not remember, of the Water Resources Board was across the street from the Murrah building.

>> **Gary Owen:** That's right.

>> **Derek Smithee:** And so we had two people killed and I and several others were injured and on that very day, I'd been promoted to the chief of water quality.

>> **Gary Owen:** Oh, my.

>> **Derek Smithee:** So I've been the water quality chief at the Water Board since 1995 doing water quality standards, monitoring and lakes work in the state of Oklahoma. And the last couple of years, amongst many other hats that I've been wearing, a reuse has become much more of a focus of what we do because when we completed the water plant a couple of years ago at the Water Board, it became clear that this reuse piece of water quality management as we head into a drought cycle, reuse has to be a part of our water quality and quantity management toolbox. Now it may not be appropriate everywhere all the time, but it's got to be a part of that water management piece. So we've begun to work on how we can manipulate or adjust our existing regulatory environment to facilitate the use of reuse of the -- the reuse of water, whether it's waste water or whatever it might be, or sometimes it's even brackish or marginal quality water that's a little bit mineralized for use in irrigation or municipal water supply or private water supply.

>> **Gary Owen:** Wow. I don't want to ask another question here because we're coming up on a break, but we have a lot of stuff to talk about and a lot of concerns among Oklahomans. I mean, I wouldn't say fear is the word, but concerns because of dry, particularly in west and southwest Oklahoma. Fortunately the rains are helping a lot and we've been blessed with a lot of that in the last couple of weeks and so hopefully that's going to ease tensions about the drought, but we still have a lot of work to do on the state when it comes to water usage. So we're going to talk more about that when we come back on your science radio magazine. Stick around, we have a lot to talk about and maybe get a little wet here on Oklahoma Innovations.

[Music]

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>> Now back to Oklahoma Innovations with Gary and Tessa on the OCAST Radio Network.

[Music]

>> **Gary Owen:** This week we're talking about water usage in Oklahoma and water reuse and recycling of water. That's what we have focused on this week's Oklahoma Innovations Program. We have three interesting guests who are in different fields that deal with water, Dr. Robert Puls, who's director of Oklahoma Water Survey at the University of Oklahoma and the College of Atmospheric and Geographic Sciences. Derek Smithee, who we were talking with right before the break who's chief water quality programs at the Oklahoma Water Resources Board, and Michael Graves, who we're going to talk about now -- talk with now. He's vice president and strategic [inaudible] claim water planner for Garver. Garver's a -- an engineering firm, is that right?

>> **Michael Graves:** That's correct, yes.

>> **Gary Owen:** Are you primarily in the water field?

>> **Michael Graves:** That's right. Yes, I spent the last 21 years of my career in water, started in municipal service actually, having the chance to operate a lot of these treatment systems that we'll probably talk a little bit about today. And then, for the last 12 years in the private sector implementing projects.

>> **Gary Owen:** Wow. Okay, so there's some interesting statistics here that was provided to us that raised my eyebrows. One of the big ones was the state's largest ground water basin and aquifer in western Oklahoma. Who wants to take that? Because that -- that's a --

>> **Michael Graves:** Well, the Ogallala's one of --

>> **Derek Smithee:** -- About 22 major ground water basins [inaudible] --

>> The Ogallala?

>> **Derek Smithee:** The Ogallala, it's named after the Sioux Tribe, the Ogallala Tribe. It extends all the way from North to South Dakota, all the way to Texas. And in Oklahoma, it covers the panhandle and little bits and pieces of like, Ellis County and far western Oklahoma. It's been a -- it's a major deep ground water aquifer that's stores a whole lot of water and so most of the irrigated agriculture that people see when they're driving to Colorado through the panhandle of Oklahoma to go snow skiing, the water that irrigates those corn crops comes from the Ogallala aquifer.

>> **Gary Owen:** We haven't had a lot of moisture in those regions in the last couple of years, what's happening there?

>> **Derek Smithee:** Well, which is why it's so critically important, Gary, that we know what's going on in those aquifers. One of the things that the water plant pointed out was a deficiency in information that the state of Oklahoma had on not only surface water, but especially ground water that we didn't have a monitoring program in place to see how is the Ogallala and the other

aquifers responding as we pump water out of that aquifer for crop irrigation or for water supply. The majority of ground water is actually pumped for crop irrigation. We just didn't know how much was being taken out. So, we now have -- because of the water plan and funding through the legislature, a monitoring program to look at how our aquifer's responding to the withdrawal of ground water. People might now realize it, but we don't need information to make water quality and quantity decisions, but we need information to make good water quality and quantity management decisions. So hopefully as we acquire more data that can feed into our decision making processes, when water laws were first envisioned in Oklahoma about 50 years ago, water was philosophically viewed as a resource for economic development, not necessarily as a protection. So we didn't necessarily view water to protect it for future generations, we wanted to use it as an economic engine. That's worked very well in the state of Oklahoma, but as climates changed, as people have changed, as demographics have changed, as technology has changed, the water plant started to look at -- is that still the right way to deal with water resources in this state?

>> **Gary Owen:** When you look at the conditions of Oklahoma right now, first of all when you look at the metropolitan areas, let's look at those two entities, [inaudible] by themselves and you look at the surface water usage. Let's take Oklahoma City as a good start and Tulsa of course, but Oklahoma City has grown a lot over the last decade. I mean, just an influx of people moving in, a lot of development, a lot of business growth here -- that has impacted everything from highways to water usage. Then when you add to the impact of the climate changes with drought issues and we're not as -- we're not as -- as much of a serious issue as we are in western and southwestern [inaudible], but we do have those issues. When you look at a lake like Lake Hefner in Oklahoma City, I mean, that lake dropped dramatically over the last year, year and a half because of the lack of water. A dividing line here, giving our public just kind of an idea the differences between aquifers and lakes and those resources that we open that tap, we just think that water's going to be there. But we have some real concerns among people like you to say, "Hey, look, that water's precious resource and with the climate changes, don't expect the water to fall out of the sky be it whether it's rain, snow or what have you," we're going to have to find ways to recycle and reuse water to keep these conditions, the demand on water usage plentiful. So who wants to take that mic?

>> **Robert Puls:** Well, in -- in the last several years, when we've had this severe drought, the effects of that have been most noticeable in our surface water supplies as you mentioned, just looking at some of the -- the reservoirs or lakes in the state.

>> **Gary Owen:** Right.

>> **Robert Puls:** But as we go low on our surface water, that causes us to use more of our ground water resources, water that's in our aquifers. And for instance, take the case and point of the Ogallala that you bring up. We do know that that's been drawn down several hundred feet over the last several decades. And that water recharges very, very slowly. And so that's -- we're taking that water out of storage, out of a bank, if you will --

>> **Gary Owen:** Yeah.

>> **Robert Puls:** -- and using that water now, but it's not going to be replenished any time soon. And this could be the same situation for some of our other aquifers if we increasingly rely on ground water when we have shortages of surface water.

>> **Gary Owen:** Well, look at all the people in rural areas and in areas that live outside the metros, where they rely on well water. I mean, those people are being affected as well, right. Because that's -- that's -- that water comes from aquifers, right?

>> **Michael Graves:** Absolutely, we have some 800,000 people that drink raw ground water, where they drill a well at their house.

>> **Gary Owen:** Yeah.

>> **Michael Graves:** So it's a -- it's a real issue for them as well at the -- the water plan had a goal of -- it's called the water for 2060 --

>> **Gary Owen:** Yes.

>> **Michael Graves:** -- and the goal for the water for 2060 was in 2060, the state of Oklahoma will use no more water in 2060 than it uses today.

>> **Gary Owen:** Oh, wow.

>> **Michael Graves:** Now, is that an aggressive solve?

>> **Gary Owen:** That's not realistic.

>> **Michael Graves:** Absolutely. Well --

>> **Gary Owen:** It is?

>> Michael Owen: -- that's -- that's a question and we believe that it is. Now it's going to be difficult and it's take a lot of work and it's going to take a lot of cogs to turn in a unique way. We've got to look at loss, water loss and distribution. We've got a lot of water systems that lose up to 30% of treated water just to get it out to their people. So, getting it that, getting it water reused, how do we reuse waste water? All those things have to work in concert and we believe [inaudible] that we can use no more water in 50 years than we do today.

>> **Gary Owen:** Coming up, a lot more to talk about when it comes to water and water reuse with our guests, Robert Puls, Derek Smithee and Michael Graves, when we return on Oklahoma Innovations.

[Music]

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[Music]

>> **Gary Owen:** Welcome back to Oklahoma Innovations. This week we're talking about water and water reuse. Got a couple of a things I want to tell you before we go back to our interview. First of all, those of you that have just joined us on the half hour here, there is a public forum on water reuse. Going to be held at the National Weather Center, the campus of OU -- May 14th and then there's another one, June 18. We highly encourage you if you have concerns about water in your area, that you attend and get more information. This is an educational outreach forum to the public at no cost. And the meetings are basically designed to inform the public and allow people to provide input for Oklahoma's future, water resource planning. Here's an interesting statistic, Oklahoma has approximately 55,646 miles of shore line along lakes and ponds. Oklahoma contains 1401 square miles of water area in its lakes and ponds, and Oklahoma has approximately 167,600 miles of rivers and streams. That's a lot.

>> **Tessa North:** That sounds like a lot of water to me.

>> **Gary Owen:** This is a lot of water -- a lot of water as we say.

>> **Tessa North:** So before the break, we were talking about this very aggressive plan for -- to use no more water in 50 years than we use in 2010, and [inaudible] Gary asked, "Is that realistic?" And you guys seem to think that it is, it was a lot of work. It's something that we can achieve, so how on earth are we going to make that goal?

>> **Gary Owen:** Especially with all the challenges we've already met in the last several years.

>> **Michael Graves:** It's certainly a challenging goal, but I think it is -- it's definitely attainable. And we've got to look at some of the things that Derek mentioned earlier [inaudible] conservation efforts that can be employed, water loss is a big issue, making sure that the fresh water that we've invested, costing to develop for drinking purposes actually gets delivered to those consumers and we don't have large leaks that we have to deal with. There's a -- that's a -- that's a very significant problem throughout the state and particularly small -- smaller

communities. But obviously recycling and reuse of that water is going to be or at least play a very important role in ensuring that we meet that goal.

>> **Tessa North:** What -- what is the difference between recycling and reuse when it comes to water?

>> **Michael Graves:** Well, typically when we -- we talk about recycling of water, it's more of a small scale use, particularly like gray water usage. The -- the water that is used for washing clothes, sink usage, things of that nature, not the -- the usage of water that ultimately ends up at a wastewater treatment facility. The wastewater treatment facility is more of the reused type of water. That's -- that's a large volume of water that is collected from homes, businesses, throughout the community and -- and discharged back to the environment after significant treatment is employed at these wastewater treatment facilities. And if you think about it, that's a pretty consistent amount of water. We usually take approximately the same amount of showers every day, we wash the same amount of clothes every day, we wash same amount of dishes every day -- that water that goes -- that leaves your home or leaves your business is a pretty consistent amount of flow after it's treated and discharged back to the environment. There are other things that could be used for that water. There are nonpotable uses for that wastewater and then there are ultimately potable uses for that wastewater. And the potable part gets a little bit scary sometimes because it did come from someone's sanitary sewer system at one point.

>> **Tessa North:** Right.

>> **Michael Graves:** But what we have to remember is that all of our wastewater treatment plants are discharging into -- back to the environment now and that discharge location is upstream of someone's water supply.

>> **Gary Owen:** So engineering wise, it is my understanding a lot of new homes, in particular areas of the country, I don't know whether they're doing this in Oklahoma yet or not -- builders are now required to install certain piping so that water is distributed to particular recycling systems. Is that true?

>> **Michael Graves:** That does happen. We haven't seen that take off a great deal yet in Oklahoma, there are some cities that have adopted gray water use ordinances that are [inaudible].

>> **Gary Owen:** Oh, gray water, that's right, yeah.

>> **Michael Graves:** There's some legislation passed recently at the capital to -- to implement that, but again, that is a much smaller scale and it's going to take several hundred communities to adopt something like that before we can meet that goal. It's really the larger reuse of treated wastewater that helps us get to that 2060 goal of no more freshwater.

>> **Gary Owen:** Derek, what would you say -- I think we touched lightly on this in the beginning of the program, but for those who have just joined us -- what is the biggest demands of usage in water when it comes to everything from agriculture to oil and gas and industry? Who -- who pulls the biggest demand on water today?

>> **Derek Smithee:** Irrigated agriculture, Gary, is -- uses almost -- almost half -- 41% --

>> **Gary Owen:** Wow.

>> **Derek Smithee:** -- of all freshwater usage is devoted to irrigated agriculture. Next in line [inaudible] private water supply uses a little over 30% of all fresh ground water is used -- what

people recognize as water supply. And so those two areas account for almost 80% of all water usage, just irrigated agriculture and [inaudible] private water supply

>> **Gary Owen:** So what happens in communities and say, western and southwestern Oklahoma where they've had tremendous amount of droughts, stress, draining the aquifers and of course, when we talked about irrigation, most of that is ground water. It's not coming out of the lake.

>> **Derek Smithee:** Especially in the western part.

>> **Gary Owen:** Yeah, that's what I'm saying, yeah. So a big demand, and so those aquifers that we've discussed earlier are getting really drained. What is the answer? I mean, where do we go, how do we manage that better?

>> **Derek Smithee:** Well, that will be -- that will be far sided. Recognize that the drought that we're now experiencing isn't a surprise. We've know it's been coming for a while.

>> **Gary Owen:** Really?

>> **Derek Smithee:** Oklahoma's had wet and dry cycles throughout its history.

>> **Gary Owen:** That's true.

>> **Derek Smithee:** And in general it's about a 25 or 30 year period [inaudible] so, when this drought arrived, you know, a couple years ago, we knew it was on the way. So how do you respond, one is of course, conservation, one of course, is taking the wastewater, that gray water and maybe using it more effectively and not losing a lot of that to evaporative loss. In Oklahoma, especially in the western part of the state, a reservoir can lose five feet of water a year just due to evaporation.

>> **Gary Owen:** Wow.

>> **Derek Smithee:** So, is there a better way perhaps, we can manage the utilization of those -- of that water supply -- of the gray water, the discharge water to help water supply uses or irrigation.

>> **Gary Owen:** Tessa was surprised about this and I was too, about the evaporation. Talk about that. That's -- this is something they probably should hear.

>> **Derek Smithee:** Well, most people -- it's surprising to me how many people that live in Oklahoma don't know Oklahoma, you know, in southeastern Oklahoma, we go from -- I say it all the time, American alligators to the panhandle and [inaudible]. So, we get from 50 inches of rain a year to 15 inches of rain a year. And especially in the western and southwestern part of Oklahoma, where you have a lot of wind 100 degree days --

>> **Gary Owen:** Yeah.

>> **Derek Smithee:** -- you can lose a lot of water to evaporation. Now, you say lose, really it's not lost, it's --

[Inaudible Speaker]

-- sent somewhere else, but we lose it out of Altus-Lugert Reservoir or [inaudible] and that water is lost for water supply or irrigation capacity in that part of the state.

>> **Tessa North:** Now there's been a lot of talk about drought, certainly here today, but also I've read this drought that we are in -- well, I guess first of all, are we technically in a drought? Is the drought still coming?

[Multiple Speakers]

We're in a drought.

>> We are.

>> **Gary Owen:** Robert?

>> **Tessa North:** So, does this -- is this -- I've heard that this drought is perhaps a historic drought. What -- what is going on right now that makes this drought something that's so -- that we really need to focus on?

>> **Gary Owen:** Robert Puls can probably answer that.

>> **Robert Puls:** I think the thing that we are looking at down the road here are some of these climate projections that scientists are -- are making in terms of climate change and what impacts that would have on this region of the country. And most of those projections indicate that it's going to be hotter and it's going to be dryer. We're going to have more 100 -- 100-degree days then we're -- then we're used to having. The number of those days might double or triple on an annual basis. We're going to add more high temperature at night days also, and so this is going to not only aggravate water availability issues, but it's also going to impact energy issues.

>> **Gary Owen:** Well, we know that metro areas have tried to enforce conservation by the even/odd watering and those kinds of things. Do you see Oklahoma running into a situation like California? I mean, California has gone so dramatic that they've gone to a new ecological system of forget the lawns, and put in, you know, landscaping that doesn't require watering that much.

>> **Michael Graves:** Gary, I think there are certain regions of the state that -- that could see that --

>> **Gary Owen:** Really?

>> **Michael Graves:** -- as the drought continues and worsens. But like, like Derek mentioned earlier, we certainly are a state divided with regards to our rainfalls. And then, I could see that occurring for -- for our Tulsa metro area or the eastern side of the state anytime in the near future. But really, we've done a, I think a really good job today defining the problem --

>> **Gary Owen:** Yeah.

>> **Michael Graves:** -- which is the drought and the water supply usage in general and -- and really would like to impress upon you that -- that the wastewater and the treated wastewater that is a sustainable resource, can be evaluated and implemented as a -- an alternate water supply. There are nonpotable, nondrinking uses for that water --

>> **Gary Owen:** Like for industry and agriculture.

>> **Michael Graves:** That's correct. The state of Oklahoma, particularly the Department of Environmental Quality has done a fantastic job of implementing new regulations relative to the use of nonpotable wastewater. And those projects around the -- around the state are beginning to -- to come to fruition. And those are having significant impacts on water supply, reducing that

irrigation demand from the drinking water system during the summer is taking a -- making a large benefit in the overall preservation of those water supply reserves.

>> Gary Owen: Man, that's a -- oh, we have a -- you -- you're a wealth of information. And so, what is the future of water conservation, reuse and recycling. We'll touch up a little bit more on that when we return on Oklahoma Innovations. Don't go away.

[Music]

>> Gary and Tessa will be back after the break with more interesting conversation. This is Oklahoma Innovations on the OCAST Radio Network.

>> As a police officer one of the most dangerous parts of my job is arriving on a scene where an armed suspect has barricaded himself or we suspect some type of booby trap. We're most vulnerable when we don't know what kind of explosives or weapons are on the other side. It can be deadly.

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[Music]

>> Gary Owen: By the time you hear this program, we have mentioned earlier in the program that the public forum on water reuse, there was a date May 14th, it was already passed and of course, as many of you know, we take these programs. So, we want to tell you that the next and final public forum on water reuse is June 18th. I said May 14th earlier and obviously May 14 has passed by the time you hear this program. So, June 18th is the date, 6:00 to 8:30 at the National Weather Center at the campus of OU in Norman, Oklahoma. Before the break, we were talking with Michael Graves, who's vice president and Strategic Reclaimed water planner for Garver Engineering, and he was talking about the implementation now of recycling and the many advantages of doing so, reuse of water. You had a really good -- good plan going there. Tell us more about this and give us a visual of the types of people that'll be using this kind of program.

>> Michael Graves: Sure, Gary, you know, there are -- there are a lot of uses of nonpotable water, that's what we were talking about during the break. The -- one example is irrigation sources like golf courses, taking treated wastewater -- we call it wastewater affluent, that meets all the state's requirements on the -- with in regard to the newly developed reuse regulations. And pumping that water to a golf course for its use, typically overnight, not during play. It's perfectly safe to come into contact with the next morning. There's a lot of uses there, not only in the metro area, but in the southwest Oklahoma, as well as the University of Oklahoma uses Norman's treated wastewater affluent for irrigation purposes. There are other nonpotable uses, industries, cooling tower operations. In fact, Fort Sill military reservation down in Lawton has embarked upon a large scale nonpotable water reuse master plan, where they are not only interested in for energy uses, associated with cooling towers and so forth, but also golf courses, parade grounds and -- and filling stations for construction activities. So there are a lot of ways to

utilize nonpotable water to shave those irrigation demands in the summer, take those demands off of our drinking water system and -- and again, that preserves water supply.

>> **Tessa North:** So now the key is, you know, you've got these examples that you just gave about people who are -- who are implementing these policies and practices now, now the goal is to just get more organizations and groups to think this way. Is that correct?

>> **Michael Graves:** That's correct, that's -- that's certainly part of it, is for communities and organization to realize what their nonpotable uses are and be willing to evaluate and -- and convert those systems from drinking water to nonpotable water. But you know, another big area that should be evaluated for reclaiming this water is for potable uses. You know, there are certain treatment technologies now that are available to take treated wastewater affluent and produce a quality product, a product that is of the nature that is discharged back into our water supply reservoirs and can be reused and then retreated by the drinking water supply and distributed to the consumers. Now, currently in Oklahoma there are not regulations in place for that. DQ, as well as members of this panel you have today are working --

>> **Gary Owen:** That's probably coming.

>> **Michael Graves:** -- working very hard to develop those rules to ensure that they are -- they're safe, not only for the water body itself, the quiet community that's in that water body, but also downstream water treatment plants and ultimately the consumers. And so those regulations are being developed and, as you might expect, there's a major public education component associated with this as well.

>> **Tessa North:** So are there other states that do, you know, we know certainly Oklahoma has, you know, is in a drought. California, as we've spoken about, has -- has major issues with water as well. Are there other states that are in -- is this a nationwide thing, is the entire country worried about this? Are there stakes that you guys are sort of taking, you know, the -- the following examples of or are we the leader, or one of the leaders in -- in this water reclamation and reuse?

>> **Robert Puls:** Potable water reuse has been going on for decades in certain parts of the country. Places where you might expect, like southern California, south Texas, even Virginia. People hearing this broadcast will have missed the second forum, but in the second forum we had two case studies from north Texas. Wichita Falls now uses direct potable reuse for their drinking water because of severe water shortages. Also, other communities in north Texas are using indirect potable reuse. Indirect meaning that once the wastewater receives advanced treatment, it is then discharged into a environmental buffer, which could be a lake, a river or even underground before it is then extracted again and put into the water treatment plants. So, we have examples already where this is being done nearby here in north Texas.

>> **Tessa North:** Very cool.

>> **Gary Owen:** So, we talk about, like golf courses, for example, places for agricultural irrigation. The distribution of this is mind boggling because I mean, that sounds like an expensive venture when you think about how you've got to distribute all this reusable water. How does that work?

>> **Derek Smithee:** Well, it is -- it is -- it is somewhat expensive, Gary, the -- the treatment components at the wastewater treatment facility. The distribute components, that being pumping and piping to convey this water to, as you mentioned the golf course. Certainly have a capital

cost component that can be significant. But when you're looking at addressing a long-term drought, the cost comparison of a nonpotable network system as compared to importing water from some of the region, as compared to development of a new reservoir or development of -- of ground water. It might surprise you how cost effective that all of a sudden looks

>> **Gary Owen:** Well, and the other thing we have to look at is the effectiveness of water and what it has on the business economic impact of our state. When you look at the losses, and agricultural losses and oil and gas, if they don't have those resources, would you look at industry that uses water for cooling in some of their systems. I mean, there's lots of applications. We as a public, don't think about what kind of water is being used where. So these reusable applications you're talking about, it makes sense.

>> **Tessa North:** Derek, something that you had sent over in the notes to us or something that we have received in the notes about what you were going to talk about today, is that you wanted to point out that reuse is not free or risk free. Can you talk a little bit about what you meant by that?

>> **Derek Smithee:** Well, life always has a balance.

>> **Tessa North:** Right.

>> **Derek Smithee:** And at the end of the day, whether it's the water business or any other business, you realized in a lot of ways, you got to be careful what you do, you know, I -- my mother just bought a new piece of exercise equipment, a treadmill. And everybody thinks, exercise is great, we've all got to exercise, but every piece of exercise equipment says, see your doctor before you do this to make sure it's okay for you.

>> **Gary Owen:** Yeah, yeah.

>> **Derek Smithee:** So we need to make sure that as we proceed down discussions on reuse, that it's the right thing at the right time. Sometimes it -- it is conceivably possible, there could be things in that wastewater that traditional treatment technologies may not remove. We need to be careful when we do that to make sure that the public health is protected, that the aquatic community, as Michael said, is protected and that downstream users of that water resource don't have an increased cost to remove that wastewater component that was left in upstream. So there could be some additional risks, we need to make sure we understand them. We deal with them and we -- we address those problems in a upfront transparent way.

>> **Gary Owen:** By the way, we know that a lot of people have concerns over water rights usage. We know a lot of communities right now are struggling to try to define what -- how they can work together to share resources and those kinds of things. And politically, we don't get into those kinds o f issues on this program. Our -- our job here is to present the scientific research and technological advancements to help further revolve our water systems. And you know, one of the things that I think all communities have done and the state has done a great job, is making the public aware that look, we have a precious resource [inaudible] state of Oklahoma. We're in a drought cycle right now where we need to all participate of whether it's industry, whether it's the public use, we all need to be more conscientious when we open those taps or turn those valves on, to be conservative, be -- be proactive about conserving as much water as you can. And guys, we only have about a minute left. I wanted to once again, tell the public I was not aware -- sorry about this folks, at the beginning of the program, when this program was going to air, so our producer, Debbie Cox informed me that, "Hey, this is -- we're not going to air this program until

later." So, my apologies for the May 14th mess-up there. But the June 18th is -- the June 18th water use public forum, try to attend that if you can, 6:00 to 8:30 at the National Weather Center in Norman, Oklahoma. And gentleman, I have to tell you and Tess, I don't know about you, I've learned a lot more about water application usage in Oklahoma and how we can recycle and reuse. And we've just scratched the surface part in the pun on where engineering is going, where research is going and of course, the resources board, you guy provide a great service to Oklahoma and we encourage you to take a look at the OWRB website. A lot of great information there and, Derek, you've been great. Thanks very much. Dr. Puls, thank you very much for your insight and we hope you have a great attendance. And Michael Graves, thank you for bringing us details on the engineering side of things because Garver and organizations like yours help people out there really rethink how we can recycle and reuse water. It's great information. So, Tessa, I guess we'll talk to you next time.

>> **Tessa North:** See you next week.

>> **Gary Owen:** And we'll see you all of listeners, thank you for joining us each week on your science radio magazine, Oklahoma Innovations. We hope you have a wonderful week. Take care.

[Music]

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