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NEW APPROACHES AND INNOVATIVE TECHNOLOGIES TO IMPROVE WATER
SUPPLY

WEDNESDAY, APRIL 20, 2016

U.S. SENATE

Committee on Environment and Public Works

Washington, D.C.

The committee met, pursuant to notice, at 10:01 a.m. in room 406, Dirksen Senate Building, the Honorable James Inhofe [chairman of the committee] presiding.

Present: Senators Inhofe, Boxer, Capito, Crapo, Fischer, Rounds, Gillibrand.

STATEMENT OF THE HONORABLE JAMES INHOFE, A UNITED STATES SENATOR
FROM THE STATE OF OKLAHOMA

Senator Inhofe. Meeting will come to order. We apologize for being a few minutes late. We had a vote at 10:00 o'clock. So that is our daytime job and we have to do it.

Drought conditions are still, well, they have and they still affect many regions of the Country. California and Oklahoma have been dramatically affected. This morning we have witnesses that represent Orange County, California, promising new technologies of desalination, and the U.S. Army Corp of Engineers.

For the vast majority of the past six years, Oklahoma suffered from a devastating drought event that had nothing to do with global warming, I might add. As the drought reached its worst in the summer of 2014, more than 60 percent of Oklahoma was in the U.S. Drought Monitor's extreme category. More than 30 percent of the state's land area was experiencing "exceptional" drought or worse category.

Communities were rationing water. Some communities in the hardest hit areas looked to reuse of wastewater and tapping unconventional sources or those of marginal quality for non-potable uses in order to free up more valuable fresh water supplies.

Evaporating lakes and ponds in Oklahoma force cattlemen to

sell their herds and oil companies to search for increasingly expensive alternatives to continue production.

Abundant rainfall to excessive flooding conditions occurred nearly a year ago which caused dangerous situations throughout Oklahoma, but greatly improved our water supply, at least for the time being.

Our water supplies are also overtaxed with old and often failing infrastructure not able to keep pace with demand. These problems affect communities all across the Nation. It is not exaggerated to say that water supply issues limit growth and impose a very real threat to local and regional economies and peoples' quality of life.

However, in Oklahoma, the communities have started planning with business groups, agricultural interests and the energy sector on the local level to develop regional water action plans to resolve their mutual water problems. The foundation of the water action plan model demonstrates that water, as the key element in the State and local economies, it focuses on unifying and enforcing stakeholders to develop near, short and long term regional strategies to maximize reliability and diversify the supply of water.

The severe drought conditions Oklahoma encountered forced us to identify new sources of groundwater and further develop our existing underwater supplies to address our over-reliance on

surface water, to build infrastructure and pipelines to reliable underused water resources, building new wells, we have tried it all. City planning and regional planning has been the most efficient way of preparing to addressing the water supply problems but there are supportive roles for State and federal government to assist our communities and there are roles for corporate citizens as well.

For example, one area in Oklahoma hardest hit by the drought is the city of Enid, Oklahoma. One innovative example by the Koch Industries' is their nitrogen plant, one of the largest fertilizer production plants in North America, uses the city of Enid's treated wastewater for in-plant cooling water. Eventually, this re-use project will free up almost five gallons of water each day. That's almost one-half of Enid's total current usage.

The Federal Government can have a role to play in assisting the regional infrastructure planning among States. An example of that are the chloride control actions on the Red River between Oklahoma and Texas. These projects were specifically authorized by Congress dating back to 1966, with chloride control studies beginning at the Red River as early as 1959.

Chloride control actions in Oklahoma and Texas have and will provide new drinking water supplies, increase agricultural irrigation and improve downstream water quality. In fact, Mr.

Dalton, I am currently working with the Corps, their Tulsa district office, to develop a general reevaluation and review and record a decision for the Elm Fork Chloride plant in Oklahoma.

At one point, some reservoirs in Oklahoma were less than 20 percent capacity. Now, many are nearly full with multiple year supply. Although, presently the drought has subsided, plans must continue too, so that we know it is going to be coming back.

It is kind of funny, when we talk about this issue, for me anyway. This was an issue in Oklahoma way back when I was in the State legislature. The big issue at that time was transporting the water from eastern Oklahoma to western Oklahoma. It was really a situation that made everybody mad. So this is not a new situation and it is not just local to Oklahoma. It is across the Nation.

Senator Boxer.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF THE HONORABLE BARBARA BOXER, A UNITED STATES
SENATOR FROM THE STATE OF CALIFORNIA

I really want to thank you so much for this hearing. We have some contentious hearings, I do not think this one will be such. Because we are going to discuss innovative technologies to improve water supply. This is something very dear to me, and significant for my home State of California.

I tell you, I have gotten into some pretty heated conversations, I was telling the Chairman, in my State, because I really do support these technologies. Others just turn away, say, it is too expensive or, we shouldn't do this. There could be unlimited supplies of water for growth and all the rest.

To me this is a moment in time, whether we believe climate change is causing these droughts or not, what is the difference? We don't have to fight about that. The fact is we are dealing with these droughts.

And so I know this issue is dear to me, as I see what is happening. Even though we have had El Nino this year, it didn't live up to expectations. It certainly has done a lot to help us. But we know we are looking at long-term problems. We have horrible arguments between all the stakeholders, whether between the agricultural people and the fishing industries, and the urban users and the suburban users. And they fight all the way to the courthouse door.

And Mr. Chairman, you and I know when you get to the courthouse door one thing happens: delay, confusion, we don't know the rules of the game. We need to have a water supply that is there for us.

Now, I am so pleased to have Denis Bilodeau here from the Orange County Water District. I am really happy to see you, Denis, because you have been engaged in the development and implementation of water supply technologies for many years.

Orange County, my latest notes say, tell me if I am wrong, is the sixth largest county in our Nation. We have 2.4 million people just in Orange County alone. Is that about right?

Mr. Bilodeau. We have 2.4 million in our service area, there is 3.2 million in total in Orange County.

Senator Boxer. Three point two million, 2.4 million in your service area. So we are literally talking about making sure people can live comfortably and have the water that they need.

This severe drought has forced our governor to declare a drought state of emergency. We have water restrictions. Again, even though El Nino has done better up north, it has not done that well down south. We know that we can expect more droughts in the future.

So we do face many challenges associated with this ongoing drought, including over-tapped aquifers, mandatory water

restrictions, threats to our Bay-Delta ecosystem, to our fisheries, to our agriculture. When you mention water in California, everybody's back goes up because there are so many arguments going on over diminishing resources.

My view as a United States Senator is I do not take sides between the jobs in the fishing industry and the jobs in agriculture, they are all jobs. I don't take sides, I am trying to get everyone to the table. I believe, that is why I am so proud that my Chairman shares this, that we need to look at ways to avoid these terrible battles. That means a bigger water supply.

When you get into where do you put in a dam, that starts the march to the courthouse door. But if we were to be able to move forward with desal, move forward with recycling, move forward with conservation that makes sense, we don't have to fight over these supplies. We need to work together to expand the pool by using our water more intelligently and making sure we can tap into these technologies.

So we are very fortunate, Mr. Chairman, to have two excellent witnesses. We probably have three excellent witnesses. I know two of them who will offer thoughts on how the government can help. The Orange County water district will explain how it converted wastewater into 100 million gallons per day of clean safe drinking water, enough for 850,000 people.

Mr. Price will talk about his experiences with desal in the Middle East, particularly in Israel where so much truly innovative water supply activity is occurring. So when people look at desal and they say, oh, what are you thinking, they should just talk to the folks who have been living with this technology for a very long time.

I am also pleased that the Corps is here, because they have such an important responsibility for managing water around the Country. The Corps operates 30 dams and reservoirs just in California. These reservoirs serve critical water supply needs. The Corps must employ the latest technologies to ensure these reservoirs are operated efficiently and can meet the growing water supply challenges.

I think today we can look for these opportunities to invest in new technologies. We can also learn from our international partners, such as Israel, who has confronted these supply challenges.

In closing, I would say this we have a chance in this WRDA bill to make some more history, Mr. Chairman, to take a look at this and start a new way of looking at water supply. Because drought faces us, it always has and it always will. It could get worse. We are not sure, but we can't take a gamble on water supply.

Thank you.

[The prepared statement of Senator Boxer follows:]

Senator Inhofe. One thing, Senator Boxer, that neither one of us mentioned is the significance of the water in terms of our military. It happens that right now in the audience we have Bill Burgess and several of them from the city, from Fort Sill, which is the city of Lawton. Right next door to it is Altus Air Force Base. And it is something that really is critical. Because the needs of those two, we have gotten to the point of where they would almost have to shut them down from time to time. That is a huge issue also it is affected by this.

We welcome you to observe. You are observing a hearing where Barbara and I love each other. We don't have any disagreements. That is rare. But I hope you enjoy it. We have three witnesses.

Senator Boxer. Remember this moment.

[Laughter.]

Senator Inhofe. We have three witnesses. Mr. Denis Bilodeau, First Vice President and Director of the Orange County Water District, as Senator Boxer said. Mr. James Dalton, we know him, Chief Engineering and Construction, U.S. Army Corps of Engineers. Mr. Kevin Price, Senior Science and Technology Advisor in the Middle East Desalination Research Center.

So we welcome all three of you here. We will start with you, Mr. Dalton and we will kind of work down. Try to keep your opening statements to close to five minutes. You are

recognized.

STATEMENT OF JAMES C DALTON, CHIEF, ENGINEERING AND
CONSTRUCTION, U.S. ARMY CORPS OF ENGINEERS

Mr. Dalton. Thank you, Chairman Inhofe, Ranking Member Boxer, and other distinguished members, thank you for the opportunity to present information about the U.S. Army Corps of Engineers Civil Works program activities related to drought and drought technologies.

I would like to briefly discuss drought in general terms, and then provide some information on the actions that we have taken with respect to drought, and finally touch on drought technologies we are investigating.

Drought, of course, is a deficiency in precipitation over an extended period, usually over weeks, months, or years, resulting in water shortage causing adverse impacts on vegetation. But drought is a lot more complex than just the lack of water. Drought is a relatively common weather-related phenomenon in North America and occurs to some extent every year in some parts of the U.S. It affects our agricultural water supply and many other aspects of our well-being.

The Corps performs water management activities at its reservoirs consistent with the project-specific, congressionally authorized purpose or purposes for each reservoir.

Two missions we often balance competing needs during periods of drought are flood risk management and water supply.

It is important to keep in mind that most dams in the current drought areas are solely authorized for flood risk management.

For instance, as Senator Boxer just mentioned, the Corps operates about 30 dams in California. Seventeen of those are mostly for single purpose flood risk management and 13 have multiple purposes.

Generally speaking, the Corps will not construct a project solely for water supply, but may include water supply as a purpose in a project constructed primarily for one or more of the three mission areas of the Corps of Engineers, which are flood and storm damage risk reduction. Number two, commercial navigation and number three, for aquatic ecosystem restoration.

The Corps water supply authorities that the States and non-federal entities have the primary responsibility in the development and management of their water supplies. Water rights, of course, are the responsibility of the States. The Corps does not own or sell water.

Water supply storage in a Corps reservoir may be a key component of the water supply plans for non-federal entities. So non-federal entities that do not have storage in a Corps reservoir may request that the Corps study and consider reallocating existing storage from another authorized purpose to water supply.

Corps reservoirs are operated according to water control

manuals, which by policy include reservoir rule curves and, where appropriate, it includes Drought Contingency Plans. The purpose of the Drought Contingency Plans is to provide a basic reference for water management decisions and responses to a water shortage in a basin due to drought.

The Corps is working on methods and web tools to assist in understanding the projected droughts and how will this impact Corps projects. The results of this work will serve as a guide for developing a strategy to update the existing Drought Contingency Plans.

The U.S. National Climate Assessment, published in 2014, reported that climate is changing and is projected to continue to change. The expected changes vary regionally and include warming temperatures, resulting in altered precipitation patterns, increasing heat waves and changing snow patterns and droughts.

There are two current efforts that we have underway to try and assist with our ability to manage water resource for climate preparedness and resilience. The first effort is developing and implementing methods to update our drought contingency plans to account for climate change. A second method is to enhance reservoir sediment information to assist in climate preparedness and resilience by helping to identify current and future reservoir sediment volumes, which can affect food and water

supply.

And a third effort we have ongoing is the Forecast-Informed Reservoir Operations research at Lake Mendocino, which is a pilot study that would use atmospheric river forecasting to inform water management decisions in a manner which reflects current and forecasted conditions. The results may indicate whether this technology can be applied in actual operations of certain projects.

In summary, the combinations of water control manuals and deviations that we can have with those manuals provide a great deal of flexibility to respond to short term or long term needs based on best available information and science consistent with each project's congressionally-authorized purposes.

Thank you.

[The prepared statement of Mr. Dalton follows:]

Senator Inhofe. Thank you, Mr. Dalton. Mr. Bilodeau.

STATEMENT OF DENIS R. BILODEAU, FIRST VICE PRESIDENT ORANGE
COUNTY WATER DISTRICT

Mr. Bilodeau. Thank you Mr. Chairman, Ranking Member Boxer and members of the committee. I am Denis Bilodeau and I am the First Vice President of the Board of Directors of the Orange County Water District. I am deeply honored to appear before you today to discuss the most pressing issues of our time: the provision of safe and reliable water supply.

The Orange County Water District is located in Fountain Valley in Southern California and provides groundwater to Orange County, including 19 cities and water agencies serving 2.4 million people. Since 1933, we have taken great pride in advancing the development of sustainable water supplies.

In Orange County we live in a desert. The base flow of the Santa Ana River, our main source of surface water, continues to decline. Imported water supplies from Northern California and Colorado are restricted.

In the late 1980s we recognized that to preserve our region's economic and social vitality, the challenges of ground water depletion, seawater intrusion and unreliable surface water demanded an innovative solution. This initiative grew into the Groundwater Replenishment System, which is a joint project between my district and the Orange County Sanitation District.

The GWRS is the world's largest advanced water purification

system for potable re-use. It takes treated wastewater that otherwise would be sent to the Pacific Ocean and purifies it using a three-step advanced process. This treatment and purification process produces high-quality water that exceeds all State and federal drinking water standards.

We are currently producing 100 million gallons a day which is about 25 percent of our water supply. Our next and final planned expansion will provide an additional 30 million gallons a day.

Senator Boxer, it was during your term on the Senate Appropriations Committee that you were able to secure our first federal appropriation towards construction of the GWRS. Over a five-year period, \$20 million in federal funding from the Bureau of Reclamation's Title XVI program leveraged over \$72 million in State, local and private funding to provide for the overall \$481 million construction of the Groundwater Replenishment System. We greatly appreciate that. The GWRS has allowed our region to take control of our future.

There is no one size fits all solution to water re-use. The GWRS establishes a technology foundation to design and build innovative approaches to sustainable water needs. Therefore, I encourage the committee to include funding for water re-use in the WRDA reauthorization.

Secondly, our district is currently exploring purchasing

more than 50,000 acre-feet per year of desalinated sea water or enough water for more than 400,000 people from the proposed Huntington Beach desalination project as a way to increase local water supplies. The proposed project will be built and operated by Poseidon Resources in the city of Huntington Beach. The project is scheduled for final hearing before the California Coastal Commission later this year. If approved by the Coastal Commission my board will consider moving forward with a purchase agreement for the water. The largest hurdle we face, of course, is the economics of ocean desalination.

Finally, one of the most cost effective solutions that we avail ourselves involves water conservation. Conservation through reduced demand is not going to solve our overall need to assure that we have adequate water supplies. In order to supplement our conservation program, my district entered into a collaboration with the U.S. Army Corps of Engineers, who have been a great partner, to leverage the investment that our region and the Corps made in the construction of Prado Dam on the Santa Ana River. Rather than using Prado Dam for a single purpose flood protection, we recognized the potential of conserving water at Prado during storm events that could subsequently be recharged into our aquifer for future use. The alternative would be to lose this water supply as it coursed down the Santa Ana River to the Pacific Ocean.

Senator Boxer, you were instrumental in assisting us in our negotiations with the Army Corps, and this year we have already accrued 31,000 acre-feet of water due to your efforts.

Mr. Chairman, we appreciate your efforts for an orderly passage of the WRDA bill. We have provided suggested policy to facilitate enhanced conservation of Corps facilities. Our recommendations to the committee arise from our experiences over the past few years working with the Corps to implement a long term agreement to store water with a priority placed on public safety in an environmentally protective manner. Simply stated, a clear statement on the priority to approve and implement water conservation activities needs to be made a part of the reauthorized WRDA.

Also, we need a clear statement to ensure that costs are fairly allocated by guaranteeing that only the separable costs attributable to the water supply conservation is allocated to the local water agency.

The ability to facilitate an expeditious and equitable agreement may seem like an obvious approach to implement an innovative and cost effective solution. But we need a strong statement on the matter as part of the reauthorization of WRDA. We stand ready to support the committee to this end.

Again I thank you for the opportunity to appear before you today.

[The prepared statement of Mr. Bilodeau follows:]

Senator Inhofe. Thank you very much. Mr. Price.

STATEMENT OF M. KEVIN PRICE, SENIOR SCIENCE AND TECHNOLOGY
ADVISOR, MIDDLE EAST DESALINATION RESEARCH CENTER

Mr. Price. Chairman Inhofe, Ranking Member Boxer and members of the Committee, I am Kevin Price, Senior Science and Technology Advisor to the Middle East Desalination Research Center in Muscat, Oman.

My passion throughout my career has been the application of new technology to the purification of nonconventional waters to increase water supplies, reduce the risks of drought, increase jobs and standards of living and to assist in resolving conflict around the world. I will focus my remarks on desalination and indirect and direct potable water re-use.

Early in my Bureau of Reclamation career, I was responsible for the desalination research portion of the Science and Technology Agreement with Israel. During one of my trips, I was asked by a television reporter why someone from the U.S. was attending the Israel Desalination Society meeting. I explained that with the problems and solutions Israel was currently solving would be important to the U.S. as it faced similar problems in the future.

I currently work for MEDRC, which is an international institution created in 1996 as part of the Middle East Peace Process and is hosted by the Sultanate of Oman. Members of MEDRC include the Palestinians, Jordanians and Israelis as well

as the U.S. Department of State. MEDRC works to address two grand challenges: water and peace. This is done through capacity-building in training and research.

There is an important technical distinction that must be made before proceeding with my remarks. Water purification means a number of things depending on the audience. Regulatory frameworks around the world describe what needs to be removed from water and to what levels. For many, this means removing suspended particles, bacteria, viruses and very large molecules through helping the particles to stick to each other followed by filtration. This will not work with many non-conventional sources, because a major portion of the contaminants is dissolved, not suspended as particles in the water.

Desalination or the removal of dissolved materials is a fundamentally different process than filtration. Desalination is also a critical component of indirect and direct potable water re-use.

No longer is it necessary to think of drinking water, wastewater and impaired water as separate entities. They are all water, waiting to have the containments removed to the desired level. Among the 21st century technologies are: microfiltration, ultrafiltration, reverse osmosis, membrane bioreactors, humidification-dehumidification, capacitive deionization, closed circuit desalination, forward osmosis and a

whole bunch of other technologies that people continue to develop.

The lessons learned in Israel have consequences for the U.S. especially in the drought-plagued areas near the sea. Israel's water supplies have been limited from its creation. They have had to learn how to conserve through public education, reducing water losses and appropriate pricing. Because the need for new sources was so immediate, they knew membrane technology which was invented and commercialized in the U.S., would work and decided to move forward using desalination without perfect information. They had good knowledge from the experience of others and their own research on how to manage the environmental effects of desalination such as optimizing energy use, reducing chemical addition, reducing entrainment and impingement of intakes, and mixing of the outfall concentrate back into the ocean.

In discussing this with Oded Fixler, the Deputy Director General of the Israel Water Authority, he said that technology is only technology and it already works. The real issues are broader such as who owns the water, the cost of water, whether or not the cost is appropriate for crops and which crops, and who will subsidize. By developing desalination as a part of their integrated water resources, Israel was also able to develop an industry that can now compete internationally. It is

important to note the differences between and a State like California. Not only is the control of water highly fragmented in California, the State is much larger than Israel. Israel has a population of around 8 million in 8 million square miles. California has a population of around 39 million in 164,000 square miles. In addition, the opportunities to move water throughout Israel are much greater than in California.

Some of the lessons I learned with my colleagues while I was in Reclamation for generating innovation and unsolicited proposal request for broad boundaries generates unexpected ideas and proposals. Innovation should follow progression related to risk taking and project size. Consistent funding at low levels is better than higher levels of inconsistent funding.

It is imperative to have strong initial and periodic technical reviews combined with freedom to accept risk when studying the unknown. If research is to solve problems and meet needs, a strong technology transfer must exist to pull innovations from the laboratory into use. When moving technology to rapid implementation, demonstration provides the opportunity to involve all parties at an early stage.

Mr. Chairman, this concludes my remarks. More detail can be found in my written statement and I would be pleased to answer any questions at this time.

[The prepared statement of Mr. Price follows:]

Senator Inhofe. Thank you, all three, very much.

Let me just restate that in Oklahoma, the legislative goal for chloride control is to reduce the naturally-occurring chlorides in the Red River. Now, multiple studies, dating back many, many years, and designs have been completed, many of them by the Corps of Engineers, we are talking over 40 years ago, in 1978 was one of them. Yet a single project has not been constructed in Area 6, that is Southwestern Oklahoma, despite the Corps spending \$3.1 million in Area 6 over the past 10 years.

Now, my question would be to you, Mr. Dalton. If all of these studies and designs, at full federal expense, have been completed over the past four decades, then why is the Corps asking for yet another study of the project to determine feasibility of building projects to reduce the chlorides in the Red River?

Mr. Dalton. Mr. Chairman, that study we are looking at now for Area 6 started out, as you mentioned in your opening remarks, looking at now a re-evaluation of what had been previously completed for that particular study. I think it was maybe around 2005 or so that we looked at it and we started revising the study or updating the study. At that time, we ran out of money to do that.

Since that time we have been looking and talking with the

State and county for, looking for a non-federal partner to cost share in that.

Senator Inhofe. But there have actually been studies. They completed studies we are talking over a period of 40 years. I am looking at my situation how do I go back to Oklahomans and ask them to spend money for a new feasibility study when we have gone through all of this. We have spent millions of dollars. Not a shovel has been in the ground yet.

Did you listen to Mr. Price's testimony? Do you think there are some technologies, is this something, Mr. Price, where technology is moving in desalination right now and there are areas like perhaps the area I referred to in Southwest Oklahoma that might be able to benefit from some of these?

Mr. Price. Yes, chlorides can be removed by desalination.

Senator Inhofe. Yes, but if it is as simple as that, then is it a matter of cost?

Mr. Price. Generally, it is a matter of cost.

Senator Inhofe. So your technology has not really had a dramatic improvement in terms of reducing the costs?

Mr. Price. In the past 30 years it has had a dramatic improvement. Several orders of magnitude.

Senator Inhofe. Is anything going on right now that we may be overlooking in Oklahoma?

Mr. Price. I could discuss it with the Corps of Engineers.

I am not aware that they would have kept up with the technology.

Senator Inhofe. Have you kept up with all the technology, Mr. Dalton?

Mr. Dalton. I am not familiar with exactly what the chloride removal we are looking at for this particular project. It is something we looked at as part of some of our other projects, I believe. I do not have specifics on that.

What I would like to respond to, Mr. Chairman, is that we don't know how much is required to complete the study, how much more work is required. As far as talking with the non-federal sponsor or citizens about why they should cost share, we plan on taking advantage of the work that has already been done. There's has been a number of parts of that study that have been completed.

What we need to do now is to take a look at what has been done and determine what needs to be done so that we can provide you with the work that we think is remaining, and the cost and schedule to do that.

Senator Inhofe. Yes, that would be helpful. I remind you and everyone else who is here that, next week, Senator Boxer and I plan to go ahead and start the markup of the WRDA bill.

Senator Boxer. Yes.

Senator Inhofe. So we need this stuff now. I want to make sure that anything that can be done, and these projects are the

kinds of projects we are dealing with in this bill. We want to stay on top of this thing and yes, I would like to have, to be sure and I am sure as Mr. Price said, that the Corps has a lot of research and all that. But just make sure there is not something looming out there that would help us resolve this problem. Because right now, we are getting into the WRDA bill and that is what this is all about. Our intention is not to let these things slide. We should be doing the WRDA bill every two years and I think we are on schedule to do that. This is the type of thing that we are wanting to do.

Senator Boxer.

Senator Boxer. Thank you. That is music to my ears and I hope we can avoid on either side any kind of poison pill amendments that do not belong there. I think we have shown that we can do that.

So Mr. Bilodeau, do you view desal as a potential component of a comprehensive water supply system? I have a few questions on this, I will ask them all and then give you the time. Do you think it should be a component, is cost a concern as you explore the addition of desal to your water supply system? Could federal water infrastructure loan programs help address some of these cost issues?

Mr. Bilodeau. Senator Boxer, the answer is yes to all those questions. Definitely desalination, we are looking very

closely at having that part of our portfolio of sources. Of course, we have the Santa Ana River which is sort of our free source of water, and we have the groundwater replenishment system as we discussed. Desalination would be sort of the third leg to the stool.

Of course desalination is the most expensive, though, of those sources. But as you mentioned, federal loan programs could certainly help with the cost of that.

We are fortunate in that there are innovations taking place, though, in that arena with membrane technology and we are looking forward to breakthroughs.

Senator Boxer. Would you explain that to us in short what that means, membrane technology?

Mr. Bilodeau. Well, in terms of reverse osmosis, of course, you are pulling the water molecules across a membrane. The private sector actually, I believe Lockheed Martin is developing a membrane called Graphene. We have offered to pilot test their technologies in our plant, to look at the effect of it. Because we are very excited about these innovations and we want to push those forward, because they are going to have worldwide implications and hopefully drive down the cost of that water.

To put it in perspective, the water that we produce in our ground water replenishment system the non-subsidized cost is

about \$850 an acre-foot whereas the cost of desalinated water is about \$1,200 an acre-foot. So it is about 50 percent more expensive.

Senator Boxer. I would just note, and I think my colleague agrees, everybody needs clean water. So when you are faced with a situation where maybe you have a water emergency, the cost diminishes because we need it. It is the staff of life in so many ways.

So what we are trying to do is work with my colleague to get a lot of my Water-21 legislation in this. I think so far it has been great. We are looking at reauthorization of the Desalination Act. Mr. Chairman, if we can put that in the bill, reauthorize an act we already have, which would include desal pilot projects, also required development of drought-resilient guidelines to help communities deal with drought, that would be helpful. I hope we could support new grants to support development of innovative technology and change or modify the SRF loan program to better support innovative technologies, because we kind of haven't updated it in a while.

Those four things, would you agree, would be a good start for us?

Mr. Bilodeau. Absolutely. One of the bigger challenges we have is actually the distribution of the water because this will be a new plant that we are looking at in Huntington Beach. And

the distribution system alone is over \$100 million, just to move the water around to where we need it. So a loan program would be a tremendous help to us.

Senator Boxer. How about the WIFIA program? The Chairman and I worked together to get that done. It is based on TIFIA which would allow you to leverage funds and get pretty much interest-free loans. Would that be helpful as well?

Mr. Bilodeau. Interest-free, yes, we certainly could use that.

Senator Boxer. Well, it is extremely low interest, because basically the interest rate is set based on the chance that you might default. It is very low, especially, I would say Orange County has proven it can get out of some trouble. You did in the worst situation after the market crash. How well I remember that and how hard that was.

So let me turn to Mr. Price. Do you think the U.S. should have a greater role in water supply technology development? You discuss in your written testimony the historic role of the U.S. Government in developing desalination and other treatment technologies. But you say the investment has declined and we are not participating in the new research as much as we were. Is that a correct reading of what you said?

Mr. Price. That is correct. One of the ways that I investigated that was talking to one of the professional journal

editors to get a feel as to how the number of scientific publications have changed over probably the last 30 or 40 years. Basically the U.S. was a leader in the science of desalination 30 years ago. It has now dropped to maybe, it is an order of ten, ten times less in terms of publication then it was in the past. I think that is probably due to the Federal funding more than anything else.

Senator Boxer. Well, thank you. I don't have any other questions for the panel.

I just want to say again to my Chairman, this is an area where I just think the work of this committee could really spark an entire new effort to rekindle the new technologies. We hear of defense companies that are looking at the ways to deal with desal. I think it is right there and I just think a little spark from this committee could drive change and alleviate one of the biggest problems that we face as a Nation.

And we always have had these issues. I know Oklahoma, my God, when you think back in history the problems that Oklahoma has had and California over the years with drought. This is like buying a really good insurance policy, and while we are doing it become a leader in the world in these technologies. So I am excited to work with you, Mr. Chairman, and I think this committee can really light a fire under this desal and recycling, the kind of things we like to see happen.

Senator Inhofe. I think that will happen and the timing could not be better. I know there is a simple answer to this.

Mr. Price, when you are talking about researching it, you have Barbara and me, and you have the big ocean out there and we have the little Red River. Is your research into technology and all that, will that equally apply to both? Or do you concentrate in one area that is more advanced looming technology in one area than the other? Or is it the same?

Mr. Price. The technologies remain the same, but for brackish water like the Red River, is a lot less expensive. It takes less energy to remove the dissolved salts because there are fewer salts.

Senator Inhofe. Well, Mr. Dalton, we will submit a question for the record to get new details on how to make chloride control construction a reality in our Area 6 that we are so concerned about.

Anyway, the timing is right, we are getting into our WRDA bill. That is what this is all about and it has been a problem in my State for a long time and it is one that, it would kind of be fun to solve a problem instead of just delay it. We are anticipating doing that.

So I think any other comments any member of the panel would like to share with us on this committee, while we only have the two of us here, we have staff from all the rest of the committee

and they are very interested in this issue. Any other comments you want to make?

All right, in that case we are adjourned. Thank you very much for coming.

Senator Boxer. Thank you so much, everybody.

[Whereupon, at 10:57 a.m., the committee was adjourned.]