EPA's Arsenic Rule Web Cast Written Transcript

December 1, 2004

Tammy: Welcome, ladies and gentlemen, to today's seminar entitled "The Arsenic Rule." Before we begin today's seminar, I would like to review a few housekeeping items. First of all, if you haven't clicked on the meeting URL link provided to you in your invitation email, please do so now. This will launch today's Web seminar. If you have any problems with today's audio or Web portion of today's event, please contact Customer Care by pressing *0 on your telephone keypad. We would like to acquaint you with some of the ways you can participate. You may submit a text question any time during today's seminar. Simply click on the "Ask a Question" located in the lower right hand corner of your screen. Type in your question and click "Ask." During periodic question and answer (Q&A) breaks, your text questions will be addressed first. We will remind you of these instructions at the time of question and answer session. You can also press Control H on your keyboard; this will allow you to expand the image to full screen. Again, should you need help at any time during this seminar, press *0 for an operator. At this time, I'd like to introduce Andrea Matzke from the EPA's Office of Ground Water and Drinking Water. Andrea you have the floor.

Andrea: Thank you Tammy. Well, good afternoon and good morning depending on where you are in the country. As Tammy said, I'm Andrea Matzke and I work on arsenic and radionuclide implementation in the Office of Ground Water and Drinking Water Protection Division here in Washington, D.C. I'd like to welcome everyone to the last Web cast training on the Arsenic Rule for this year and congratulations to those who have attended all four Web casts on the Arsenic and Radionuclide Rules this year. Today we'll focus on a rule overview, exemptions, health effects, and point of use technology. To be better able to address more questions during this Web cast in case we go over in some of the presentations, we set aside a ten-minute question and answer in the middle of the Web cast as well as 15 minutes at the end. As before in earlier Web casts, we will provide written documentation of all the questions that were answered, as well as all the questions that could not be addressed during this Web cast. We do appreciate your patience in allowing some time before this Q&A list is posted onto our Drinking Water Academy Web site. I expect the Q&A from the last Web cast to be posted by early next week. Sorry for the delay, but some of the presenters were out for a while and we weren't able to get some of the answers right away, so again it should be out early next week. We will also record the session and post both written and audio files onto the same Web site and here are all the presenters for today - all of our mugshots. These are the presenters today so you have a sense of who's speaking. So with that, I'd like to give a 15-minute overview of the Arsenic Rule so Tammy if you could pull up my presentation, I think I'm ready to go.

Okay, I'll be covering an overview of the Arsenic Rule. And the agenda will be covering basic overview, some of the timelines, looking at compliance issues with options, monitoring, violation determination, weighted averaging, and we'll just touch on exemptions. Looking at a general overview, I think most folks know that January 23, 2006 is the compliance date for the Arsenic Rule. And what does this rule do? It sets a revised MCL for arsenic at 10 parts per billion, which was down from 50 parts per billion. It also set a new Maximum Contaminant Level Goal for arsenic at zero. It also clarified monitoring requirements. The new

systems or sources are required to demonstrate compliance within the timeframe specified by the state. It also clarified compliance with MCLs for the IOC, SOCs, and VOCs, which means that states have a flexibility to require confirmation samples. They can require more frequent monitoring in addition to required quarterly samples. The compliance determination will be based on the average of the initial MCL exceedance and any state required confirmation samples and then the next three quarterly samples unless any one sample exceeds the running annual average. The average is based on the samples collected.

Okay, let's look at a timeframe here. Primacy revisions were due back January 22, 2003. Many states applied for a 2-year extension and that extension is this next January of 2005. For those of you that are interested, according to our national primacy database, which isn't always kept up to date, but it's pretty much up to date, there are eight states who have their primacy packages approved for arsenic. Those states are Delaware, Maryland, North Carolina, South Carolina, Arkansas, New Mexico, Oklahoma, and Colorado, and there's about 29 other states who have adopted the arsenic rule but just haven't had their primacy packages approved. In terms of grandfathering, ground water systems may grandfather data after January 1, 2005 all the way up to the compliance date of 2006. For surface water systems, they may grandfather their data basically just 20 days or so from the beginning of January to the compliance date of January 23, 2006. Surface water systems must complete their initial monitoring by the end of 2006 while ground water systems must complete their initial monitoring by the end of 2007.

Looking at the consumer confidence reporting timeline, for those systems who have arsenic in their water between five and ten parts per billion, reports covering 2001 and beyond must include an educational statement. For those systems that have arsenic in their water between 10 and 50 and even though they're not exceeding the current MCL of 50 parts per billion, they must include health effects language and then after the compliance date of 2006, if a system has greater than 10 parts per billion, they must include a health effects statement.

Compliance options: well, you could develop a new source. For some systems, this may be an option. For others it's not. You must have another source to be able to develop and sometimes that might involve getting water rights for that or that source might have other contaminants in it that you have to deal with so depending on the situation it may or may not be a choice for some systems. You can also blend before the entry point. So if you have a couple of sources that are above or sources that are below, you can blend before the entry point. Of course, you can install treatment. There is a point of use option and we'll be talking about point of use in the latter half of this Web cast. There is the exemption potential and, again, I'll just be touching on that.

Okay, the standardized monitoring framework (SMF), looking at compliance monitoring. This is a snapshot of our SMF and our quick reference guide and I'm just focusing on IOCs here, which arsenic falls under. These circles and arrows here are trying to denote where arsenic falls. So for ground water, systems must collect their last sample or they must by the end of 2007, so they have within the second period of the second cycle between years 2005 and 2007 to collect their sample, while surface water systems must collect it annually so they have until the end of 2006. If a system exceeds 10 parts per billion, quarterly monitoring is required. To go back to reduced monitoring, you have to be reliably and consistently below the MCL, which

means that a ground water system has collected a minimum of two consecutive quarters of samples at the entry point to the distribution system with the exceedance and the surface water system has collected four consecutive quarters of samples.

Now, if a system wants to apply for a waiver which would reduce monitoring to once every 9 years, it's based on three rounds of monitoring at each entry point to the distribution system and all the analyticals must be below the MCL. And one thing to keep in mind that if some older methods were used, like the ICP AES method was used, and this method had a detection limit of about 8 parts per billion or so or higher, if you use that for analysis they can not be used for compliance determinations, grandfathering of data, or waivers, so it's just something to keep in mind.

Violation determination: systems triggered into increased monitoring are not necessarily in violation until they have completed 1 year of quarterly sampling. However, if any sample result will cause the running annual average to exceed the MCL, the system will be out of compliance immediately and if a system does not collect all required samples, compliance will be based on a running annual average of the samples collected. So even if you don't collect all the samples, you can still do the running annual average, however, you would still get a monitoring and reporting violation for not collecting all four samples.

Weighted averaging: what is it, and why are we talking about it during this Web cast? Well, basically we had a lot of questions. This language came up in our implementation guides in the preamble where it discussed the flexibility to adopt alternative approaches to monitoring and we've had questions since then from EPA regions as well as from states on exactly how this works. And so just to explain it a little bit, basically weighted averaging is normally the situation where a system might use a seasonal source and they might only use it for say a couple of months or so during the summer for drought purposes or for peaking purposes but then they have another primary source that's below the MCL. So instead of looking at compliance at the entry point to the distribution system, you're really doing kind of an in-system averaging in the distribution system. So what you're doing is determining compliance by how long or how much flow from that well is being used and then at the end of the year, you look at compliance. So one thing to keep in mind with this language as it's written, it wasn't necessarily meant to imply any kind of system. It was really meant to apply to simple systems - meaning systems that might have one or two wells or so, not systems that have twenty or thirty different wells, which could be really complicated to track water use and we are also looking at systems who are just over the MCL, so maybe 12 or 13 parts per billion and not necessarily 200 parts per billion.

Something that states would need to look at in terms of if a system requested this alternative way of monitoring is to look at the representativeness of the normal operating conditions. The primacy agency may require additional sampling to account for changes in source use. But there really needs to be a link between source use and sampling. So for example, you might require the system to sample the highest source used during that quarter and not the lowest source. Another issue is a system needs to demonstrate that it can accurately calculate in-system averages with respect to hydraulic behavior within the water distribution system. You also need to look at how much time the well was being used during the year. I mean, that can

definitely vary from year to year, so is the system really tracking well use? And the fourth issue is communication of weighted averaging to consumers. Some consumers may understand this concept of weighted averaging, but I would suspect that it might be something difficult – a difficult concept for most consumers to understand, so it's just something to think about between both the system and state if they would want to do this kind of monitoring. Another issue to think about are the resources a state may have to monitor in this alternate way of monitoring. You might have greater costs for overseeing a plan like this. You may have to keep separate tracking documents for sampling purposes. But again, it's something to keep in mind before you would tackle this approach.

So the bottom line: states and EPA regions with direct implementation authority are responsible for ensuring that any compliance approach will reliably protect public health and if a system cannot easily and transparently demonstrate how its approach will protect all consumers then the primacy agency should not approve the plan. And we do have a draft memo right now, which is currently discussing these very issues. So we will continue to work on these issues.

Exemptions: the point of this slide, I guess, is really to get the point across that even though it's a tool that states can use, it's not necessarily a click of the mouse, so to speak, of being able to go in and just do an extension. There's a lot of requirements involved. One of them is that your water cannot contain arsenic at levels that would cause an unreasonable risk to health. Bill Jarocki will be talking in the next presentation about some of the financial considerations of exemptions, but overall, public water systems may have an additional 3 years to comply and systems serving 3,300 or less may be eligible for up to three additional 2-year extensions.

So with that, that is the end of my presentation. I did want to put a list up here of all the EPA regional arsenic contacts and I'm sure many of you are already familiar with these folks, but please feel free to call them or myself if you have any questions. And here's some useful Web sites. And just as a heads up, we do have arsenic face-to-face trainings coming up this spring, most likely starting towards the end of April or so, and these regional trainings will mainly be focusing on treatment technologies. We also have a series of ten Web casts coming up and they'll be on both rule and non-rule topics. And the first two on deck are on the Total Coliform Rule and it says January or February, but actually they've been pushed back a month or so, so we're looking at February and March for these Web casts to come out. So please look for information. It should be coming your way at some point. So with that, if you have any questions, again, I'll be trying to answer some of those questions during the 10-minute question and answer period later on.

I'd like to go ahead and get Bill's presentation up. I'd like to introduce Bill first. Since 1996, Bill Jarocki has been the Director of the Environmental Finance Center located at Boise State University. He serves as an adjunct faculty member in the Master of Public Administration Program in the College of Engineering. Bill was the chief of the Idaho Department of Environmental Quality in 1992 and was Chief of the Research and Analysis Bureau. Among many distinctions, he received two national performance review awards from

Vice President Al Gore for his work in small communities regarding implementation of environmental and community priorities. So with that, Bill, are you set to go?

Bill: I think I am, thank you. First thing I was going to ask if anyone remembered who Al Gore was? Thank you very much everybody with the opportunity to share with you some thoughts that we have on the financial considerations of an exemption. I prepared this graphic on this opening slide to try to place in your thoughts this idea of balancing the unreasonable impact to health with the cost of implementing technology to remove arsenic from the drinking water. The other point I wanted to make was Andrea, it seems like all these deadlines tie to my birthday, January 23rd, which is kind of scary. This next slide, if you very quickly write down that Web site, I would encourage you to put this in a bookmark on your Web sites so that you can relate back to the information we produce, not only the services and tools that we produce, but also publications about what we're learning about financial and management capacity, so this Web site will come up very quickly.

The Safe Drinking Water Act Amendments in 1996 formalized this concept of technical, financial, and management capacity. I think everybody has seen some variation of these interacting sets of information and we're still learning a lot about the connection between financial capacity and compliance, as well as management capacity and compliance. The good news about financial capacity is that we can measure that pretty readily. Management is not as direct a relationship between compliance and management capacity, but a couple things I wanted to say about this slide is that whenever we have a new regulation, change in the rules, levels of MCLs like the arsenic standard, systems that do not have adequate capacity have trouble implementing those rules. The successful systems that have a good balance of management, financial, and technical capacity even have the ability to look forward to changes in rules and regulations. Our assessment of most small systems is that they don't have the management capacity to stay on top of the standards. They need a lot of help with the water industry, the regulating community to keep them on track. So, systems with inadequate financial and management capacity are more likely to have problems implementing new standards.

The other thing that's interesting about TFM is that this capacity assessment is not routinely performed on systems that demonstrate good testing results. If you think about the kind of information we collect on a day to day basis about water systems from sanitary surveys for example, we don't have a lot of financial information, a lot of management information that we can go back to and look and try to predict what the effect of the new rule's going to be on that system and so normally what we're doing is we're examining capacity with somebody who's borrowing money from the state revolving fund or some other publicly subsidized funding program. So, we have a limited amount of information from the field of financial and management capacity, but what we are learning, we're starting to publish.

This document that you see on this next slide entitled "Financial Capacity Assessment Indicators" is on the Web site and I would encourage you, if you have trouble sleeping at night, you might want to download this document and read it. If you don't have trouble sleeping, it actually will provide you some good data on what we're seeing in Idaho for example. Since 1997, our finance center has been reporting on financial and management capacity characteristics of applicants to the state drinking water fund and we also do similar

work for the Alaska Drinking Water Fund. Now we're about to embark on a relationship with the State of Washington on the Clean Water SRF to do similar kinds of analysis and it's this assessment of financial capacity that has helped us to look at what we should consider as financial criteria when somebody applies for an arsenic exemption and so we're fine-tuning our approach to what are the characteristics of financial capacity that are important for an arsenic exemption.

The one nice thing about doing these third-party analyses for the revolving loan funds is when we find that a system is deficient in meeting the state's financial and management capacity requirements, we can suggest as a condition to a loan that that system implement those financial practices and management practices that will add to the sustainability of that system over time. In Idaho, we have been working with Region 10 to examine the financial characteristics of systems that are asking for arsenic exemptions. So just a handful of systems that we've looked at so far (they're all very small systems) and what we're finding out is that the approach that we're using we think is transferable nationwide and so we're developing a tool with EPA's help, kind of a template where states will be able to fill in the blanks of this template and actually produce a document that comments on the financial capacity of a system asking for an exemption. That's important because what we're doing is balancing this impact to public health with the impact to the same public of what it costs to implement changes. For the purpose of the arsenic rule exemptions, we're looking at financial, community, and affordability factors. Those are the things we're looking at that we need to review.

So this next slide is a table which shows you some of the characteristics that we're looking for and I'm going to take them in group order: community characteristics, financial characteristics, and affordability characteristics. What's interesting here is you notice on the top of the page, East Lizard Butte Water Corporation. You'd think I'd be making that up, but this is an actual water corporation in Idaho that serves 55 residential customers. It's a mobile home community located in southwestern Idaho. East Lizard Butte. Anyway, we looked at the characteristics for exemptions and we want to know something about the community. What is happening with the population? Whether it's increasing or decreasing, stagnant, just how large that systems is. Our Department of Commerce provides a community profile on just about every community in the state and that's qualitative information we can use to understand what the local economy is like, what the history is of that community, whether they're struggling or not. On the description of the project, when an applicant applies for an exemption, they tell us what the nature of their problem is and what they're seeking to do. Certainly we want to know how many residential connections there are because we're spreading the cost based on the number of customers that they have.

This next slide addresses financial characteristics and there's a little bit more detail here but the good news is that a lot of this information is available. Some of it you can actually perform trend line analysis on. Sometimes all you need to do is have a binary assessment whether or not they have something. So let me go through this list of a system with audited financial statements. It has a better chance of knowing what their financial status is and, of course, one that doesn't. Municipalities are generally required to have audits, but non-municipal water systems are not. And so whether they have an audit or not makes a difference as to quality of the financial information that you are reviewing. The annual budget's important. We

also like to look at the budget to see if within the budget, they have any money set aside or they're putting any money aside for system replacement or to anticipate system improvements based on changes and rules. Capital budgets and capital improvement plans go hand in hand and what we like to know is whether or not this system's management is planning for the future. When we look at SRF loan applications in Idaho, probably nine out of ten of those applications do not have capital improvement plans and what that means is they're going in day to day trying to figure out how they can survive without looking at the big picture and what's happening in the future.

Financial audits I mentioned before. It relates the annual audited financial statements. A bond rating can tell you a lot about a community and what we find of course with very small systems, they've never had a reason to go into the market with a bond, so they don't have a bond rating. The billing cycle tells us, along with their accounts receivable, if that system is having trouble with people paying their bills. If they have a long billing cycle and a high accounts receivable, then that may indicate a problem with affordability. The cost of the project is important, but you know what's interesting is we don't always get the cost of the project. So we're really trying to figure out is when they're asking for an arsenic exemption, what kind of technology or techniques are they going to apply to that situation.

This next item, frequency of rate setting, what we're trying to learn here is how many times have they changed their rate, along with the number of rate changes in past 10 years. We want to know if the customers are conditioned to the fact that the rates don't change. A system that has modified its rates every year does a lot better job when they have to go back to the public and say, it's time to raise the cost of water one more time. And we also want to know the last time that they increased their rates.

On affordability, we want to know what their current average monthly residential rate is as well as to calculate the future average monthly residential rate should improvements be made. We compare that against the median household income and things like the poverty rate and the unemployment rate in that community. All of these things tell us whether or not there's going to be a significant amount of stress with them paying for improvements in the system.

When we look at all of these kinds of data points, those things that we can use as trend lines, we're actually trying to get 3 years of history to see where that system has come from and then current information to see whether using all of that will predict what's going to happen should they employ the arsenic technology. It's very useful to have this information available because then you can decide whether this is truly affordable, whether anything that will occur to that system in the future is going to create another burden that they have to deal with, and whether they're in good financial shape today but they can tweak their financial conditions through better financial management that will make them less resistant to problems in the future. So I guess what I could say is stay tuned to our Web site and also to Andrea at EPA because as we develop these tools and make them available for testing and for review you'll get to see more of the detail of what we look at and how we construct that information in making an arsenic exemption determination.

Andrea: Thanks, Bill.

Bill: Thank you.

Andrea: We'll have to answer some questions that came up in your presentation in the Q&A in the middle and the end.

Bill: Great.

Andrea: So, up next we have Charles Abernathy. Charles has been with the EPA since 1984 working in the field of risk assessment and toxicology. Before EPA, he worked as a pharmacologist for 11 years with the Veterans' Administration Medical Center in Washington, D.C. He has authored and co-authored over 85 scientific research articles and reviews including co-editing six books. So with that, Charles, are you ready to go?

Charles: Thank you Andrea. Yes, I am. Fifteen minutes to cover arsenic health effects seems a little bit short, but we'll do the best we can with it and will you have my email address so they can ask other questions if they come up?

Andrea: Sure.

Charles: What I'd like to do today is just really talk about the characteristic uses and sources of arsenic, talk about the toxicokinetics, absorption, distribution, metabolism, excretion, health effects, cancer, non-cancer, and then just give you a short example of how we would do a risk assessment. I will mention the fact that we are in the process of updating the IRIS Risk Assessment and it should be on-line next summer.

Arsenic characteristics: almost all waters contain some arsenic species, primarily inorganic. Arsenic(III), or the arsenite, is predominant in ground waters due to lack of oxygenation whereas if you have a surface water, you have primarily the Arsenic(V) and we will see why these become somewhat important a little bit later. Crystalline rock will have about 2 parts per million, which is milligrams per kilo. Soil will have 1 to 40 parts per million. The high end is around smelters or where they've used arsenical pesticides, for example. Ground water has been reported anywhere up to 800 parts per billion except in hot springs where it's 40,000 and maybe that's what did the people good when they were relaxing in the hot springs. Surface water is much lower on the average. It's about 65 parts per billion, although you do get 22,000 in some river waters and this would be primarily where the water drained through the mine and into a river and you got it from that way. I would like to put this up because everybody in the world is exposed to arsenic. It has less usage presently, but they've been used in the past. Smelting of copper, for example, put out fly ash, the fly ash landed on the ground and the water. From the pharmaceutical industry there were a lot of medicines. In fact, the very first medicine used in chemotherapy as an organic was arsphenamine. And, it was an arsenical, so it goes back in history. Presently the only two medicines that are being used to any extent are melarsoprol, which is used for the treatment of trypanosomes and also arsenic trioxide which is used and very effectively for certain forms of leukemia, so we still use it.

Pesticide manufacturing used to be extensive. They were used quite a bit in vineyards as the calcium and lead arsenic wood preservative. The CCA (chromated copper arsenate) is in a phase out to the end of the year, but it's already there. In cattle and sheep dips they used to actually run the cattle and sheep through these dips in places like Florida and Texas. When they no longer used the sheep dips, they just covered them over, so you do have pockets of arsenicals. There are feed additives for example, you have roxarsone, which is used for chickens to improve the "health." You've got feed additives, dye stuffs, petroleum, coal and wood burning, some of these contain fairly high levels of arsenic and some petroleum (for instance, when you make it into gas and crank your car up, arsenic goes in the air), gallium arsenide, and waste incineration. So we have a lot of ways to be exposed to arsenic and most of them are fairly limited, but in certain cases they can be high.

The toxicokinetics - absorption, some of the early data indicated 40 to 50 to 70%, and recently it's become pretty much complete for soluble arsenical forms. Now, for the insoluble forms there's a limited absorption and the metal in the zero state goes straight through the body and is egested in the feces so we don't have any from that but we do have fairly high absorption. Distribution is found in all humans and blood concentrations. Almost everybody out there has blood concentrations of 1 to 5 parts per billion or micrograms per liter. Smokers, there's always some arsenic in cigarettes so you get it higher. Occupational exposure - Taiwan, which is where a lot of the work has been done on the risk assessment - they were exposed to high levels in the water and you would tend to expect higher levels, which they have. In various poisoning cases, where they've actually either intentionally or accidentally ingested arsenicals, you will have 1,000-2,000 ppb. So you have extremely high levels under poisoning conditions.

Distribution: the nails and the hair are by far the highest. This is because of the SH groups (sulfhydryl groups) that are found in the +3 arsenicals bind very strongly and then you have less in the heart, liver, kidney, lung, etc. Now, if we look at metabolism: inorganic arsenic in the water – we'll just say it's a +5 or +3 – and if you'll notice the arrows, the dotted red means a reduction and the solid blue means a methylation. So if it's in the +5 form that you ingest it, you will go down to the +3. This then can be methylated and you will find monomethylarsonic acid, which will wind up as from the +3 originally to the +5. This is then reduced again to the +3. A second methyl group is added (and SAM, by the way, is S-adenosylmethionine, which is the methyl donor, whereas the SAH is S-adenosylhomocysteine, which is the product after the methyl group is gone) and the $DMAs^5$ will be reduced to $DMAs^3$.

On this slide, I show you another SAM forming a trimethyl. In humans, this is either lacking, or if it is produced, it is produced in extremely low quantities. There's some dispute about this. Most people cannot find it. There was one report out in Japan where they could find it, but this is near, but if it is formed, it's very low. The species that are found in the urine are the inorganic, +3, +5, the monomethylarsonic acid +3, + 5, and the dimethylarsinic acid +3, +5, and people say: why is this important? Well, if you look at the toxicology of it, you find that the +3s are much more toxic than the corresponding +5s and that the monomethyl +3 and the dimethyl +3 in general are more toxic than the inorganic +3.

So whereas in the old days metabolism inorganic arsenic was considered to be a detoxification of inorganic arsenic, it now appears it's at least part of a process of intoxication

because the methyl +3s are more toxic than the inorganic +3. This does not mean that the inorganic +3 has no activity at all because in certain in vitro systems it will inhibit enzymes and it will cause adverse effects. Excretions primarily by the urine: 60 to 95% in 5 days, and the one exception to this that we know of is the rat because the dimethylarsenic acid binds to the hemoglobin and it takes about 60 to 90 days to reach half-life, depending. Fecal excretion is very low.

Now we have adverse health effects and we'll take non-cancer first. There's acute toxicity and I've put this up mainly to show you that humans seem to be at least as toxic, or I should say more susceptible, than are guinea pigs, mice, and rats. The only reason I say "approximate" is that we really don't have really good data on human LD_{50}s but it has been suggested to be between 1 and 4 milligrams per kilo whereas with rats and mice, it's in the 15 to 290 or in guinea pigs around 9. So humans appear to be one of the most susceptible species to the toxic effects of arsenic. If you look at the acute effects in humans (and this around an estimated LD_{50}), you'll find you get peripheralneuropathy, anemia, renal and liver dysfunction, skin pigmentations, EKG abnormalities, severe GI effects. And you say: does this really happen? Sure it does. All of these have been reported after poisoning instances and/or (you can call it poisoning) or taking of certain homeopathic medicines in the Far East where you have these adverse effects appearing. So you do see these.

However, at the EPA, we're more concerned with the toxic effects over a chronic exposure period and in humans for example, we'll show these. In Taiwan there's a blackfoot disease, which is really gangrene. The foot actually turns black, where it got its name, and the foot was then amputated. It also happens occasionally in the hands, but it's more common in the foot. This may be due to the fact that they work in rice paddies. There was arsenic in the rice paddy water and they may be absorbing some more through the skin as it becomes hydrated, but we don't know. In Poland, there were vintners (and remember I mentioned that the pesticides were used in viticulture) so you have some cases of gangrene there. In Chile, Raynaud's disease after being in the water and this is a spasming of some of the vascular in the foot.

Nervous systems, there's peripheral neuropathy mainly in the arms and legs. This has been reported, at least the slowing of it, in Utah and also in Canada, as well as in Taiwan and other places. Cranial nerves, there's a loss of hearing in Japanese infants after exposure or poisoning with arsenic and this lasted into adulthood, so this loss appears to be permanent. Cancer has been reported in a lot of countries; among them, Taiwan, Mexico, Argentina, Chile, China, Mongolia, Japan. You can now add Bangladesh and West Bengal to that. There was a report in the United States that prostate cancer may be occurring in Utah from the Lewis report that was funded by EPA. So we can say that arsenic causes cancer in many different countries.

Some of the cancers associated with arsenic: the most common is skin and this was the original end point used in Taiwan although they primarily started out to look for blackfoot disease and then as they were going through they found skin cancer. Later, subsequent studies showed that it was a high incidence of bladder cancer, lung cancer, liver, kidney, and again out there, prostate cancer's been found. So it is a multi-organ carcinogen.

And what I'd like to do is just stop at risk assessment and how we do it and what we're doing. And this is a stylized - certainly it does not mean the numbers we're going to use, but just to show you, we would calculate a central estimate. And you can see that the dotted line that goes down to the effective dose for 1%, so that would be 1 in 100. In this situation, we're talking about 350 µg/L roughly. We would calculate then a 95% lower bound for that and you can see that the LED_{01} that would give us a point of departure. And the point of departure is where we would then draw the straight line to zero if we don't have any data or sufficient data on mode of action, which with arsenic we do not. And to give you a margin of exposure, we take the old MCL of 50 and the LED happens to be 300 - we would have a margin of exposure of 6. If we take the present MCL (the promulgated) we would have 300 to 10, so we would have a margin of exposure of 30. And this is the type - we would also do a similar regression analysis for non-cancer and have a point of departure from that depending upon what we would use, we would put in certain amount of uncertainty factors to actually come up with a value for a reference dose. So it would be done somewhat similar to this and thank you very much.

Andrea: Thank you, Charles. Well at this point, we'd like to look at some of the questions that have come in from the past three presentations. One that came in was about the arsenic URTH level. Someone asked whether there was an arsenic URTH level, and although there's not necessarily an arsenic URTH level, we do have guidance that's provided in our guidance documents. And that is – I'm trying to find the reference for it. I can't seem to find it right now, but it's in our Implementation Guidance, and basically it's based on what isn't in URTH, not necessarily a risk based analysis of what URTH is. And the table in the Implementation Guidance was put as a guidance for those systems who may be applying for an exemption. So basically the lower the arsenic levels, the longer they could possibly have for an extension.

There was another question also that came up about where the regional arsenic face to face trainings will be and that's still under discussion here. It's in development. Something that we are trying to do is through ASDWA, we'll be sending out a survey to all the states asking them what they would like to see in these face-to-face trainings and although we know most likely we'll probably be focusing on treatment technologies and looking at case studies, we're hoping to get input from all of you out there of what you would like to see in these trainings.

I know there were some questions for Bill that came in. One was: what are the loan default rate differences for SRF projects between systems that don't have adequate TMF versus those that do at the time of SRF application? Bill, address that one?

Bill: Sure. The answer to that question is that when systems come to the SRF program, we have not seen a default in the history of any of those communities and municipalities or private systems that have been able to borrow money. We haven't seen the default in the history and I think it's very rare across the United States that municipalities have defaults on their loans. That doesn't mean that they're financially sound because often times in order to pay loans, they won't be doing something else that they should be doing financially, like setting aside money for future improvements. So, a system that would default would have a serious, serious breakdown in their financial management. As a last resort they can always use property taxes within a

municipality to pay a judgment - those brought forward for non-payment of a loan. So we don't see that.

One of the other questions that came up, Andrea, had to do with whether private systems could receive financing. In Idaho, private systems can receive financing from the SRF. It's a state by state decision. Sometimes there are constitutional prohibitions to having the state loan money through the SRF to a private entity. A lot of states have been able to have their attorney generals make a determination that private systems are eligible as is allowed by the Safe Drinking Water Act Amendments so it's a state by state issue whether or not privates get that kind of money. Usually the SRF is the only publicly subsidized funding program that private entities are eligible for.

Andrea: Thanks, Bill. There's another question that came in, wasn't there?

Bill: There was one question on affordability and I'd be happy to address that. Every state should have a factor, a percentage of household income that they put as a threshold, of what affordability means for utilities. It's a controversial subject. In Idaho, the state uses 1.5% of median household income as the level of affordability. We have found, in fact, that document I referred to in my slide, that has the size of systems we've been talking about and all of the affordability ratios before and after the technology projects where they received the loans but most of the systems we've seen are well under 1%. The problem is that the jump they have to make sometimes from where they're at to where they're going in taking on new loans is politically controversial, so there's a lot of work that needs to be done sometimes to get a community to buy in to the idea of their water rates increasing. And you can look at those statistics in that report. We find it's interesting to track that information over time. Most of the systems we're looking at are small. On the arsenic exemption program, the largest system we've reviewed has a population of 1,386. East Lizard Butte has 55 residential customers, so probably somewhere around 150 customers, 150 population in that mobile home park.

Andrea: Thanks Bill. I actually found the URTH reference that we were trying to find in the Implementation Guidance and that's in Appendix G-15, Table 1, so you can look there for guidance values. Another question that came up for Charles is what is the bioaccumulation factor for arsenic?

Charles: Thank you Andrea. First of all, the bioaccumulation factor plays no role in the safe drinking water regulation. It's only for the ambient water quality criteria in which we would use a bioaccumulation factor. We're working on it. Tala Henry's got the lead on it. You can give me a call and I can put you in contact with her if you need to, but basically where we're at right now is we have to redo the risk assessment for arsenic for one. Number two, when we start talking about the bioaccumulation factor, we have reports. Before we used to think it was either organic or inorganic and if it was organic, we didn't worry about it, so we only looked at that amount that was inorganic. However, as when I pointed out during the metabolism, we found out that some of the organics have toxicity. The problem with the database right now is even when they have separated into inorganic and the monomethyl or the dimethyl, they have analyzed them as the dimethyl or as the monomethyl. They have not told us how much is +3 and +5 and until we find out, some of that's going to be very difficult to do.

The next thing is in the past we have put the information we've received from marine animals and said this sort of gives us a guideline. We now know that in fresh water it doesn't appear to be quite like marine life so we have a lot of data to accumulate and to sort and even then, I'm not sure we'll have enough data without making some assumptions of how we're going to do it. There was a report that was put out the end of last year on arsenic and I don't have the exact Web site with me but if anybody wishes to have it, they can send Andrea or me an e-mail and I'll provide that Web link for them. So, right now, arsenic and biocaccumulation we don't think we can do it right now.

Andrea: Great thanks, Charles. Another question that came up was, if a system has a running annual average of less than the MCL, yet the last result was above the MCL, is it a violation? My understanding was that the running annual average was used and one sample would not result in a violation unless it was four times the MCL, so basically with the running annual average, you're looking at the average again. So if you have one sample that's over the MCL of ten, it doesn't necessarily mean you're in violation. You're looking at an average again. So that's what we mean by if any one goes over, not necessarily if it's eleven, you're automatically in violation. It's only once you do the running annual average would you be in violation. Hopefully that answered that question. I think we're straight up three o'clock. Again, the questions that we didn't get to, we can try and answer them in the last 15 minutes of the Web cast. So, I'd like to go on to Janet Cherry. Janet has an engineering degree and is a registered professional engineer. She's worked in the water industry for over 15 years in both the private and public sector. Janet's a former Montana Drinking Water Program employee and currently works for The Cadmus Group in the Helena, Montana office. Janet, set to go?

Janet: I think so. Thank you, Andrea, and greetings to everyone from Helena Montana. In this presentation this afternoon, I'll briefly describe point of use and point of entry devices, the applicable regulations, and I will be presenting two case studies. So, on the first slide, I just would like to define what a point of use (or POU) treatment technology is. A point of use device will treat the water at the tap where the device is installed. So for instance the POU device could be installed under the kitchen sink and will treat a sidestream of water from the cold water line and in this typical configuration a separate faucet will be installed at the kitchen sink to dispense the treated water from the point of use device. A point of entry or POE device will treat all water that goes into the home. A POE device is typically used when the contaminant is volatile in nature, such as VOC or radon, and water use for outside purposes such as lawn watering is typically not treated, so it will just treat the water that is used within the home for showering, bathing, and drinking purposes.

Now, I'll review the Safe Drinking Water Act (or SDWA) language that applies to point of use and point of entry devices. In the Safe Drinking Water Act, there is language specific to POU devices. EPA cannot list a POU device as an affordable technology for compliance with an MCL or treatment technique such as treatment techniques in the Surface Water Treatment Rule for microbial contaminants or an indicator of a microbial contaminant. Now note that the Safe Drinking Water Act in this particular section is silent on the use of point of entry devices for compliance with a treatment technique or microbial MCL and to date EPA has not listed any point of entry devices for compliance with the Surface Water Treatment Rule,

Total Coliform Rule, or other microbials. On the next bullet you'll see three items that apply to both point of use and point of entry devices. Again, this is in the Safe Drinking Water Act. There is a requirement that all devices must be controlled and maintained by the PWS or public water system. All devices must have mechanical warnings to automatically notify customers of operational problems and where ANSI standards have been issued, only those units that meet these standards can be used. I'll talk briefly next about the ANSI NSF standards.

The ANSI NSF certification process is a testing regime to verify the testing unit performed adequately and removed the contaminants of concern. On the screen are the ANSI NSF standards of concern for compliance with drinking water regulations when using a point of use or point of entry device. The first standard you see is standard 44. This standard applies to cation exchange water softeners. These are your in-home water softeners. Standard 53 is for drinking water treatment unit health effects. To date, only one point of use in-line device using adsorptive media is certified under Standard 53 for arsenic removal. Standard 55 applies to UV water treatment systems and Standard 58 applies to reverse osmosis (RO) drinking water treatment systems. Numerous RO devices are currently certified under Standard 58 for multiple contaminants. I'd like to make the point that not all ANSI NSF certified devices exist for all contaminants. I would encourage all of you to visit NSF's Web site at www.nsf.org to obtain more information on units that are certified for specific contaminants.

Now, I'll talk about language that is in the CFR that pertains to point of use and point of entry devices. In 40 CFR 141.100, you'll find language that is specific to point of entry devices. Part 141 of the regulations did not contain any point of use language or requirements for point of use for compliance with national primary drinking water regulations. And, if you go into 40 CRF 142.62 you'll see requirements for point of use and point of entry under variance or an exemption. And just note that the language in 142.62 is quite similar to that and 141.100 and I'll review that language. Again, in 142.62, you'll find the requirements for using a point of use or point of entry device under a variance or an exemption and, again, there's similar language to what I'm about to present in 141.100. The only difference is the language and 40 CFR 141.100 is specific to point of entry devices.

So now I'll go over the language in 142.62, the requirements for a public water system that uses point of use or point of entry devices as a condition for obtaining a variance or an exemption from the national primary drinking water regulations. Number one, the PWS is responsible for operating and maintaining the devices. Again, this requirement is part of the Safe Drinking Water Act language also. The PWS must obtain approval of a monitoring plan prior to installation of the devices so the system must work with the state on getting an approved monitoring plan. Number three, the PWS must apply effective technology under a state approved plan and the microbiological safety of the water must be maintained at all times, so under item three, the state has the authority to require disinfection if there are concerns about microbial growth within the POU or POE unit. Number four, the state must require adequate certificate of performance or rigorous engineering design review of the device. Typically a pilot study is conducted to verify the effectiveness of the device. Number five, the design and application of the POU or POE device must consider heterotrophic bacteria concentrations and water treated with activated carbon. There's concerns that activated carbon is quite prone to bacteriological growth and, again, disinfection or some other form of microbial growth control may be required.

Number six, the state must be assured that all consumers will be protected. So this requirement implies that a hundred percent participation of all homeowners, residence, businesses within the service area of the public water supply system, must have a POU or POE device under variance or an exemption.

And then number seven - and this is just unique to language in 142.62, you won't find this language in 141.100 - if a POE device is used as granting an exemption from the Lead and Copper Rule, the state must make sure that device will not lead to increased corrosion. For instance, RO typically produces a low alkalinity, highly corrosive water, so this type of device may not be suitable for compliance with lead and copper. The Arsenic Rule lists point of use, reverse osmosis, and point of use activated alumina as SSCT (small system compliance technologies) for arsenic removal. SSCTs are available for systems serving 10,000 or fewer.

Here's a diagram of what a typical four-stage RO device would look like and you'll see here on this first filter, it's a particulate pre-filter and then that will be followed by a GAC pre-filter. These two pre-filters act together to remove sediments and contaminants and help extend the life of the RO unit, which is the third in the sequence. Then that's followed by a storage unit. A storage tank is needed for this type of device due to the typical low production rate of your RO point of use devices to make sure there's adequate volume available at the tap when using this device and then with this fourth stage RO unit, there's a post treatment GAC filter. This is for aesthetic purposes. And then you'll also see in this diagram, there's a UV disinfection unit. This is shown as an option. Again, the state has the option to require disinfection if needed.

Here's a POU adsorptive media. This particular unit is NSF certified under Standard 53 and it uses adsorptive media. In this vessel there's both a particulate prefilter followed by the adsorptive media filter and for this particular setup, the absorptive media is used on a throwaway basis. Here's another POU adsorptive media configuration. The adsorptive media could consist of either activated alumina or granular ferric hydroxide and this type of configuration is currently being considered by a number of vendors and it's undergoing NSF certification. So you might see some of these available soon.

Here is an example of a point of entry adsorptive media unit. This media is periodically backwashed and, again, the media would be used on a throwaway basis. And here's a typical point of entry anion exchange device. This device requires regular regeneration of the anion exchange resins contained in the vessel and typically salt similar to that used in your home water softeners would be used to regenerate the resin.

Now, I'd like to quickly go over two case studies. The first on is a point of use case study at Fallon Air Force Base in Nevada. POU RO devices were installed to address arsenic. The device consisted of a four stage RO unit, as you can see here in the picture. It had a sediment pre-filter, a GAC pre-filter, RO filter, and then a post-GAC filter. This picture illustrates a good point. You should avoid storing household cleaners and chemicals near your unit; you should just try to protect your water as much as possible. But specific to the point of use case study at Fallon Air Force Base, this application was rather unique where there was no pilot test conducted. The point of use RO devices were installed as a temporary measure until the

base could connect into the City of Fallon water supply. All units were installed and maintained under contract by a local vendor and installation averaged about one hour each. Maintenance was performed by the vendor under contract. It was performed every 9 months on every device. Every 9 months both GAC filters, the pre- and post-filters, and the sediment pre-filters were replaced. And then the RO filters were replaced every 27 months and these units were quite effective in removing arsenic. They had over 90% removal rates of arsenic.

Next is a point of entry case study in Lumni Island, Washington. Point of entry and ion exchange devices were installed to address arsenic. The system was required to perform extensive pilot testing. There were two pilot studies done over the course of 4 years. The State of Washington Department of Health wanted to make sure these devices were going to work. The system also had to have certified operators on staff and they had to check these devices every 3 months. Samples were taken every 3 months to verify treatment. The point of entry devices were removing arsenic quite well and meeting the MCL. These particular devices were regenerated automatically and the waste stream was sent to the individual septic tank and drain field. And this was unique to State of Washington for compliance purposes - each home was considered individually by the state. So if one home had a running annual average that exceeded the arsenic MCL, the entire system was considered to be out of compliance. And that's all I have today. You'll be hearing more from the next two speakers on point of use and point of entry and thank you.

Andrea: Thank you, Janet. Next we have Fred Pontius and he'll be talking about implementing a point of use and point of entry strategy and Fred has 25 years experience in the drinking water and wastewater field, 16 years with the American Waterworks Association and water quality research, government affairs, and management, and 9 years consulting experience. He has conducted over 50 workshops and training seminars on drinking water regulatory issues and compliance for EPA, individual water utilities, the AWWA, the National Park Service, and Government Institutes, Inc. Fred has authored and published several peer review journal papers, over 150 technical articles, several guidance manuals and has contributed chapters to three books. So, Fred are you set to go?

Fred: I'm ready. Okay, I'd like to share with you this afternoon some thoughts from some work that we have been doing for Andrea on implementing point of use in general and how it might apply to arsenic and many of the ideas also apply to point of entry. So we'll be covering all three here as we go forward. And, it's a bit of a different perspective in that in our work, we've talked with dozens of people involved with point of use systems, visited some systems, conducted a focus group. We've done a lot of gathering of information from systems that have been using point of use, have piloted point of use, or are thinking about point of use, and trying to look for sort of common themes and put it together in a package that could be used by small systems where point of use really makes sense and they really want to try to make it work, in advance of having to comply with the arsenic rule. So it's a little bit of a different angle that we're approaching point of use/point of entry from as opposed to, for example, dealing with it as a part of a variance or an exemption or an enforcement or an administrative order.

So, as the previous speaker mentioned, point of use and point of entry are allowed under the Safe Drinking Water Act but there are many questions that are involved in making it

work and so we're trying to get to the core of some of those questions and help systems and states answer them and find their way. And so this first slide might seem a little optimistic, but I think it can work for arsenic compliance and on my slides you'll see these little quotes from some of our discussions with folks at different parts of the country. The critical questions looking at it from the water community perspective, as a small system or as a water system, I've tried to capture here in this slide is: Is POU/POE the best strategy? And that's a really important question.

It might seem that it's kind of silly question to ask, but what we found in talking to folks is that in systems it really makes sense. The term that one system uses was it's a "no brainer." It was obvious to me that this was the way to go. Those are the kinds of systems that you want to find where the people are committed. It's really obvious and you have the energy level from the community sort of self-generated to make it work. That's what you need to tap into to see it through because there are a number of issues that have to be addressed as you go forward with point of use and one of those is planning carefully, what planning steps are necessary, and having a good customer outreach strategy. How do you ensure 100% participation? And, that's a point that Janet mentioned and we will come back to that. And then what about the reluctant customers?

Let's kind of briefly look at each one of these questions, I'll give you some thoughts to think about. First being: is POU the best strategy? And as I mentioned, and I think states are in the best position for this. You know kind of the lay of the land of the water systems in your state and your jurisdiction and can probably best identify those where it really makes sense - where there's sort of an economic advantage and it's an obvious advantage. And people respond to that. It's those savings that it provides and the systems that we've talked to, their energy level is high when they realize that they can implement point of use, make it work and save money (save from having to raise their water rates). And that commitment comes as they realize that. It's just a good idea and if it's one of many options and people are kind of lukewarm about it then it's probably not going to succeed because the energy level won't be there to get through the process.

In this particular case, one system we spoke with is implementing point of use RO treatment and it's giving them a very significant economic savings. In terms of planning, where it does make sense, planning ahead is really important as is knowing what the roles are. In point of use you've got four to five different entities involved. You've got the water system who's ultimately responsible for compliance. You have the vendor who's going to supply the units. You've got the state regulatory agency who's overseeing the entire process, making sure regulations are met and customers are protected and so forth, then you've got an installer who is going to be installing and most likely maintaining the units. And last, and most important, is the customer because the customer has to use the unit and has to be committed to changing and becoming used to using that third faucet device at the kitchen for drinking and cooking, changing some of their habits - keeping pitchers of water for consumption in the bathroom, and so forth. So there's certain things that all of those folks have a role in and have to work together, particularly the customer (even more so than in central treatment).

So defining those roles and responsibilities, recognizing how important the customer buy- in and the community involvement is, is really important to making this work. In most cases, systems will need some type of local ordinance. In some cases it could be in the case of a private system amending or homeowner's association bylaws and this will be a state by state proposition as to what systems have to do to obtain the legal authority necessary to implement this at the local level, but usually something will be necessary. With point of use and to some degree, point of entry, there may be some additional liability incurred by the water system in terms of customers, installers, and water system folks entering the property, malfunctioning units, leaks, that sort of thing, and so those should be identified and strategies provided.

In our draft guidance that we've prepared for Andrea I've got 17 specific different strategies for minimizing liability. So you have to be aware of it, but it shouldn't scare people away. It is something that can be dealt with. Systems need to know what states are going to require and that seems obvious, but in my work with different states, different states have different points of view. So you as a state agency or if you're involved in direct implementation, you think carefully through what it is you'd like to see from water systems that desire to take some initiative ahead of the regulation to implement point of use, not just kind of wait until they're out of compliance and then be having to face it as a part of an administrative order.

Now, local communities need to decide what vendor services are needed. How are they going to use vendors and in many cases, it's just simply purchasing the units. But it is possible for communities to have vendors that might be a point of use manufacturer or plumber or an installer or an electrician in some cases will be necessary for installation, play different roles. And so they need to think through that and how to obtain those services. In terms of outreach to customers and a strategy, that needs to be very carefully thought through and is very site specific. Scheduling installation, service and sampling also needs to be planned ahead. So I'm just briefly touching sort of the high points.

One of the most key factors is: how are you going to inform customers? And in almost every case, there's some form of written material involved, like fact sheets. In many cases, systems sent letters to customers inviting them to a community meeting to talk about the new regulations that the water system has to meet, involving the community in the decision of how to best solve that problem and in some cases they say: "Yes, point of use is the way to go." So you involve the community in the decision-making. Public meetings, phone calls, signs - there are a number of different kinds of mechanisms that we've seen used and then different ways in different communities – and so the outreach strategy really needs to be tailored to the community.

How do customers get information about their water? You know in some cases, it's some of the old long time residents who know the most about the water system and everybody trusts. If they've bought into it, everybody else will too. You know it's not necessary to rely on e-mail or develop fancy brochures. In many cases, this is the simplest and lowest-cost method of getting the word out and developing this sort of energy in the community to implement point of use is the best strategy. In terms of 100% participation, that's expected for compliance and so if a system is going to use point of use to comply with the new regulation, the best advice is to start early. Those systems that are in a good position to be using point of use for

complying with arsenic for example, have been working at it already for quite some time. And so if there are any systems out there that you can think of, this might make some sense, small community, economic advantage of using point of use, and so forth. You want to try to encourage them to start early because in almost every case that we have looked at, there are always a few reluctant customers that systems have had to deal with, and in some cases, strategies for bringing them on board to achieve 100% participation are working. In other cases, there's not much activity going on, but that will have to happen in order to achieve this 100% participation expectation to comply with arsenic or whatever particular rule they're using point of use for.

So, reluctant customers: we've seen different strategies in different communities and some communities (in terms of reluctant customers) have no hesitation at turning off someone's water for not participating or if they decide not to participate, so having point of use would be a condition of water service whether formally or informally. In other cases, we've had folks try to offer some incentives. In one case, the small water system funded the initial purchase out of their reserves. Of course they had already paid for it in previous rates, but they made initial costs to the homeowner very low, but this is a very critical question: Is the water system willing to shut off water? And different communities will answer that differently and so, therefore, you need to think through this reluctant customer issue.

Implementation tools we've prepared - they're in draft form - the model ordinance, generic fact sheets on point of use that could be adapted easily for point of entry, letters, access agreements. We've reviewed typical performance indication devices - that hasn't been talked about yet, which is really an important consideration. We have model contract language and a draft small systems planning guide. So for state folks, who are mostly here today, where in you're area would a point of use of point of entry compliance strategy make sense? Which water system? Where is it obvious that this is the best way to go? Those are the folks you want to encourage to start working on this because it'll take some time to implement. What requirements are you going to expect see from them? How can you work with them to help them come up with a successful installation? What's the role of the mechanical warning device with the light or the indicator on the unit and we haven't talked much about that. How are you going to set servicing and monitoring intervals and what customer participation level is acceptable to initially proceed? Recognizing that you need 100% for ultimate compliance but if the system can't get a 100% right out of the box but has some time and a strategy, well, should they be allowed to proceed? Those are some of the key questions here in terms of implementation and with that, I'll end.

Andrea: Thank you Fred. Again, we'll have time to answer any questions that came in for Fred at the end of the Web cast (the last 15 minutes). So we've moved from technology to implementing point of use strategy and now we'll talk about the on-the-ground case study in Grimes, California, which Gordon will be presenting. Gordon Bellen is the Vice President of Research at NSF International. He has been at NSF for 27 years. Over the past 20 years, he has done numerous projects with residential water treatment. These projects include EPA funded projects looking at reduction of fluoride and VOCs using both point of use and point of entry water treatment in small communities. Gordon has a B.S. in chemistry and an M.S. in water

resources science from the University of Michigan. He is currently an adjunct lecturer at the university. Gordon, are you set to go?

Gordon: Yes I am. Good afternoon. Before I go too much further, I want to give you my e-mail address in case we don't get to all the questions: it's bellen@nsf.org. This is a project that was funded by the Office of Ground Water and Drinking Water to look at the actual implementation of point of use treatment for arsenic in a centrally managed way. We had substantial funding in terms of donated equipment and services and some from us as well. We had a project advisory group, including the state drinking water administrators, AWWA, National Rural Water Association, Drinking Water Council, and Water Quality Association, including EPA as well.

And, set up some guidelines for this. We wanted to look for a community that was in the neighborhood of 25 to 100 connections with arsenic in the range of 20 to 50 and nothing over 50. The EPA didn't want to provide this kind of service to somebody who had been out of compliance for such a long period of time. We obviously wanted to look at the water quality and the local and state support. Also, we wanted to find a community and not just a collection of homes and I'll show you a couple of examples of that in a second. This is what I call a collection of homes. We came down to two communities in Northern California just north of Sacramento. This is called Wildwood. It's 40 homes and just about every one looked like that. They're all middle income folks. We could have done a project there very easily. They had two wells, but we could have done the installations very easily and the monitoring, and the whole thing. A very supportive community. We ended up with this community. This is called Grimes, California and as you can see it is surrounded by farm land. This is a farming community and about 40% of the community is Hispanic. In addition to the homes that are in place there's a lot of other kinds of connections that we had to deal with.

Here's the Grimes water quality: pH in the range 8 to 8.4, all the arsenic is in the +5 category, which makes it easier to deal with. It is in the +5 because of the chlorination in the system. It's 50/50 +3 and + 5 and it ranges from 23 to 30. It had a little bit of silica, but it was something we could deal with. This is what you call a real small local community. It's administered by three town board members, and it's all volunteer time. They charge people $5.00 a month for water and $4.00 if you're a widow. So, it's a real sense of community. In total we had 122 installations and 5 non-participants. Two of those five were people who already had devices in place so we just did the monitoring for those devices. This gets to what Fred was talking about. This is pretty good participation, although we do know that some of the people that did allow us to install in the homes weren't using them as well as others. But, in general there was a lot of acceptance of it. At 104 residences; 18 other sites, a school, a couple of day care centers, and a couple of restaurants.

You can see there are some challenges with this kind of implementation of a point of use system that you wouldn't have had in Wildwood. In fact, in one of the restaurants we had to get a unique device to handle the water flow for an ice machine. We wanted to use a media - we didn't want to use our own. There had been a lot of data generated already and everybody was kind of excited about activated alumina at the time. That's kind of gone by the way side since this project was started. Iron oxide products are looking like they're going to be more

favorable. We have a little data to share with that. We wanted something with an automatic shut-off device, or other kind of metering device, but we ended up with an automatic shut-off device. I think that's preferable to trying to do an extensive sampling program and try to predict when these things are going to be expended. Because of the different sizes of families and different uses at the school we had to replace units much more frequently than we did at homes. We wanted to get a local experienced service provider, units under warranty, something that's commercially available, certified to the appropriate NSF ANSI standard, although at the time the standard wasn't quite there. We did do the testing on the unit and it did pass the standard as it was currently configured. We also wanted to consider the waste removal cost and what had to happen in that regard.

We came down to three vendors that were offering to provide equipment. Finally, we picked Kinetico because they did have a dealer within about 40 to 50 miles of Grimes that was willing to participate so Kinetico gave us their service. They donated quite a bit. Kinetico ended up donating about $70,000.00 in the project in terms of equipment and labor. This is the media – iron-modified activated alumina. The system uses two cartridges. I'll show you a picture in a minute. Two activated alumina in series followed by carbon filter for taste and odor treatment. And that became a significant factor because the water is chlorinated and almost immediately when we started installing the units in the community, word of mouth got around that the water tasted better. So, we really didn't have the participation rate that we ended up with that I showed in the previous slide initially, but it grew pretty readily as people found out that it was making the water taste better.

And these are units rated to 500 gallons capacity. This is a couple of units in series - we're doing a pilot test. So there's two activated alumina cartridges and a carbon cartridge and on this side we have the two activated alumina systems. On the other side, we actually did the pilot with iron oxide units so we could compare that data. What we ended up with the activated alumina units were able to get to 800 to 1,100 gallons before breakthrough and breakthrough for the state of California wasn't the MCL of 10 parts per billion but it was detectable, which was above 2 parts per billion. You can see that the iron oxide units got up to 1,600 gallons and when you think about use rates for people, a family of two is going to use about 360 to 370 gallons of water a year. Right now, the EPA draft guidance is calling for mandatory change out of cartridges at 6 months so you're really leaving a lot of potential on the table. These iron units could be going for 4 to 5 years and we'll talk a little bit about the costs of that in a minute. This is also conservative - the actual breakthrough is underestimated because we were testing these units at an accelerated pace. We were putting about 90 to 100 gallons of water through them in a day and typically they're designed to put like 2 to 5 gallons. We were pressing the units a little bit and I think if we were doing it more slowly, we would get even more capacity. We took them all the way to breakthrough and beyond and so we had pretty much saturated cartridges. The State of California did the WET test - the TCLP test - to determine whether they would pass in terms of being able to be discarded in the homeowner's trash or would have be to dealt with differently, and they did pass. So the waste disposal is a non-issue for these products.

This is a drinking water fountain in the school and this is where you had to put the cartridges. This is one of many installation issues that came in play. This is a really tight fit to get

back there and install these units back there and it ended up in a problem. We did use the vendor to provide service and installation, but we also trained the Board Members in terms of changing out cartridges. It's a very simple process. You just twist out the cartridge and twist a new one in. But this is a farming community - they're kind of can-do people. In one case, we had a janitor who just came and got the units himself and put one activated alumina and two carbon cartridges in and so we got samples out there later that were about 17 parts per billion. That was one of two units that exceeded the MCL of 10. The other one was in a daycare center where the kids were outside and the kids had kind of abused the system.

We considered that's what the problem was there, but you can see the installation problems we had in this kind of community with very non-standard plumbing issues. If you went into a home that looked like the one for the Wildwood slide, you can do an installation in 15 minutes. They range from 15 minutes to 3 hours in Grimes because they were doing all kinds of things. We would have to run a tube under the floor to get to the refrigerator because we were also treating all the icemakers as well and some things just didn't have a place to mount the faucet. They had to create something. There were all kinds of different things: old plumbing, a lot of trips to the hardware store to get to the pieces of plumbing that would allow them to install the devices - a significant challenge.

All right, some of the installation issues, we had difficulty in scheduling. We started doing the installations in late July 2002. This is a farming community; we were running right up into the harvest season. And so trying to get a hold of people and get it scheduled and have them show up was very difficult. The installation took close to 2 months and then it trickled in after that as more people in the community came on board. Even to the extent that the last day that we were there for sampling in October of the following year, there were a couple of people that came and wanted to get units and the community didn't even know they existed. One of the challenges for a community like this is how much administrative and management support do they have and in one particular case, they knew that one man had the unit in place, but what he had done is rented out a trailer behind his house and so he just had a hose out to that trailer and we ended up installing a unit in that trailer on the last day that we were there.

So administrative control in a community like this, is one of the issues and one of the things that may be a deciding factor on which communities are suitable or not. So, old plumbing was difficult, suitable location for installing faucets - a lot of these issues that were difficult in installation. We did have water meters in place to try to measure the actual use and to get a sense on how people were doing. You can see we had a gallons per home of 1.3. The average gallon per person was right on target for what's used in the regulations, 0.5 gallons, but you can also see that there were fourteen that were less than 0.2 so there were some people that clearly weren't using these very much and so it's not just a matter of getting into the home and installing them. It's one of those things you can take a horse to water, but can you get it to drink? And that's one of the things that has to be considered.

For monitoring, we did 100% of all the units at installations to verify that they were all working. Then we did quarterly sampling, weighted towards the end. We did fewer samples in the first couple of quarters then we did towards the end. We did 6-month inspections of all units. That was to simulate the 6-month change out, and then we also did some meter

readings. Fecal coliforms were all negative and HPCs averaged around 300 units per ML. Of the 250 POU samples, all but six were less than 2 parts per billion. We had a few under 10. What we discovered was that these units had been specially manufactured and they found that the subcontractor that was filling them was inconsistent so we think we got a little bit of channeling, but for the most part, they worked. These are going to belong to Grimes, and right now, they're doing their own maintenance. California has not determined how they're going to go forward with this in the future.

Waste disposal we discussed, and test kits are useful. They're cheap, at least for indicating if there is a presence of arsenic in the effluent or not - it's not really good for very precise testing. This is some of the cost differential. We had actual estimates from Kinetico for central. It was $31.42 for central treatment for AA and $28.37 for the new iron. If you did the 6-month change out with no other sampling, $18 a month for point of use with AA, $15 for iron. But if you went a whole year and then sampled every unit at some point during that year, it comes down quite a bit to $14.67, $12.82, and it gets even lower if you go out and use like 2 to 3 years like the iron units are capable of doing.

We did a little survey at the end - that's the demographics, this is the more important data. Sixty-nine percent said they always use POU, 23% said usually. They're pretty agreeable, only 5% said not acceptable. Three-quarters said that the water was safer, reasonably good results. Ninety-four percent said they were not inconvenienced by us coming in to do monitoring. They'd be willing to pay $8 a month for point of use or $12 for central - not quite enough but at least there's a willingness to pay.

Summary: the technology does work; a community infrastructure in terms of the administration is important; automatic shutoff is the way to go rather than frequency sampling; and if you're going to sample, from our experience, we only ended up changing out ten units in a year. The rest of them were still in place and a couple of those changeouts were in places like the school where there was a high use rate, or larger families. The community did accept this approach and we will continue to provide cartridges to Grimes, or Kinetico will for another couple of years and get them into a transition into compliance if in fact the state allows them to do this. POU treatment doesn't achieve comprehensive treatment in the sense that people can drink out of taps. They can drink out of the bathroom, but you think about body burden, these units are producing water that's at 2 parts per billion or less and the allowable level is 10 parts per billion. If you're talking about 2 liters of water, the difference there says that you can have an occasional drink of water from someplace else and be okay. And, in fact, if you were using packaged plants, we were to get treatment levels around 5 to 6 parts per billion, which is still higher than point of use so I think it provided reduced exposure and that's a good thing. But, it's a little messy - you've got to accept some things that are different. That's it.

Andrea: Great, thanks Gordon and thanks to Janet and Fred as well for presenting the point of use discussion. So we have some time at the end to answer some of the questions that came in. Janet, I know there was a few that came in for you. Did you want to address a few of those?

Janet: Sure, there are five of those I'd like to address. And it looks like people were paying attention to me. I had two questions about the Fallon Air Force Base case study. One was:

what was the influent arsenic concentration? It was about 0.10 mg/L and they also asked about the silica level. I don't have data on the silica level of the influent water. The cost for these units at Fallon for the point of use four-stage RO units was about $300 per unit installed. So that includes all the equipment and installation costs and then for maintenance (on the maintenance scheme I presented), which was every 9 months the vendor would go out, change out three of the filters and then every 27th month, all filters got changed out. That was about $120 per year, per unit.

Then there was a question of: can point of use be used for other inorganics and radionuclides? Yes, they can use point of use. It's specifically listed in the radionuclides rule. Point of use RO and point of use ion exchange can be used and there's also the EPA small system compliance technology lists and I can provide the Web sites where you can get to that information for all the listed point of use devices for radionuclides and inorganics.

And then there was a question: do you need to go through a variance and exemption to use point of use or point of entry? No, you do not. You're allowed to use point of use or point of entry as part of your compliance strategy. It's not just exclusive to variance and exemption applications.

And then the last question was: are there other organizations that provide certification other than NSF International? Yes, there's three others - and Gordon help me out if I've missed anybody - there's Underwriters Laboratories, the Water Quality Association or WQA, and then CSA International.

Gordon: Those are the three that I know of and people just ask that the products are certified to the standard, they don't ask if they are certified by NSF. So there's a lot of organizations that could do that. We certainly do most of them.

Janet: All right, and I'll let Fred and Gordon tackle any of those remaining questions.

Gordon: There's a question about whether bottled water is allowed and I think that's only on an emergency basis. I don't think it's allowed yet and the same way that point of use is being discussed.

Fred: Okay, well I'll take a crack at the 100% participation questions. As I saw it, 100% participation was required and the period is not in this example. I presume they're referring to your example, Gordon. But 100% participation - as we've talked with systems, we need to pause for a moment and think about point of use and point of entry on two different levels. One level where there's quite a bit of guidance that was covered in the presentation on the technology is a variance and exemption. And that's how, as regulators, we typically think of it. I was speaking yesterday with a regulator who's working with a system of forty homes for fluoride removal, putting in point of use and they're going through that as a part of an administrative order process under the variance and exemptions requirements and so forth.

What I'm speaking to (or attempting to anyway) is at a different level of saying, okay, we have an allowance in the Safe Drinking Water Act for point of use. It's designated as

small system compliance technology for a number of contaminants. We have a new arsenic regulation that we know is going to affect quite a number of small systems and that regulation comes into effect in February 2006 (as people generally refer to it as January 23) and so some communities have thought ahead and said: "Point of use makes sense for me and so let's start early and try to work towards getting 100% participation, having the state satisfy that it's protective." And so forth, going through the process proactively rather than the traditional way.

As regulators we kind of think about it as addressing it at the back end as part of a variance and exemption or an administrative order or a compliance situation. And so for example, Michael's Ranch in Arizona, which were those pictures that I showed, is using point of use RO and it's a small community (twenty homes) and they're excited about it. They like the water. They're making it work. They're doing it now. We visited there a number of months ago, but that's well in advance of when the compliance date is required. So what I'm suggesting is that we kind of think if we're going to allow point of use for compliance we need to kind of think through how we encourage communities where it really makes sense to be sort of proactive and go through an implementation process that satisfies EPA and the states and is protective, gets 100% participation, but 100% participation by the time compliance is required. If you were to go around most of the places that use point of use or have piloted it , and say: did you have 100% participation right out of the box? Probably it's going to be no, because customer communication and buy-in sometimes takes time and so that's what I'm suggesting.

If we're going to let communities move ahead with the point of use strategy, initiate that well in advance of the compliance date and perhaps with less than 100% participation, as long as you're satisfied and we're satisfied as regulators, that by the time the compliance date kicks in, they're ready to go with that 100%. So that's what I'm suggesting and I think it's doable but it's not a simple thing. Point of use requires a lot of energy, community meetings, and again this customer role is really important. So 100% participation, my understanding is still yes, it's required. But if the compliance date is not until February 2006 and a small community says, "Hey, this really makes sense to us and we've got everybody but one home on board initially, but we've got a way to bring them on board as we go along," well, I think as regulatory folks that's something you should consider. And so you think: well, is this likely to succeed and are they likely to be ready to go by the time the compliance date comes on board? And so that's kind of a different take on implementing point of use as opposed to coming up after they're in non-compliance and then putting it in. So hopefully that helps clarify a little bit about this 100% participation.

Gordon: I agree with Fred. Point of use, if you're going to use it in general, it's going to have to be some flexibility and a little bit of change in perspective. I don't know if you ever completely have 100% participation. We felt pretty good about getting all but three. There was a question about what were the reasons for the three. One of them was what we call the curmudgeon factor. It was a lady in the red dress. She was in her 70's and she stormed out of the town meeting and said, "I've been drinking this water all my life and I'm fine." We ran into the same thing with fluoride a few years ago. So there's just some natural human resistance. A couple of the people just were almost anti-social. One guy we couldn't get to come to the door and the town board member was afraid to even go to his house. I went up there. He just wouldn't respond and you're going to have people like that. If you're going to shut off their water if they

don't do it, okay, fine. You get them to finally put the unit in. You still can't guarantee that they're going to use it.

So I look at the point of use treatment for compliance purposes as not a first choice option obviously, even with the economics, but I would always prefer central treatment. But the fact is that exemptions are out there and there were still communities that hadn't met the 50 ppb rule that had been in place for God knows how many years. And I think it's a lot better to get a system like this in place in those kinds of communities that just for whatever reason can't afford it or aren't going to be able to deal with it than to absolutely require 100% participation and then deny service to everybody else. Those old folks that were giving us a hard time, if they would have kept this community from using this kind of protection, all the kids in that community would have been exposed to more arsenic. The minute we started installing those devices in Grimes, we started reducing exposure to arsenic and I think that's a kind of change in thinking in the regulatory community that's going to be necessary if this really is going to work. The EPA guidance isn't finished on this and we'll see what happens and how much flexibility they will allow the states. There was a question about the shutoff device.

Fred: I'd like to give our listeners a different perspective on the 100% participation. There are a number of strategies other than shutting off water - and I won't have time to go through them - that can be used by a community. And it's one thing for an outsider from the community to come in and try to convince these folks, but we've seen it work, and Grimes is one experience, but there are other experiences where it's been more positive and they've been able to work through those kinds of issues. So it's not always a negative thing. Some people might throw up their hands and say, "Well, we're not even going to try." I'm not sure that's the message we want to send.

Gordon: Well, I don't think Grimes was a negative at all. The level of participation that we had, particularly since there is no rule in place right now. We didn't have any legal enforcement capacity and the lady in the red dress has now moved out. Somebody bought her house and they're installing the units in there. Eventually they're going to get to that point. There's a question about the PID if it causes the point of use devices to shut off how are people supposed to get their water? First of all, usually there's an indication of slower flow before it actually shuts off and they get that indication. There's also a little indicator device on the particular units we have. It's a little button that was visible in some of the slides, I just didn't point it out. And as it rises higher it tells you you're getting close to shutoff so you've got that visual indication. But again, if you don't have treated water for a couple of days, your body burden for that week, that month, that year, is still well below what it would have been with central treatment.

Fred: That's a good point and in terms of the PID, I just want to again for the listeners benefit - there is a review now of a draft that's within EPA. I imagine that would be made available at any point of the most common PIDs, how they function, what they do, what they don't do, and give you some thoughts about how to think through their role in a compliance strategy.

Andrea: Thanks Fred and Gordon. Sounds like there's a lot of discussion with point of use and there were a lot of other questions that were still out there, so again, we'll get those answers

posted onto our Web site so you can see some of the answers here. So, I'd like to thank all the presenters and the audience for attending today's Web cast and I hope you're able to gain some useful information here. I do encourage folks to talk with their EPA regional representative or myself for any questions that you encounter along the way to arsenic compliance and, again, stay tuned for information regarding the arsenic face-to-face training taking place this spring. So thank you again for joining us today.

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