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Presentation

Patrick Jones: Good afternoon, and welcome, everyone, to today's webinar. This is Patrick Jones with MDB. I'll be handling the technical aspects of today's webinar. If you have any difficulties viewing today's presentation or hearing today's presentation please use your questions panel to submit a question to me or you can e-mail me directly, and my e-mail is pjones@michaeldbaker.com, and I will respond to your technical needs and assist you with the technical aspects of this webinar.

If you have any questions about the content of the webinar we encourage you to submit those as the webinar is in process. We will hold all questions to the end, and our moderator will sort through the questions and ask them out loud to the presenter.

To submit a question use the questions panel of your GoToWebinar panel. From time to time it may minimize to the upper right-hand corner of your screen into a little orange arrow that is pointing towards the right. Click that arrow and it will re-enlarge your questions panel to where you can submit the question via the questions pane and hit send and it will be submitted to the moderator.

With that, I will turn the time over to our moderator.

Maureen Tooke: Good afternoon to all the participants and welcome. Today we are going to be doing a webinar today, and the title is The National Standards For Decentralized Wastewater Treatment: An Overview Of Methods And Criteria For Demonstrating Product Performance. And the presentation will be given by Tom Bruursema with the National Sanitation Foundation, NSF. Tom is a General Manager of the Environmental and Sustainable Services. He has been employed by NSF for over 25 years, serving in a number of technical and administrative positions.

Tom holds a Bachelor of Science in Medical Technology and a Master's of Science in General Biology. He is a former Board Member of the National Onsite Wastewater Recycling Association, Controlled Environment Testing Association, an Honorary Member of the [Water Ploti] Association, and a Member of EPA's MOU Partnership representing NSF. He has primary responsibility for all of NSF's environmental sustainable green chemistry and wastewater treatment unit testing, auditing, monitoring, verification, and certification services.

This webinar is one of many in a series that the MOU Partnership for Decentralized Wastewater Management puts on. We do them generally quarterly. All the proceedings, the slides and audio, will be made available and the URL to go to those will be provided at the end.

My name is Maureen Tooke at the U.S. EPA, here in D.C. And, without further adieu, we'll get started with Tom.

Tom Bruursema: Thank you very much, Maureen. And welcome, everyone, to the webinar. We very much appreciate your participation, and I'd like to extend my special thanks to EPA for hosting this event and to the fellow Decentralized MOU Partners for promoting it.

So, as Maureen mentioned, the event today is really focused around national standards in decentralized wastewater, which I think probably a number of you, if not most of you, are familiar is a function that NSF provides within the marketplace in terms of developing those standards.

So this is going to be – I'm going to share quite a bit of information. As Maureen mentioned, the slides will be available afterwards, so I'll apologize a little bit in advance that I'll probably move through this fairly quickly, but enough hopefully to give you a very good understanding of what the contents are of the various NSF Standards and how those relate to the marketplace.

And knowing that there's a fair amount of perhaps dry material laying ahead of us, I thought I might start out first with perhaps just a bit of humor, though I suppose, like all of you, every day in onsite wastewater certainly brings excitement and challenges, hopefully perhaps not quite this challenging, but perhaps this exciting. And so the balance of this presentation I assure you won't quite be perhaps this level of entertainment, but hopefully it'll lighten things up a little bit as we kick-off into a lot more material.

So just to give you a quick high level of today's agenda, we're going to just do a brief overview of NSF, just quickly a little bit about the organization, and then do a bit of an education on how American National Standards are developed. And all the standards I'm going to speak to today are American National Standards, which has an important designation within, of course, the U.S. in terms of how these standards are developed and how they're applied into this marketplace.

Quite a bit of detail on the current NSF/ANSI onsite wastewater treatment product standards that exist today, as well as a few that are in development, just to give you some information on those, as well. And I thought it would be good just to contrast them a little bit with a few international standards that you probably have heard some of, though maybe not in a lot of detail, but just to do a little bit of comparison with those and then hopefully have time at the end for questions.

So, again briefly, NSF is focused entirely as an organization around protection of public health and safety. We were founded in 1944, so we have a long history. We are quite global in our representation. We certify about 350,000 products currently across a range of different categories, but principally in the areas of food and water.

Our mission, which has remained really unmoved for many, many years, we are an independent, not-for-profit, nongovernmental organization, and really dedicated to being a leader in the area of public health and safety based risk management solutions. And we do serve a broad array of stakeholders, not only clients and manufacturers but certainly the public health arena, consumers at large, communities, so we touch upon many different aspects of the marketplace, and all with the intent of making the world safer through improved public health.

So just briefly the areas that we're focused in, and the first one we're going to talk about in much more detail, which is consensus standards, I think many of you are familiar with our product certification programs, which rely heavily on our standards though not exclusively, and some of our other certifiers that certify to the NSF Standards, they are in the public domain.

But our focus is principally, as I mentioned, in food service, as well as in water treatment, plumbing, wastewater, and a number of others. And then things you may not be as familiar with in terms of NSF, but we have a very large systems registration business, which is in the ISO registration services for management systems, a variety of testing and auditing, and then training and education services, as well.

And I thought it might be helpful just to give you a bit of a sense, on the water side of the range of areas that we are involved with, and this would be in the context of both standards, as well as certification. So, again, you're probably familiar with what we do in the area of wastewater, but we also have a number of programs in other areas, including beverages and bottled water, point of use and point of entry, drinking water treatment units and systems, plumbing systems, plastic piping, pool and spa, rec water, as well as probably the largest area that we deal in is in drinking water, both in the treatment and distribution systems, as well as treatment chemicals, everything from source to tap, and then also standards that we're actually going to talk a little bit more about in terms of water reuse and water conservation.

All right, so moving then into what NSF does more specifically in onsite wastewater and, again, progressing more into the standards side of our organization. So we are an accredited standards writer, and we'll come back to that, which simply means that we're approved to develop and adopt and publish American National Standards.

In the context of onsite wastewater we actually date back to 1970, the standard, if you're familiar with one, it's probably Standard 40, which is the most commonly recognized one in the marketplace, that was actually first adopted in 1970. We'll talk about standards development and revision, so a standard is never done, it's never stagnant, it's forever under revision and review and update, of which Standard 40 has gone through many revisions since 1970, but the onsite program in the context of standards does date back over 40 years.

And we then, of course, as many of you know, provide third-party product certification, which we won't talk about – actually, this is probably the only slide that I have making mention of it, but just to acknowledge that that's certainly a large part of what we do in this market space, as well, which is the testing and the auditing and then the service and maintenance requirements that come with the onsite wastewater programs.

So collectively the onsite program is really designed around ensuring a national program of product compliance that addresses both a kind of a level playing field, if you will, a consistent basis by which methods and measures of performance are available for use and for reference, and then to have a third-party source of data and a listing of products that shows compliance to those standards.

So moving now into how the NSF consensus standards development process works, it's – it is very much a consensus process, which simply means that we bring together all of the critical stakeholders, and there is a very formal membership that represents this group. It's referred to as the Joint Committee. It has a chair that comes out of a very elite group of consultants that NSF works with, and they are not consultants in the sense of paid consultants but more advisors to NSF, which is our Council for Public Health Consultants, it's a peer group, has no industry representation but is more academic and public health driven, so all of our Joint Committee Chairs come from those.

We do have a variety of Joint Committees in different areas, and there is one specific committee dedicated only to onsite wastewater, so that is their focus. All the membership is directed around that specific area of interest. And the three areas that are represented are shown in this slide, which includes the product manufacturers, the regulatory, the public health segment, which includes federal, state, and local representation, and then a little more general category or a little more open in terms of representation, which is the user category, and that would be laboratories, certifiers, utilities, consultants, in some cases consumer advocacy groups.

And in the context of a committee then this group would represent anywhere between 30 and 40 individuals. NSF's role is to facilitate and manage it. As the certifier we do have one vote amongst those 30 to 40, and then the balance is all the other individuals and industry representation and public health representation that comes to the table. It's a very formal voting process. It goes through very structured ballots, and each segment of this is represented by roughly one-third, so no one group has the ability to overshadow the process or influence the outcome in terms of reaching consensus process.

And then behind that committee there are many what we call task groups, so it's not just that 30 to 40 individuals developing standards, there's literally hundreds even with onsite, hundreds of people participating in a number of different segments within what we call task groups, that feed-up into the committee and, frankly, do a large amount of the work that then gets brought back to the committee for review and for consideration and balloting and adoption.

So, again, the NSF Joint Committee is the formal body, they are a consensus group, balanced membership, as I mentioned in the previous slide. And they have responsibility for not only new standards but then the maintenance and revision of current. And, as I mentioned, no standard is ever completely finished, it's always up for revision and review and change as the market changes and as people are going about new issues.

And then the product that we produce out of this process is an American National Standard, so it's developed around the interest of the U.S., the applications that are relevant in the U.S., the conditions that are pertinent for us, and that's why they carry that designation.

And so the goal of the standards, again, a uniform method of product evaluation and that uniformity is important. It standardizes how products are evaluated. It standardizes how they're critiqued, if you will, with – in the context of how they're judged in their performance. So it gives product manufacturers an ability to assess their products' performance or be evaluated for their performance, health officials for a convenient point of reference for specifying for compliance. And then, of course, for buyers or specifiers that they can have confidence in their product selection, knowing that it's been evaluated in accordance with the American National Standard.

So this ANSI, as we commonly refer to as the acronym, you'll see not only with the NSF standards, there are many accredited standards writers in the United States accredited to the American National Standards Institute, so when you see the NSF/ANSI, ANSI is not directly involved with the technical content of the standards, very rarely. They don't sit on the committee. Their responsibility is to oversee standards writing or organizations to make sure that, in fact, what they're doing is in accordance with their requirements, international requirements for consensus driven standards.

One of the up sides or one of the benefits of that process is there is only one standard then in the marketplace for a given scope. So you would never see competing American National Standards, if you will, for the exact same product and scope of work. It would always be a single standard that carries that designation and that's part of their responsibility to oversee that there isn't that duplicity.

And then it represents these standards, appropriate for the U.S. market. That's the point of having American National Standards and having a committee that's focused on U.S. needs. Though, having said that, it is not unusual for American National Standards to be used and adopted, either in total or in part in many other countries, particularly where they may lack those standards and rather than to work from a clean sheet of paper they'll oftentimes leverage the ANSI standards and frequently the NSF Standards in other markets.

Okay, I'm going to move now into the current NSF/ANSI Onsite Wastewater Treatment Product Standards, and start out first, and I'm – there's eight of them fully adopted today, and I am going to move through all eight of those fairly quickly so we don't get bogged down too much in any one of them, but just to cover quickly the scope of them.

So we have standards for complete systems, which includes those for I call it combined total, meaning all the waste flow from a building or a facility, and we're talking now again onsite so this would be at a residence or at a commercial building. We have those for blackwater only, for graywater only, we have them for both residential and commercial onsite treatment systems. And then we have a number of standards that touch on components or modules, things like disinfection devices, filters, pumps, graveless trench products, all exist today. And then two brand-new ones that I'm going to touch upon that are in development is a standard for tanks or tank manufacturers, and then wastewater treatment additives.

All right, so I'm just going to bring these up one by one, but I'll move through them fairly quickly. And, again, we're going to go into a lot more detail. So you're going to see, for example, this first one, that's NSF/ANSI 41-2011. So 2011 is the current edition. If you go all the way to the right you'll see another year, that's the year that it was first adopted. So this one has been around for a number of years, but you can see just last year was revised and updated.

Standard 46 is a more recent standard. It was evolved out of something called Criteria C9, that some of you who have may been around awhile will recognize as an older standard. And this one deals in a lot of different components and devices.

The very latest of these standards is for trench technologies, which we'll come back to, but you can see both the date at the end and the date in the title is the same. That one was just recently adopted.

These two I've brought up together because they really mirror each other in very, almost identically in many ways, except for the scope as it relates to the contaminant – Standards 40 and 245, which is for nitrogen.

Another pair that mirror each other very similarly, which are also quite new, came in late last year, Standards 350 and 350-1, which are the reuse standards which we'll talk about in a little more detail.

And then we have a Standard for field performance, as well, which is a little different, obviously, than these others, which are much more for the most part laboratory type evaluations or more controlled conditions would be the appropriate way to describe it as opposed to a field assessment. And then, as I mentioned, we've got a couple that are under development, both for tanks and treatment additives.

So moving on then and I'm going to, again, cover each of these. Some of them with just one or two slides, some of them in a little bit more depth, really just I think related to what I would expect probably your interest is in general and where you might want to see a little more detail.

So Standard 41 has an interesting title, Non-Liquid Saturated Treatment Systems. It's essentially compost toilets, and even though that's in italics it's not in the title, just Non-Liquid Saturated Treatment Systems is the title of the standard. It has no size restriction, and we have certified products as small as one person per day as it would be rated, all the way up to more of a day park use application with like 180 uses per day, which would be a typical park environment. So they do range in size. The standard allows for certification or evaluation, I should say, of both those that treat the liquid and the solid, as well as those that treat for the solid only, which some technologies will divert the liquid portion to a different waste stream.

And then the standard covers three different classifications – residential, which is a more typical, probably what you would think about a typical residence, and then a day use park, which is more of a kind of a transient application, not necessarily fixed but people coming and going on a regular frequency, and then a cottage application, as well.

The picture in the lower left there would be a typical, more of a park application. The treatment system would be below it, and then the others are a little more self-contained type applications.

So Standard 41 has both a laboratory control test and a mature test. And as we go through these you'll see how the committee has really tailored the standard to what they think is relevant for that product, for that application, and for its typical use environment.

So in the case of this particular standard there's a minimum six-month treatment test, and this is loaded with actual human waste, this is not a synthetic waste. And there are, like with most, in fact I think really all of the standards have some kind of stress defense, and this one has vacation which is fairly common, but it also has some fairly high level overloading stress events, which is not common in some of the other standards. There's a 200% overload, which is just a more typical kind of a high use situation, and then my favorite, which is the party stress which is a 500% load.

And each of these are throughout the test at different points and have very defined, as is the case of all these standards, they're very explicit in how these tests are carried out. So it's not as if you can – the laboratory or the manufacturer can say, ah, you know, I really don't want a 500%, let's go with 400%, I don't want to do it at the first half of the test, I want to do it in the second half of the test. None of that can be varied by either the laboratory or the manufacturer. The standard is very explicit on how the method is to be carried out, and it's very detailed in how the test is to be performed.

And then also under Standard 41 there's a number of structural tests that are believed to be relevant to these types of products and these will be looking at the whole structure of the system, not only the toilet, itself, but also the holding reservoir. And then this standard also has the mature system test and this is where we would actually go out in the field and with the manufacturer's help find several locations that have existing systems where we would actually also collect sample from, just like we would under the laboratory controlled conditions.

And the criteria, it's pretty straightforward for Standard 41. Odor can be a problem with these systems so there's a requirement for no odor. Liquid containment is probably pretty obvious. There's also some moisture requirements around the solid end product, and then ultimately from a public health standpoint this is a fecal coliform measurement, and it's less than 200 MPM per 100 mils.

All right, moving on then to Standard 46, which is a little bit of a catch all standard, it covers things like septic tank effluent filters, grinder pumps, disinfection devices, and it's really meant to be kind of a forever expanding component standard. There's a front section to the standard that all products must meet and then each of these additional technology aspects that are included have their own section, which get into much more detail about how to evaluate the products. So I'm just going to take each one of these briefly and just give you a flavor for how the testing is performed.

So the first one, septic tank effluent filters, the scope of this is for gravity flow and meant to be at the outlet path of a typical residential septic system. You'll see this 400 to 1,500 gallons per day

as a fairly common point of reference when it comes to residential applications throughout the NSF Standards. The scope of the testing includes structural, as well as retention of physical particles. Essentially, this is meant to be a physical barrier of solids retention to keep it from entering into the drain field. While some certainly claim to be able to treat for suspended solids, as well as BOD reduction and perhaps may well achieve those claims, this standard is not designed around those, it's really looking just at the solids retention within the septic tank.

So I've just laid out here the flow or the lineup, if you will, of the tests. And there are five of them, and the standard is designed in such a way that a product or a filter has to move through each of these in this order. So, again, very explicit in how the testing is to be done. And, of course, we don't have time to go into the detail on any of these, but I'm available at any point in the future if you see things here that you would like to have a greater understanding around.

But it starts out with a flow test on a clean filter, brand-new filter, fairly high flow, and then we clog the filter, artificially clog it to 85%. And then there's a different flow condition for that test, but in both of those cases for the first two what it's really looking to do is make sure that there isn't an unusually large head rise, which would then cause flow to back-up into the pipe or potentially into the residence. So the first two are really looking at can it manage a fairly high volume of water without creating a significant head rise.

You then move into a structural integrity test. Essentially it's putting the filter in and removing it. There's five dry and 100 wet kind of installation and removal just to represent or mimic the lifespan of a typical filter, that it can remain structurally sound over those kind of uses. And then there is an interesting aspect of the structural, which is that it gets 100% clogged, and then there's 12 inches of head put on it for 48 hours and it can't move, dislodge, be displaced during that period of time.

Next is solids retention, which is essentially looking to see does it, in fact, protect against particles moving around the filter, can it actually retain solids. And solids in this case, they're essentially physical beads that are used. This is a kind of a synthetic, if you will, approach, simulated test, and it uses either one-eighth inch or one-sixteenth inch beads depending on the manufacturer's choice. Again, run at a fairly high flow. This is a clean filter over eight hours per day for seven days.

There's that, and then there's a separate bypass protection. This was just brought in the 2010 version, and we had some products that weren't able to meet this. Certainly some of them did and all the listings that we have today show all the products that have met this test. But this brought in some new challenges, partly because of the upward force that's applied, it's also 100% clogged. And in all these cases zero spheres are allowed to pass out into the effluent and also the filter cannot be dislodged, though typically if it gets dislodged it's going to pass spheres, so the two kind of go hand in hand. But there was a revision in 2010, and it's a pretty stringent set of tests even though it's under more of a simulated condition. This is a fairly challenging evaluation for these products.

Moving on to grinder pumps, this is a standard that evolved out of criteria C9 standard, that's slowly being taken out and replaced with Standard 46. But grinder pumps, in particular, it's

based largely around the impact of – on the product as it's loaded with some pretty aggressive materials. So we do an initial pump curve assessment. It has to be within certain plus or minus within the manufacturer's claimed pump curve, but that sets the baseline. And then you move through a number of evaluations.

And probably the most interesting is the household items loading test, where we load things like cloth diapers, toothbrush, crushed glass, a matchbox car, bottle caps, none of which I'm recommending that anyone should ever flush down their toilet, but in a simulated test where things could potentially get down in the toilet and affect a grinder pump, it's really meant to be a bit of an aggressive, somewhat worst case scenario. But it's tested over six weeks.

There's a couple other tests, shutoff and negative head, throughout that test any of the things we throw at it it can't clog, jam, or have mechanical failure, and then there's really two critical assessments at the end of the grinder pump test, and that's looking at the gap between the stationary and rotating cutting elements to make sure that throughout all the things we threw at it it didn't have more than a 20% change. And then we go back and do a comparison to the baseline curve, where the maximum change in the curve cannot be more than plus or minus 5% kind of. So this is a test and evaluation that's been around for a number of years.

All right, and last in Standard 46 is the disinfection devices. And there's really three currently. This may very soon be split-off into its own standard, so not to digress into that detail but you may see eventually a Standard 385 that actually kind of plucks out the disinfection devices out of Standard 46. There's been some activity to do exactly that, and I'm sure in time that will happen. But currently that standard or in this standard will still cover these three main categories, which is chlorine disinfection, UV, and ozone.

And in all cases these are for residential applications, so up to 1,500 gallons per day. In the case of chlorine we have two different categories. One is more just a dispenser, which is fairly common to the marketplace, it just delivers a certain volume of chlorine into a given existing tank, like a pump tank, and it has some kind of a retention period. But the tank, itself, is a part of the dispenser, it's just the dispenser, and then we have those that are more complete disinfection devices that include the contact chamber. And those are evaluated differently under the standard just because of the different applications. Dispenser is just more judged on its ability to deliver a minimum volume of chlorine, and then disinfection device is more measured on fecal coliform reduction, and then UV and ozones.

So each of them have their own test lineup. UV is tested the longest, for 90 days because it has the potential for following of over time of the wastewater and contact that UV, as you probably know, is very dependent on UV transmittance through the wastewater and so the more following there is the less light is transmitted and the more likely it is that it's not going to achieve disinfection.

The test conditions for all these are meant to be class one, if you're familiar with Standard 40, but on the poor end of that, so roughly a 25, 30 type effluent quality or thereabouts, maybe even a little bit poorer than that. But it's meant to be on that worst end. So this is – these are not designed to treat septic tank effluent. These are designed to treat advanced treatment system

effluent, and so we designed the test around a fairly poor effluent quality just to make sure that it can perform under those conditions. And then roughly 10 to four coliform in terms of an effluent challenge.

There is material resistance testing for all these because all these can be aggressive in the sense of material exposure and [crosivity], and then ultimately for all of them they default to the fecal coliform reduction, which is again the 200 MPN per 100 ML.

Okay, moving along into the next, which is our Standard 240, and, again, this is the most recent standard. And I wish we had more time to go into this, but in the future I'm sure there'll be other events – I think there's a plan to present this perhaps at the [SORA] meeting coming up in combination with the [NEHA] event. We're giving a presentation on this, and it really is – it's a standard that was actually being developed for roughly eight years.

And I should have mentioned early on the typical duration of a standards development cycle, eight years is long and may even be a record of sorts in terms of the marathon. But typically two to three years is not unusual. Two to four years would capture probably the majority, but there's a few exceptions like this that went on for quite a long time.

And this is specifically for alternative technologies to conventional course aggregates, so – which many of you know have been in the marketplace for many, many years, but there has always been this desire to have some measure, among some anyway, a measure of how to evaluate these technologies under a more standardized set of conditions.

And so the standard is built around comparison to aggregate, which is unusual in the sense of the NSF Standards. Typically, we're just looking to evaluate a given technology for its given performance and not necessarily comparing it to something else. But this one since there really isn't a good standard measure of what aggregate drain field material does, so the point was that it would always be a one-to-one comparison under test conditions. And it's based on hydraulic performance, that's the point of this evaluation is around hydraulic performance.

So there are two evaluations under Standard 240. There's a long-term acceptance rate, an LTAR for new technologies under test controlled conditions, much like we evaluate a lot of the other products or, and this is somewhat unique to have both in a standard, there's a field performance assessment option and that's for products that have been in general use for 10 years or more, which certainly there are, and it uses an expert panel to review existing field studies. I'm going to spend a little bit more time on that just to give you a little flavor of it.

But, first, the LTAR is a, again, it's controlled test conditions. You can see the photo there, is actually when we were doing the validation work for the standard. It's -- it was done at the [Mas Tec] Facility in Massachusetts, and you can see them there constructing one of the controlled cells.

And in the final standard that was adopted we ended up with six of each six control and sixth product, so there's a large number of replicates for this standard. And just some of the details, they're all 12-foot minimum, one to four foot in width, so essentially these are trenches that are

being loaded, loaded with residential wastewater, typical Standard 40 type influent strength, representing residential wastewater, which if you're not familiar with that I'll have a slide for that in a moment. And then septic tank effluent coming out of a septic tank goes to these actual trenches. It's a 36-week test. It's meant to be very accelerated loading to achieve a bio match and ultimately then ponding, and there's observation ports that are used to measure that.

And, again, the LTAR is an assessment of hydraulic performance, measurement of gallon-per-day acceptance rates for both the control and the product, so you have that point of comparison, and it's really meant to deliver a unit of measure in gallons per day per square foot of bottom area for the trench.

Next then is the field performance assessment. And, again, this was quite a unique aspect of the standard. It relies on an expert panel and there's, as with the testing there's a very explicit set of conditions and requirements around how the FPA section is laid out, including who is appropriate for the expert panel. It is based on a review of existing data sets, as I mentioned, 10 years, 1,000 systems, 600 of those could be at five years or more but the balance has to be more than 10 years. And then it goes into some geographical distribution and that it's judged by.

And there's a rating system. I'm going to show you a little hint of what that looks like just to kind of put your arms around what this scoring system is, but it's based around, first, the type of the research, whether it was third party or manufacturer led, if it compared against a control or was just looking at the product, itself. If it was only based on permit data or actually had somebody going out and making a more real assessment of the installation. And then a number of data quality measurements that feed into the scoring system, as well – the performance, the age of system, soil, climate, peer review are all built into it.

So this is just the weighting end of it. This is a table that if you look on the left-hand column you'll see if it's compared to a control, if it's a benchmark for data set for benchmark of failure rate, if it's a survey of permit data. So that's one criteria, and then across the top is whether it's third-party led, second-party, or manufacturer. And then so this is your first, kind of as you take a study and you drop it into one of these buckets based on whether that was the type or the – how it was led in terms of its third, second or manufacturer would give you a value. So that's one piece of how it's evaluated.

And then I know this is a little bit busy as a table, but this is the other piece of the assessment, which is the data quality. And if you look to the far right and you come over to the second column, where it says total group score equals 100, you can see if you went down you won't get to 100 just only because I couldn't fit it all in and still be realistic for you to look at, but it covers what – 90% of what's – would be included, so there's a little bit left over.

But you can see the kind of things that would be judged then – performance, age, soil conditions and climate, and how those get rated differently in the assessment. And so not to waste any more time on this, this is all in the standard, this we plucked right out of the standard in terms of the table and the requirements, but just to give you an idea of how the individual reviews would be evaluated and assessed to come up with a score.

And here's an example score that ultimately you feed these into a table, so in this one example it got all ones for the ranking because it was all perfect execution. It was a third-party study, had all the right characteristics of the ranking, but then you can see the data quality score did very well but not perfect. So some of it came down in terms of not achieving the 100, but this would be a very good study as is defined by the standard achieving a level of 73.

And then, and I should go back just briefly – so there are requirements. You have to achieve 100 minimum score to meet the standard. You can have no more than six studies. You have to bring forward all studies that you know exist, so there's none that you kind of cherry-pick and hide. So it's very much an interesting and we think an appropriate standard and aspect of a standard for those products that are already established in the marketplace and have a lot of good research that's already available to make that assessment.

Okay, moving on then, hopefully, you're hanging with me. I know this is a lot of information and I'm moving fairly quickly, but hopefully you're getting a sense for how these standards are structured. So if there's one, again, that you know much about or have some familiarity with these standards in the marketplace it's probably Standard 40. It's been around a long time. It's the most pertinent in terms of residential systems. It's heavily in state and local regulations, and so that's one. And then it's mirrored by one that we adopted a few years ago for nitrogen reduction.

So I'm going to talk about these kind of at the same time because they do so heavily mirror one another. And so Standard 40 and 245 is for any residential treatment system with a capacity of 400 to 1,500 gallons per day. Now, what defines a residential system? We have evaluated a whole range of technology types, from sequencing batch reactors to fixed film, peat based, sand based, and every other possibility – well, not every, but many other possibilities that you can envision and you may know exists in the marketplace today.

So the standard doesn't get into being explicit about whether it can or cannot have natural materials, whether it can or cannot have additives included, it really doesn't get into that level of prescription. It really boils it down to its going to take residential waste strength. It has to produce a certain quality effluent, which means you have to collect a single sample from the entire treatment train, and it has to be within 400 to 1,500 gallons per day. Beyond that there is not an explicit – it can or cannot, it doesn't even say it must be biological, though I don't believe we have ever seen one that's not biological based, but you could certainly have a chemical based or a heat based treatment. So it is quite general in that sense.

So Standard 40 is specific to BOD and solids reduction, and then 245 is nitrogen reduction, both 40 and 245 do have requirements for PH, 245 does have a requirement that you must first meet or in parallel meet Standard 40, so you would never see only a Standard 245 certification or evaluation.

Some critical parts of the standard -- there's no restriction for seasons. It's a six-month test, so you could start in the spring and end in late fall, you could start in the dead of winter and end in the spring. You can, depending of course on where you test because there's different locations, but there is no absolutes around geography or particular seasons.

A very important point, we allow no service or maintenance during the entire test, so there's no tweaking, no adjustment, no cleaning, no repairing, there's no service or maintenance during the test.

Everything gets reported. There's no allowance for any discard, which was true of certain versions of the standard many years ago, but hasn't been around for quite awhile. And, of course, the only allowance is if there's something that goes wrong with the facility, but in terms of the test unit, itself, all the data gets reported out.

So the standard, of course, deals and we'll talk a few more slides about the performance evaluation, but just appreciate there is a lot more to the standard than just the effluent quality requirements. So we would include things like essentially water type, its infiltration, exfiltration resistance. There's noise level requirements, this is a system that's going to be in someone's property and so you want to make sure it's not producing noise levels that are problematic. It does have the requirement for mechanical components.

No periodic maintenance or adjustments, electrical compliance around the [lacsis] ports for maintenance sampling and examination. There are audible and visual failure sensing and signaling requirements for mechanical and electrical components, and then there's an entire section on what the content must be within various O&M and installation and operator manuals, as well.

So just to give you a sense of, again, how explicit the standards are around how a product is to be evaluated, this is the loading schedule that would be true of Standard 40 and 245. So it lays out very specifically what periods of the day and what percentages. And so this is, of course, meant, as you might expect, to represent or mimic what's the typical residential environment but also then to make sure it's standardized so that one product to the next gets evaluated in a very consistent way.

So it sets out the time period, sets out the percentages, and it also sets out that the gallon volume shall be no more than 10 gallons, so it's again meant to represent, so you wouldn't just send 200 gallons in one large dose and then wait another several hours. It's meant to be delivered in increments over these time periods in fairly equal divisions.

And so I gave an example here, if you had a 500-gallon-per-day system and you divided it up into like, let's say, six-and-a-quarter gallon doses you would have roughly 80 of those would be spread across all these different time periods in which essentially the doses are sent. But the picture to the left there is one of our test facilities, just showing we have multiple tests going at the same time and so there's just controlled conditions by which this is all metered and delivered to the test units.

Sampling is 24-hour composite. We produce a lot of samples and a lot of data. Standard 40 is sampled five days per week, so we have well over 100 sample points. Standard 245 for nitrogen is three days per week, a little less but still a large volume of samples. And really what this translates to is there's really nothing, maybe not nothing, but very little chance that anything can

happen with this product over six months that we're not going to detect in the sampling. Composite samples are set-up that essentially it pulls an [LKWAT] every time a dose gets delivered to the system.

So it's – you can think of it as, and the example I gave if it was 80 doses then there's literally 80 grab samples going into each sample times over 100 samples. So we're really capturing virtually everything happening within that treatment technology, which is the point of it, to know exactly from start to finish what that system is doing. It runs 26 weeks. There's stress events included, like I had showed you earlier with our Standard 41, very typical, so it's a very rigid process that we go through in the test arrangement.

Effluent quality requirements, it's a minimum standard. These values have not changed much over, in fact, maybe not even from the beginning because it's meant to mimic secondary effluent treatment requirements that would be typical of a wastewater treatment facility, a public facility. So it's built around BOD and solids. There's different requirements for the 30-day versus the seven-day. Again, these are all based on composite samples collected during those periods of time. Nitrogen is based upon a minimum percent reduction, and then there's a requirement for PH.

So while these are the minimum requirements, many of you know that there are state codes or state regulations or county that will require tighter numbers than these. That's no problem as it relates to the standard, the certification. There's often been talk about having different tiered levels, having even tighter effluent criteria within the standard, and it was always decided that really because so many of the codes and regulations differ slightly in their numbers and the data that we produce shows exactly what the system does, that there was really never a need to go into that kind of a tiered approach but rather just let the data speak for itself and whether it complies with those local regulations. So the standard sets these minimums. Any product [MMUs] could be certified to that standard, but then the data actually speaks to its actual performance.

Okay, next pair, and these are, again, fairly new and there's been a lot of interest around these. And NSF has done a very detailed webinar on these that we actually have posted to our website so if you want a lot more information on these two standards there's certainly a way to get a full webinar around just these. But we have now reuse application standards, they're residential and commercial, and I'll speak to how these two compare and contrast to one another.

So, first, Standard 350, residential and commercial, deals with both graywater and combined wastewater. Graywater can be laundry, bathing, or both. The standard actually delineates it to that level. Combined residential, meaning all the flow, would be black and gray, so that's a separate category. And then the third category is commercial, and I call it combined. It could be a lot of different sources that feed into the commercial type treatment train that gets used in a reuse application.

The effluent under Standard 350 is for indoor applications, toilet and urinal flush chain, outdoor surface and subsurface irrigation, and then other comparable applications. And we'll come back to what the effluent criteria are specifically in terms of the parameters, but 350 is meant to cover

this full scope, residential and commercial, graywater, combined residential, combined commercial, and then for these effluent applications.

So to contrast that with 350-1, it is also for residential, commercial, but it's for graywater only. And, again, same split, could be laundry, bathing, or both. And it's for subsurface only, so clearly then it's a poor effluent quality, which the criteria are, so subsurface only, graywater only, whereas 350 has a much broader scope, and I won't – we won't spend the time on why we have even the 350-1 but it is a standalone standard, poor effluent quality, graywater, whereas 350 really covers the bulk of what the interest has been in the marketplace for reuse, which is more toilet and urinal flushing and surface irrigation and such related types of applications. So that's the one that tends to be much more of interest to most.

System sizing, residential, again, up to 1,500 gallons per day, though this one does not have a lower end of 400. There is no lower end for this particular standard. It's laboratory tested with actual wastewater, so much like Standard 40 and 245. Contrast that with graywater, similar size, but there we actually use a synthetic wastewater, and I'll come back to that and we do have a synthetic wastewater recipe for bathing water, for laundry water, and for both, very explicit in the standard. The exception with graywater is commercial laundry water is looked upon as a commercial system, and so that and other systems that would exceed the 1,500 gallons per day are actually evaluated under field conditions where there's an actual building installation just because of the size of the flow.

So for residential wastewater, again, for complete residential systems tested almost the same way we test 40 and 245 type technologies. There is a prerequisite for meeting Standard 40 before you could do a Standard 345, not for 245 but there is for Standard 40. Same basic influent, six-month test, almost mirrors, in fact it does mirror Standard 40 and 245 and in fact so much so that you could run all three standards at the same time with the same unit and have a single test that covers all three, which some manufacturers have done. And so, again, 40 is BOD and solids, 245 nitrogen, and then 350 adds in turbidity and E. coli as additional requirements above the others.

So graywater, again, that was residential. Graywater, as I mentioned, is synthetic wastewater and there was an interesting validation and development process. The photos you see there are the NSF Laboratory, so much different than how we would evaluate a system under one of our test field conditions. This is under a much more controlled environment, where we create tank water and deliver it to the actual treatment systems, but you can see the different components, typical of what you would expect in graywater. And the standard actually goes through the history of how this recipe came about and how it was developed.

So the recipe is important, but what's more important is to have the characteristics be reflective of graywater, which is fairly well established in literature. And as you look at these, to the right, the values, you'll see that graywater is oftentimes thought about as fairly benign in terms of concentration, and actually it's not, certainly not true as it would be of gray and blackwater but it does have its own fairly significant loading characteristics, which is why generally there is a requirement for some type of treatment application before it can be reused, certainly within the building.

And so these are the parameters that would be true of the influent challenged water that would then be subjected to the treatment system during the six-month evaluation. And I know this is a fairly busy table, and I'm not going to go through it in detail. The only point of this is just to show again the level of detail, the design loading conditions, the stress loading conditions that would be detailed in the standard for each of these different approaches. And on the left you could see if it's a residential beta unit only, the regimen that it goes through, if it's a commercial system the regimen that it goes through. But the standard lays out in very great detail what the product is subjected to in order to demonstrate its performance.

Commercial facilities deals in things, like lodging establishments, parks and campuses, shopping facilities, but it's not meant to be where there's manufacturing, so not industrial, no assembly, no food processing, but it does also include laundering facilities but not those where there is a very high amount of soiling or high strength commercial cleaners. So it doesn't go into the very extremes, so it would be more a typical apartment building, office building, and there's a number of others that we've seen come about since the standard was launched that are somewhat in that category, having more the residential or the more human use component rather than more the industrial conditions. And, again, it's evaluated at an actual field installation where we're monitoring then sampling and the duration and what the influent characteristics are, but we're not actually controlling the dosing, the dosing would be whatever that particular facility produces.

Okay, so here's the criteria, kind of the nuts and bolts of what these products must meet. So this came about by essentially canvasing everything that we could find, we the Committee could locate as it relates to existing regulations in the marketplace, which is actually quite a few around reuse quality parameters. We looked at every state we could find. We looked at international. We looked at world health organization, EPA reuse guidelines, wherever we could draw upon and put together kind of the landscape of what are existing regulations.

And then we took not the very worst case scenario, but on the upper end certainly of conservative and derived these parameters and these values. So Class R is residential, single-family only. Class C is both multifamily, as well as commercial. You can see they're very well aligned, with the exception of turbidity and E. coli being a little bit tighter for the commercial and the multifamily. And then the number in parentheses is the single maximum sample effluent level throughout the test. The others are averages throughout the entire test.

So fairly tight, it's 10, 10 essentially on BOD and solids, which is a fairly high level of performance. Turbidity, if you remember back the effluent is somewhere between 50 and 100 so it has to do a fairly substantial reduction of turbidity. And then E. coli is essentially close to non-detect as it relates to the overall average. So that's Standard 50. Remember, that's the better effluent quality.

And then Standard 351, which is allowed for subservice irrigation only, has essentially the same as we would have under Standard 40, it was actually meant to mirror that in terms of a discharge criteria, so it's essentially a 25, 30 overall average.

All right, and then the Standard 360, which is the last of the NSF standards that I'm going to talk about, at least that are already adopted. And this is meant to kind of bridge from the laboratory into what systems are actually doing in the field, which we, you know, is a common question, under controlled conditions that's great but what does the system actually do when it gets out into the field? And this is meant to cover those systems that are evaluated, then certified to Standards 40 and 245 are very similar standards, so that there is a baseline performance under controlled conditions, so you know under all that exhaustive sampling and stress events you know what the system will do before you take it out and do an evaluation under field conditions.

So, again, why the need for such a standard? It was really making sure that we've addressed not only what would happen under lab conditions, but then also what would happen under field conditions. There were a number of studies that have been done over the years that weren't done very well, so it was really meant to have – ensure that there was a standardized means of doing this, if somebody was going to undertake it, so that was point one is let's make sure that there's a standard for if somebody is going to do a field evaluation how that's to be done appropriately.

And then certainly there's many states that do require field evaluations, so the intent was to have hopefully one data set to one national standard that then the states can have as a report, no different than they would have as the lab test report, and have that satisfied, satisfy their particular needs for both a field evaluation, as well as laboratory evaluation.

So very briefly, again, just like all the other standards this one has a very structured set of requirements – field evaluation of a minimum of 20 samples, but those come from a pool of 100. The manufacturer doesn't pick the 20, the test organization picks the 20. They all have to have been in operation for at least six months. They're sampled quarterly, so 20 times four, you wind-up with 80 sample points to judge. That's been determined statistically to be a reasonable representation of what a system's performance would do under variant conditions.

BOD and solids is the baseline, though certainly other parameters can be added to that. There's a suggestion, though not a mandate, to have a diversity of geographical locations. And, obviously, if you're trying to look at a data set that's going to be accepted by many different jurisdictions the broader it is, of course, the better the acceptance will be.

And then all the oversight sampling analysis has to come under a third-party organization, not that somebody like NSF has to necessarily do all of it themselves but certainly has to manage it all and make sure that it all has that quality of data analysis that comes into the final process.

So it's not a requirement of Standard 40 and 245. There's no pass, fail. It's simply a report that's published and made available and, again, only systems that have already met Standard 40, Class One would be appropriate for undertaking this kind of an evaluation.

All right, so I'm going to speak now to the two standards that we have in development, so these are still working through the Committee. And I'll speak first to the one that's actually been in play, if you will, for a few years now. The second one I'm going to speak to is a much more recent effort.

So this is still it's not an American National Standard yet, and so whenever you see a standard that's in development it's always going to be just labeled with NSF until it fully completes the full adoption process before it would ever carry the ANSI designation. So it's still a draft standard.

The title is Procedure for the Quality Control of Onsite Wastewater Tanks. And so immediately you realize this is meant to be largely driven around appropriate manufacturing of good quality tanks, though there certainly are very specific tank assessment requirements. But it's more than that, and it's not really as we would think about it in the sense of a traditional product certification. It's almost more of a registration of the manufacturer that they have the appropriate controls in place to produce good quality tanks.

So there's minimum documentation requirements related to materials, design, construction, water tightness. Basic product requirements, and then more hinged on the manufacturing quality assurance plan and how they undertake their manufacturing process to make sure essentially that they're producing good quality tanks.

And it was heavily built in thinking around this that it be linked back to what are the local and state regulatory requirements because ultimately that's what local manufacturers are intending to meet, as opposed to setting some kind of a national standard which would really not be practical as the market functions today. So it's really meant to show that manufacturers can produce good quality tanks in accordance with those local, state and regulatory requirements and they've proven that they can do that through their in-house quality assurance and the measurements and assessments that they take of their tanks on their lots or at the point of installation.

This one has gone through balloting I believe twice now with the Committee and just finished one. There's more comments to be addressed, but it's realistic that this one may finish by the end of this year.

And a much more new effort, which is for additives, and this is mirroring in some respects a very well established standard, which is called Standard 60 for drinking water treatment chemicals where we today, and this is just NSF certification, we're not the only certifier, but there's well over 1,000 companies and well over 40,000 certified products. So certification of additives is certainly not a new thing. As it relates to wastewater it is something fairly new.

This is draft Standard 409, and there's no particular relevancy to these numbers, they just kind of come-up as they – as we march through the numbers, but it's designed to be split-up into both a formulation review, as well as performance. And the performance is split out into both kind of smaller sized systems. In this case up to 5,000 gallons per day and then larger systems would have a separate evaluation. And it's dealing with all the different types of additives or expected to, that are in the marketplace today. Microorganisms, a lot of them are bacteria based, there's some that are enzyme based, and then some that are more chemical type additives. And so it's looking at all these things, but then also very strict labeling requirements to make sure that we're addressing some potential confusion that can be in the marketplace with these products.

So, as some of you know, there's certainly state programs around these that look largely at the formulation level. This will certainly hit in a similar way, though not exactly in how those are structured, but then looking to layer on, also, some performance requirements.

All right, and the last section that I wanted to speak to was just to give you a sense, and I'm just going to touch on three different standards – the Canadian standard, the Australian standard, and then a standard that's present in Europe today.

And Canada adopted in 2009 a Canadian National Standard. It came out of Quebec standard, and we worked with the Quebec group to be in queue. They're a certifier and a standards writer, much like NSF. When they were first developing their standards some years ago that then moved into a Canadian National. And so it very well is aligned with Standard 40. And I don't know, we haven't certified anyone to this standard. It's still fairly new, but it is getting some traction in the marketplace.

But the up side is any company that's already met Standard 40 would likely meet the majority of that standard, but there are some uniqueness's, such as they have a requirement for the overall average influent to be at least 200 milligrams per liter. They have some different temperature options. You can do non-control, which has always been the case with the NSF standard, or you can do controlled temperatures, so a little bit different in that sense.

And I'm going to show you a table of the different types of treatment and classes because they're pretty diverse. And then it has a seasonal reliability test, which is interesting, so they require 12 months of which six months can be actually kind of the more rigid sampling, and then the second six months can be a much lighter sampling, or if you already have a Standard 40, for example, you can do 12 months on the much lighter sampling, but it still has to be 12 months.

In the plant heartiness zone, now, those that do a lot of plant type things may know of what heartiness zones are, and others of you may not, but I'm going to show you a picture of the heartiness zones here in a moment. So these are the classifications. They have four different areas – basic, disinfection, phosphorous, and nitrogen, and then based on the [ethylene] quality you fall into any one of a different layer in terms of types.

So it's much more elaborate in the sense of ultimately kind of picking a scope. So this one rolls, like for us, we have separate Standard 245 for nitrogen, this puts nitrogen in the same standard and then also has several different layers of performance that lead to individual criteria. So just a different approach, but certainly one that can be done and can certainly be used, it's just a matter of making sure you understand what the different designations are, which are pretty straightforward.

So here's heartiness zones, and I didn't do the full country. I just kind of took the northeast. And the heartiness zones would be kind of the purplish and the orange colors in this graph. So you can see here in this slide, like northern Michigan, southern Ontario, northern Maine, up through the northeast, northern half of Wisconsin. So there's a fair area that's in heartiness zones three and four, but you actually have to test in a facility in a controlled environment within those jurisdiction or within that span to be able to meet the Canadian code and it has to be for 12

months. So, obviously, they're placing a lot of emphasis around being able to show performance in their climate.

All right, the Australia standard, also, quite similar in many respects to Standard 40, a 26-week test. And the reason I mention Australia you may see some products coming in that there certainly is some exchange of technologies that come into the U.S. market uniqueness, and you're going to see this even more highlighted in the European standard, where their water consumption is just less. Americans use a lot of water. A lot of other parts of the world, particularly in Australia where they've had a lot of drought conditions and water restrictions for a lot of years, so their maximum per size is 530 gallons per day, that's the largest system that would meet this standard, and there are smaller ones that certainly could meet it.

They do much more infrequent sampling throughout the test, though it's still a 26-week test, but they only sample at weeks eight, 16, and 26. They do allow maintenance during the test, where Standard 40 would not. And then their effluent criteria is a little bit different in terms of the requirements. They're a little tighter on BOD, but it's only 90% have to fall within that. And then they have a maximum that no sample can exceed. So it's a fairly robust effluent quality, but they have a lot less sampling and allowance for the maintenance.

And the last one I wanted to speak to that you're probably starting to see a little bit more of, there is quite a large market in Europe for advanced treatment technologies and there is a growing number of those technologies coming into the U.S. market. We've tested certified, some of those, and so we're seeing certainly some of the interest coming over, as well. In fact, we have a test facility that we use in Germany, that tests for these types of technologies for the European market, as well as to our standards.

So the first thing I would draw your attention to is the upper flow condition, which is 2,000 gallons per day. They don't have a lower limit, but they have a maximum of 2,000. But if you look up in the title you'll see for up to 50 PT, that's for up to 50 people. So if you do the math, 50 people at 2,000 gallons means their typical expected flow per person per day is 40 gallons, which in Europe with all the water conservation measures that they take, 40 gallons per person per day is a likely volume of water. So much, much different than what would be expected of the U.S. market.

And, therefore, if you look at the influent strengths you'll see they tend to range on the upper end. And typically their BOD strengths for the test sites there are around 300, [spenathol] is around 400, so but again you have to remember that the much lower volume of water, so the dilution factor is much less and the diet, certainly, the European diet is different than what a typical American diet would be.

So it's a good standard for Europe. It's probably not such a good standard for the U.S. just because of the fairly significant differences in the application in terms of what it's intended to achieve. But if you look beyond that in terms of the duration of the test, a pretty long test. It does have some low loading and some overloading requirements that are included in terms of stress events.

The sampling is a lot less. Again, you remember back to what I was describing. We have over 100 samples that we collect over 26 weeks for the European norm, it's only 26 samples over 38 weeks, so much less frequent. And they do allow, if the manufacturer specifies within 38 weeks to do routine maintenance, the routine maintenance will be done, so there is an allowance for maintenance during that. And there's no pass, fail, but each individual country has its own requirements so they don't embed it in the standard, they're really almost something like we do in terms of generating a report that can be used in the marketplace for comparing against the actual requirements.

So I'll give my summary here. I'll pull up my contact information, then we should have a few minutes left for questions. So there certainly are a number of standards that exist today. Some have been around for a long time, some you can see fairly recent. There's been a lot of activity and I expect there will be continued, a lot of activity around new standards for onsite wastewater.

Products certainly that have met them have met strict measures of performance. And the data, of course, proves if you're looking for something even tighter than what the standard might require, but even still all the standards are developed around fairly strict expectations of public health safety. Certainly, that's what the public health component to the committees brings to the table.

They're all consensus driven standards. They are all American National Standards, so they are meant to be the standards for the U.S. market. And, as I mentioned earlier, no standard is ever complete. They're constantly undergoing revision and updating and changing as the market dynamics change.

And last slide I'll just put up my contact information, as well as a couple of my colleagues here at NSF, as well as the MOU Partnership links, where you can access the presentation and a lot of other very useful information for the onsite decentralized markets.

And, with that, I will conclude and, Maureen, I'll turn it over to you for any questions that we may have.

Maureen Tooke: Okay, great. Thanks so much, Tom.

Again, this is Maureen Tooke at EPA. Today I'm going to field the questions that were sent in while Tom was presenting. The first question is from Marguerita, she asks what does MPN stand for regarding coliform, bacteria?

Tom Bruursema: Very good question. That's most probably number, which just simply relates to a type of method that's used for microbiological analyses. It's a tube test, test tubes, but it's just how the test is conducted. So you can almost think of it as no different than a colony forming unit, if it's a filtration method. It's just, MPN is the number of bacteria expected, so 200 MPN is the same as 200 bacteria per 100 ML is the linkage.

Maureen Tooke: Okay, and the next question is NSF 46, how does the upward force test for outlet filters work?

Tom Bruursema: Yes, so there I could probably send you pictures or send you that part of the standard to give you more detail, but if you're essentially pulling on – you can think about it the same way as someone is pulling the filter out if they were maintaining it or if they were replacing it. It's an upward force pulled on that part of the filter, and the amount of pull is a formula so it's not a pre-described number. There's a formula in the standard based upon the volume and the head and the location of the water into the filter as to how that's calculated. So it's a little complex, and I apologize I can't give you a much clearer description. But it is specifically meant to represent kind of that force that you would use to pull the filter up out of the housing.

Maureen Tooke: Okay, the next question is under Standard 46, 1,500 gallons per day is specified for the ozone systems, is it the same for CL and UV?

Tom Bruursema: Yes, good question. That was an error in my slide. It's – that is the upper range, it's meant to be, again, for residential applications so it's the upper level is 1,500 gallons per day. It doesn't have the same lower requirement of 400, and that's for reasons not to go into detail, but, yes, all three of those technologies would have the same upper limit of 1,500 gallons per day.

Maureen Tooke: Okay, has there been any progress on phosphorous removal being added to NSF 245?

Tom Bruursema: Very good question. Yes, when 245 was first initiated it actually included both nitrogen and phosphorous, and then over time it was decided that phosphorous was less critical in the marketplace, and instead we just focused on nitrogen only. But your question is timely because we just revisited again and actually have established a Task Group to look at phosphorous. It would not likely come under 245, it would be its own standard if it was developed into a standard, it would become a new designation, 245 will likely remain just nitrogen. But, yes, we are now looking at a potential standard for phosphorous reduction, as well.

Maureen Tooke: Okay, next question is what about the temperature factor for biological activity in Standard 245 in terms of avoiding winter operation and the six-month test, should show better nitrogen removal than would not be there in cold weather?

Tom Bruursema: Yes, excellent question and something I didn't include in the slide, but very pertinent to that standard. So this person is hitting on the biology of nitrifiers, which is that if you drop below 10 degrees they, as people say, go to sleep. They just become inactive.

And so the Standard 245 actually gives the option to cease sampling if the influent drops below 10 degrees, and so that is in the standard. Some technologies may or may not affect it or it would affect it perhaps less so than others, but definitely the biology is a reality that once you drop below that you will see a change in the ability of the system typically to perform for nitrogen reduction. So that is actually in the standard, itself, to be able to cease sampling and then start sampling back up again once it gets above 10. And that's centigrade, 10 degrees centigrade.

Maureen Tooke: Okay, next question is for Standard 40 and 245 is the influent wastewater synthetic and, if so, is there a provision for actual waste?

Tom Bruursema: Standard 40 and 245, as well as for residential systems under Standard 350 is not synthetic, it's actual wastewater. There's several facilities in North America, there's several in Europe that are all set-up to divert the wastewater that is under transport or underway going to a municipal facility, so it's essentially taking a side stream of wastewater and many of those facilities they're actually on the property of a municipal wastewater treatment plant and they're just taking a side stream of that wastewater on its way to the plant and then diverting it to the test facility.

In some of those photos that I showed, those were an actual test facility at a treatment plant, and, of course, then you're concerned about what are the characteristics of that wastewater since it's a community pooling of wastewater and so there are measurements to be taken to evaluate that. But, yes, for 40 and 245 and that part of 350 it is actual wastewater that's dosed.

Maureen Tooke: Okay, next question is which of these standards are accepted in regard to green building?

Tom Bruursema: Very good question. So green building typically is referring to the U.S. Green Building Council and the lead reviews that many commercial buildings undertake. And specifically in the 2012 version of the U.S. GBC lead requirements there is reference to Standard 350, which means that you will – there's credits obtained for recycling and reusing water, that's certainly considered a more sustainable approach, and so products meeting the requirements of Standard 350, at least in the draft version of that, will be given credits.

There is also a residential green building standard that also gives credits for recycle and reuse, but I don't know that it will specifically cite 350, but certainly it already gives recognition to recycle. So it would be relevant to Standard 350.

Maureen Tooke: Okay, and this one is a bit lengthy, so I will try to go slow. Standard 350 and 350.1 do not utilize the kitchen sink and dishwasher graywater. As you're aware, almost 40% of graywater is generated in the kitchen and admittedly it does not have a high degree of BOD loading but several graywater treatment manufacturers treat the graywater with the other graywater from the laundry, sinks, and shower. If you're interested in not limiting graywater recycling from the kitchen sink and dishwasher and creating a standard maybe 350.2, which would document total recycle of all graywater to total drinking water standards, what do we do in order to create a total graywater recycling standard utilizing all graywater for total for recycle to include drinking water?

Tom Bruursema: Yes, so there's a couple things in there that, you're right, do go beyond where we landed with Standard 350, one of those being the kitchen and dishwasher or kitchen sink, which is traditionally looked upon as having a higher organic load that would be quite a bit more than what's typical of the other sources, which is bathing and laundry. And that's – there's a lot of debate around which definition should be applied, but most typically graywater is not including the kitchen component, but point well taken. It certainly could be. Obviously, it's a

different strength waste, and so it just would need to be managed better. It's somewhere in between complete wastewater flow with a toilet the only other missing component, so it's somewhere in between there.

So could it be developed into something additional with a different set of influent strengths? Certainly it could. It would still meet the same effluent criteria, so in that sense it wouldn't change anything on the effluent quality side for those applications that I mentioned. That part would be unchanged. So there's nothing specifically right now looking at that aspect of it, but it's certainly possible that the standard could be developed in that sense.

The other piece you mentioned is to flow drinking water all the way to potable, which obviously 350 and 350.1 or 350-1 do not. That's also been discussed. Some of that, obviously, is consideration for what people would expect or would accept within their homes, their residences, the buildings as a potable water supply and whether there's some social barriers to achieving that. But that also then, really all that changes is the effluent quality side, rather than the influent side, and what the additional parameters would be or quality of effluent that would be achieved to meet that level.

So it's beginning to be talked about at the municipal scale, and I certainly know of some products in the marketplace that are looking at it from a residential application, but again the same thing we don't have anything specifically moving in that direction but it has certainly been talked about and it's kind of on the matrix, if you will, of possibilities for the future.

Maureen Tooke: Okay, let's see, with regard to NSF 40 why not certify below 400 gallons per day?

Tom Bruursema: And this is a lower threshold that's been around for many, many years, so it has a long, historical point in the marketplaces. What I think as people reasonably defining as the lower end of a typical residential application. No doubt, I don't think anybody would argue that systems installed at a rating of 400 gallons per day probably see less than 400 gallons per day. So part of it is just making sure that a technology has a fairly robust loading test to make sure that under most any conditions, even under very low loading conditions, it's been evaluated to show that it can treat reasonably well for peak loading conditions or things where the flow may be much higher.

But, so I honestly can't comment much more than that because the history has been so long around that lower threshold. We've actually talked about lowering it, and we just haven't been able to get agreement that we should lower it. So it's come up, but we just haven't been able to move it.

Maureen Tooke: Okay, we have a couple more, and we're almost out of time. We'll try to go quickly. With regard to the European norm, just comments, while they're using less water how it compares in terms of organic loading, which is at the end of what impacts the most – most of the treatment system sizing?

Tom Bruursema: Yes, I don't know beyond the BOD in solids in terms of further characterization of the waste stream and how they've looked at that. It's, as I mentioned, certainly European diets are different, I wouldn't say dramatically different but different enough that the strength conditions are different. Obviously, the water consumption rates are different. So, yes, in terms of the organic – as I mentioned, certainly the BOD end of it is in oftentimes in the 300 plus range, so it certainly has a lot of BOD loading which would mimic the organic end of it. But, yes, I don't know if beyond that if it's been characterized further.

Maureen Tooke: Okay, let's see, NSF, are you contemplating opening and operating a test facility that will meet the Canadian plant heartiness zones requirement under the BNQ?

Tom Bruursema: We are, and, in fact, within probably a month's time that facility will be operational. So, yes, we do have plans to have a facility within that zone.

Maureen Tooke: Okay, and our last question is will 245 systems be field tested and verified? Will there be a database available on the performance of these certified systems?

Tom Bruursema: So 360 would include nitrogen for companies that have met 245 to have that additional field evaluation. There are none currently that have undertaken that, though there certainly has been interest in it. Once those data sets are available, like with our Standard 245 controlled test condition reports, they are available for the manufacturer to distribute as they would like and then we also make them available to public health officials because oftentimes that's ultimately the audience that is looking for them. So in those circumstances, yes, that would be the same vehicle we would use to distribute that data once it's available.

Maureen Tooke: Okay, well, we have a couple late questions, but we're going to have to answer those offline, and we've had a couple comments about the link to the Wiki, where the slides will be made available. If you have not already registered for the Wiki it's asking – when you click on that link it asks for a password. If you have not registered already for the Wiki there is a place where you can click to register. Go ahead and register, and that will come to me, and I can get you signed up so we can get you access to the presentations for today, and then ones that we've done prior and then ones that we will be doing in the future.

So before we get all cut-off here, I just want to thank Tom very much for his presentation today, and to look for the information to come on the Wiki, and hope to be presenting to you again soon in the next couple of months. Thanks, everyone.

Tom Bruursema: Thank you.

Maureen Tooke: Thank you.