Moving along. Today's webinar moderator is Bill Reck. Bill is currently the environmental engineer at our center. Bill was recently selected as the new national environmental engineer headquartered in Washington, DC, so he will be leaving us very soon. We wish Bell the best of luck in his new position. Bill has played an active role in our webinar committee and I'm very thankful to have worked with him. And with that, Bill, I'm going to turn the webinar over to you so you can introduce the topic and our presenter.

Thank you, Holli. Today we're going to have Jeff Porter talking to us about evaluation of manure treatment systems. Jeff was recently selected as the new manure management team lead at the East National Technology Support Center. So congratulations to Jeff.

Today, during our presentation, we're going to have several stopping points where we're going to be opening the floor for questions. As you get questions, you can go ahead and enter them into the Q&A form and I'll be monitoring those questions as they come in and presenting them to Jeff when we break at one of our designated spots to answer some questions. So with that, I'd like to welcome you to the webinar and present to you Jeff Porter, the manure management team lead, for today's presentation.

Well, thank you, Bill. I sure appreciate that. And thank you, Holli, for all the work that you do on this. And Bill, you're definitely going to be missed once you move up to headquarters. But there also will be the benefit of being able to work with you on some of the upcoming environmental engineer issues. So I'm remote saddened that you're leaving but also that you will still be continuing in the process of working with environmental engineers. So looking forward to the new endeavors for both you and for myself.

Well, I'd like to welcome everyone, as well, to this month's East Regional technology webinar. As it's already been mentioned today, we're going to be talking about a way to evaluate various types of manure treatment systems for both proposed and for existing operations. This process-- we'll look at the performance and the effectiveness of the various manure management technologies.

Now, since every livestock operation is unique, no one technology or group of technologies will solve every resource concern. And that's why it's so important for us to understand these systems and be able to effectively evaluate them. As we know, there's been an increased number of concentrated animal feeding operations across the country. And many of these have centered in specific locations,

such as the Delmarva peninsula, northwest Arkansas, central California, and the upper Midwest, just to name a few. And in these and in other parts of the country, we're experiencing high levels of nutrients, and also some land application issues of where we're going to put all of these nutrients that are accumulating within these areas.

State and national regulations have also impacted how livestock operations are going to function. Therefore it's critical that we be able to evaluate these systems to ensure that they are performing as designed and desired to address the necessary resource concerns.

Let me give you a brief overview of the topics that we will be discussing today. Now, this webinar has been divided into three parts. First, I will give you a brief overview of some of the various manure management technologies. We need to understand that these processes, as they are used within the systems and as they are selected, need to make sure that they fit within the farm operation.

Second, I'm going to be providing some information on this manure treatment system evaluation process. And by following the steps that are outlined today, you will be able to help landowners decide on the technologies that should work most effectively, and you can also help them debug some of these systems that are not performing as desired. And then finally today, what we will do is we're going to look at an example farm operation and apply this evaluation process.

Before I actually get into the presentation, I would like to get an idea of the makeup of our audience. So that can help me know what kind of information and how to present the material that I have today. So if you would, please just take a moment and vote on here. And I see that several are doing that already. And it looks like we have a-- at least a few of every group. Things are looking good. So a vast majority are in NRCS and that's kind of what we expected. But we do have a lot of the other category. And I'd be curious as to what that may be. But that is good to see all of those.

All right, Holli, I think we can close our poll. It gives me a good idea of what we've got today. So thank you-- thank each and every one of you for participating in that. It helps me to know basically the audience that I'm speaking with today.

As we work with landowners and producers across the country, there's so many different things to consider when we're looking at selecting various manure management technologies. And we need to make sure that these technologies will fit and that they will function properly within the farm operation.

Now, first and foremost, we must know the landowners goals and objectives. And most of the time, this will be for implementing a new system on a farm.

If what is planned does not fall in line with the goals and objectives of the land owner or the operator, then the system design is not their plan. And it may not be implemented properly. Or it may not even be implemented at all. So as we work with landowners and look at the resource concerns, we need to be asking the right questions.

Will the resource concerns be addressed with these applications? Are the correct resource concerns actually being addressed? Now, many times the reason that we get involved in working with a particular landowner is because of the amount of nutrients that are produced from the manure. Are they being addressed properly? And in a form that can be used by the landowner? Or come up with some type of a usable byproduct that can be sold or for some other use or purpose?

Now, closely tied in with that is looking at the nutrient balance that is taking place today between the amount of manure that's being produced and the crop requirements within the area for these large concentrated operations. And as farmers begin to move to more of these monoculture cropping systems, this imbalance between nutrients and crop needs is becoming a greater issue.

Now, it's also important to determine the amount of land that's required to apply the manure. Additional land may be required. Also, how far away is this land for the farmer to utilize these maneuvers? Can it be done efficiently and can it be done cost effectively? How does the landowner want to deal with the manure? Do they want to handle it as a solid, a liquid or a slurry? Are they willing to work with multiple waste streams? Knowing these types of things can help a landowner find a technology that will best fit their operation.

Now, we all know that regulations are not going to go away. And the technologies that are used must help the landowner stay within the federal, state and local regulatory requirements. Farmers want to be environmentally safe. Now, as I mentioned earlier, not all technologies will work for every operation. And it's also important to know what is available in a particular area, and can that technology adequately be maintained if it is not found in the local area.

Some technologies may require outside assistance for operation. Or they may be able to be handled by the existing workforce. So understanding the livestock operational labor force and the technology

requirements can impact what technologies are actually going to be chosen. Knowing that the type of animals, the size of operations will also impact what technologies that a landowner can choose from.

Some operations may look at other uses for the manure as an added value. Now, this could include such things as selling compost for generating electricity. This may require considerable time on the landowners part in developing a market for this particular product.

Now, probably the biggest factor a landowner must consider is the financial obligation. And this may not be limited to only the cost of implementing a practice or technology, but it may also need to include the cost of not doing something. What could result if they do not implement certain manure management technologies or practices? Determining what will work best for a particular livestock operation is definitely not an easy task, and it will likely be different for every operation.

When one looks at a livestock operation, there are so many variables and so many factors that have to be taken into account, especially when dealing with new technologies. This can be quite daunting. So where does one begin?

The easiest way to look at this is to determine what comes into the system or operation and then what goes out. Basically, looking at the big picture. Now, unfortunately, this is not the most effective way of evaluating manure measurement technologies. One does not know what is happening inside the operation. So they need to get additional information to come up with these final values.

So even though there is an overall system, or there's a grouping of technologies, each technology in an of itself should be evaluated separately to determine how it is affecting the operation of the overall system. It's important to break the manure management system into its individual unit processes. Now, in this overhead view here we can see a manure transfer type system. We can also see storage. But this does not provide adequate information on evaluating the system. We need to dig deeper into the system and to the component operations.

This is why it is so important to understand the differences between systems and individual processes. These processes make up the overall system and they work together to make the system work. And as one looks at the treatment of animal manure, the individual operations can be divided into one of three main groups of processes. We have physical processes, we have chemical processes, and we also have biological processes.

Now, time, unfortunately, does not allow me the ability to cover any of these in any great detail. But I would like to give you a quick overview of each of these large breakdowns of processes and additional information on various unit processes. You can find that in the handout that's entitled Selection Guidance For Manure Management Technologies. And that should be included in the handout within this webinar.

So let's begin with the physical processes. This is the one that the audience is probably the most familiar with. And for the most part, it's the easiest to deal with. These are the operations deal with the chunks. And that's what I like to call them, the chunky material.

Physical processes usually treat solids that are in suspension, rather than dissolved solids. But just to mention, there are also some other technologies such as chemical amendments that they can be used to help with this as well. Now, heavier particles settle out, while lighter particles may actually float to the top. Filtration methods may be used to remove some of these solids. Mechanical methods can also be used to separate solids from the waste stream.

As we look at the pictures that we have in these slides, the first is a sand settling lane. Sand is used in many dairies for bedding. Velocities in this sand lane are high enough to separate the manure and other lighter particles from the waste stream while it allows the sand to settle in the lane. This sand is then collected, allowed to dry-- dewatered and dry-- and then it can be reused for bedding.

In the second photo we see a screw press. And it removes a significant portion of the water from the waste stream. The solids can then be used for bedding, composted or come up with other uses.

The next set of operations I'd like to talk about is that of the chemical processes. The purpose for chemical processes is to bring about a change to the properties of the waste stream. And some of these changes include converting dissolved solids into suspended solids so they can be removed by physical price processes, chemicals can be used to change the chemical makeup of a product so it can be used for other purposes. Another use of chemical processes is to destroy organic compounds through actions such as oxidation.

Again, in our pictures, we see a couple of these different chemical processes. In the first we have a dairy operation in which chemicals are added, like a metal salt or a polymer, and they coagulate the manure where much of the dissolved solids can then be removed through a solid liquid separation

process.

In the second photograph, we see a thermochemical process of gasification. And through this, heat is used to break down the complex manure molecular chains into a syngas, and also other products. Now, due to the drastic volume reduction and the potential energy uses of practices like gasification-- unit processes like this-- we're seeing an increased interest in the use of these systems across the country.

The last of the three processes that I'd like to discuss is biological. And they occur around us all the time. These are processes that would occur naturally through biological activity. Basically, these are organisms or bugs that take organic material and then convert it into some other byproduct. And if the organisms are kept under certain control conditions, these natural processes can be accelerated and be useful in dealing with waste issues.

One of the common processes that many of you are familiar with is that of composting. Now, this could include both composting of animal mortalities and of manure. In both cases, the volume is reduced and it can be land applied or used for other purposes.

Another common biological process includes anaerobic digestion. Here we have anaerobic microorganisms that consume volatile compounds, and the byproduct is biogas, other gases. And then this can be used for heat and or electricity generation.

The technologies that we deal with while addressing manure management issues will fall under one of these three categories, physical, chemical or biological. Now, to properly evaluate the processes either chosen or currently being used by a livestock operation, one should have a basic understanding of the impacts and the limitations of these processes.

So the question is, where do we go from here? We need to realize that there are a whole group and number-- large number-- of physical, chemical and biological processes that are available to address manure management issues. We need to keep in mind that these various types of processes and operations may be something that we're not familiar with or there may be some operations that we don't know about. So we need to keep an open mind with this.

I'm always looking for new things to add to my toolbox to help a landowner. We need to know what a landowner wants and what a landowner needs to accomplish the desired goals and objectives. And by following the approach that we we'll be following here, this should help you help the landowner choose

the right operation, or the right operations, to adequately address the right resource concerns.

And if you're asked to evaluate an animal manure storage treatment system, you should be able to look at the individual components and determine the type of process that is taking place-- whether it's physical, chemical or biological. And with that information, you can determine the effectiveness of those operations in the overall performance of the treatment system.

Just remember that we are still going to be using the nine step planning process as we work with landowners. And those that are within NRCS, you should be very familiar with these steps. But I want you to notice the color code that I have in here. As we look at the first four steps, these are the learning steps. Here's where we gather the information, we're trying to find out as much about the system that's out there and the different options that are available.

And as we look at steps five through seven, this is what I call the thinking stage. This is where we take the information, we evaluate that information, and then we determine the direction or the alternative that's going to be selected. Then we have our final two steps, which are the doing phase. And here the developed plan is actually implemented and then we evaluate the results from that plan. Evaluating manure management technologies uses this same basic process. But it is applied at the unit process level.

When we're developing a plan or evaluating an existing waste management system, you must know where you're going in the process. Let the landowner tell you what's desired. We need to listen to the landowner and not tell the landowner. Ask probing questions. Put it back on the landowner. Help them think through the process.

Remember, we are not the ones addressing the resource concerns. It is the landowner that's doing that. And it must be the landowner's plan. As I mentioned earlier, if it's not their plan, then it may not be implemented properly or it may not be implemented at all.

Now, as we begin to evaluate manure management technologies, we need to realize that we not only have three types of unit processes, but that each of these processes fall under one of six categories which are shown in this slide. And for those just beginning in the area of manure management, I would suggest reviewing the NRCS Agriculture Waste Management field handbook for guidance. And the chapters that I would recommend that are related to manure management technologies and

evaluations are those found in chapter nine-- which is called the agriculture waste management systems-- and chapter 10, which is the agricultural waste management system component design.

And as we look at each one of these categories, we need to see where these processes are falling. Again, to help with the evaluation process. So with that, we're going to take our first break for any questions. Do we have any questions at this time, Bill?

If you've got a question out there you can enter it into the question and answer forum and submit it and we'll take a look at it. Right now, Jeff, we do not have any questions that have been submitted.

All right. Well, I would ask as you see things or you have questions about things throughout the presentation, please, please type those in and Bill will keep track of those questions. And we will try to address them during our next-- we have two more breaks scheduled. We have one once we talk about the evaluation process and then we'll have another break at the end of the presentation as well. So with that, we're just going to go ahead and continue.

These are the steps that we'll be looking at when doing manure management treatment system evaluations. It is a five step process. In the following slides, we're going to explain each of these steps.

Now, the process begins by diagramming the system. And then we will conclude with an understanding of what the fate and the final form of all the nutrients and the other products that output from the system. And as we look at each one of these steps, we need to build upon one of these steps right after another for this to be an effective evaluation. And I would also suggest that we need to follow this step by step, again, to get a good effective evaluation of the system that's either being proposed or the system that is being used.

As I mentioned, step one is to diagram the system. One needs to understand the flow of the manure throughout the entire system. Here we have a very simple block diagram illustrating how to set up and begin the evaluation process. Now, when diagramming the system, it is very important to include all of the components and to place them in the correct order.

Be careful to not skip any of the unit processes when developing the diagram. Sometimes you may look at something, you say, well, you know, that's not really that important in the process. Well, I think that's where we need to make sure we include all of the individual processes, all of these unit processes, because if we skip one, then that may actually be the critical element that is causing some of the issues

or may not allow the system to perform as designed or as proposed. So make sure that you do include every unit process within the treatment system.

Understanding the operational order of the system components is also very critical. See, the same components can be arranged in a different order, and yet they may have a completely different output in terms of the nutrient fate and also the form. Now, for example, some anaerobic digesters require very low solid content, such as an induced blanket reactor. And in this case, solid separation likely will occur before the manure enters the digester.

Whereas in other situations, like with a plug flow or a complete mix system, solid separation is likely to occur after digestion. So the order of the unit process is extremely important and can impact the results. So we need to make sure, when we're diagramming, we diagram in the correct order.

In some cases, you may not even have enough information to adequately diagram and identify all the system components. Now, if that's the case, you're not going to be able to effectively evaluate the system without obtaining this information. This, again, goes back to the planning process. Gathering the information that's needed because we need to gather as much as possible about all of the individual processes. The more information that is known, the more information that is available, the better the evaluation process. This is important to know this. If we do not have the information on those components, the evaluation will likely not yield the results that we are looking for.

If you're not able to get the information that's needed to diagram the system and identify the components, or if you've asked-- or if you had some issues or some reason to ask questions about the information that's provided, you need to have an operator walkthrough. Have them take you through the system, whether that's on paper or it's in the operation. This technology walkthrough is a great idea to do even if you know all the necessary information. It just helps you understand the system better, it helps you to see how all the components come together, it helps you to see how it's being operated. You can gain so much information by getting in and actually seeing the system through a walkthrough.

Now, we also need to remember that if we're going to be working through some of these types of issues, we need to take biosecurity into consideration. So you need to talk with the landowner before doing a walkthrough of determining what level of biosecurity is going to be needed to address these walkthroughs. Make sure that you are covering all of your bases from that aspect as well.

When you do the walkthrough with the operator or the vendor, make sure you do it in the same order in which the manure is processed. If you don't do it in that order, then you could get confused as to how things are actually flowing through the system. Begin where the manure enters the manure management operation and follow it throughout the system in the correct sequential order as it is proposed to treat or process the manure. Also ask questions to clarify information. Remember, this is their system. So you need ask questions like, the manure comes in where and it goes where? You need to be able to answer these types of questions before you actually complete your evaluation.

So now we're ready to do step three. We have done our diagram, we have looked at the various components, and we've added all the components in. We're now ready for this third step. And here we need to understand the characteristics of the manure as it enters the system.

Having an accurate estimate of the manure input characteristics is very important. The magnitude of an input, such as the chemical oxygen demand or ammonia, can cause a unit operation or process to succeed or to fail. This is your starting point. And if one does not have a good starting point and have good information, then the remainder of the analysis will likely be faulty.

Again, let me stress why this is so important. The form and magnitude of nutrients that are found in the manure or the waste, do make a difference in the effectiveness in the performance of many unit processes and operations. Look at the example that is provided here. Nitrogen in the organic form does not have a negative impact on the operation of an anaerobic digester. But if we have too much ammonia in the system, that can be toxic to the digestion process and actually kill the process altogether and you will not produce your biogas.

The typical characteristics that one would look for in the manure stream as it travels through the system includes things like total solids, the chemical oxygen demand, your total Kjeldahl nitrogen, you're ammonical nitrogen, your phosphorus, your potassium, your pH. I mean, these would be the minimum things that you would need. There are other things such as dealing with pathogens or other products that you may need to gather formation, depending on what the landowner's ultimate goals and objectives are.

Here we have an example of the manure characteristics prior to entering the manure management system for a swine operation. As we look at these numbers, we've got a 4% total solids. Then we also have these other values are looking at milligrams per liter in our CODs, total nitrogen, ammonical

nitrogen, phosphorus, and potassium. So we have numbers to deal with in this particular case.

Now, what may happen, though, is that if it's a new operation, or they're making adjustments to their system-- they're changing their operation-- you may not always have the analysis for the system. Now, in this case, we can do what we call a general assessment, looking at a high, medium, or low in terms of the input characteristics. And these can be effectively substituted for the exact values.

Now, of course, you're not going to have exact values at the end either. So you're still going to have this relative assessment or general assessment as your final outputs as well. But at least it gives you an idea, a generalization, of what should be expected from this particular system.

Now, this will also require at least some knowledge of manure systems and of relative analysis levels. And here we see how this is done with the example that is provided here. Notice the 4% solids, we've chosen that to be about a medium total solids content. And then looking at the other numbers, they are considered in the high category. We will see as we carry that on throughout the system, we'll see what impact the different processes have on these generalizations that have been done for the assessment.

In step four, one tracks the nutrients and the other design characteristics throughout the system. This is where the diagramming is so important in understanding what happens. Now, as seen here, the output characteristics for one year process becomes the input characteristics for the next. And this pattern is followed until all the processes have been completed.

Now, this can become quite complicated when dealing with multiple waste streams, when you have multiple buildings. Again, the issue of having a good diagram is so important for this to make sure that all the elements come together at the end.

Finally, the last step is to identify all of the system outputs in terms of what they represent. Do the unit processes produce a marketable product such as electricity? A residue that can be managed, like land application of nutrients? Or an air pollutant that must be reported or controlled, which could include methane or NOx. Any of these could result from the unit processes that are implemented on a livestock operation.

And by following these five steps, one should be able to effectively evaluate the functionality and the performance of a waste treatment system. Now, through this process, one can help a landowner determine whether the system is operating properly. And if not, can provide some guidance as to where

within the operation changes could be made.

Well, Bill, at this point, we're now at our second break. Have we had any questions come in?

Yes. Yes. We've got several questions.

All right.

So I'm going to start of with a question in the unit process diagramming. And you mentioned getting the values for the waste stream. Where would those values come from? And, for instance, if the landowner doesn't have or doesn't know, where would those values come from? And also, are you talking about a system that's installed or are we talking about a future design system?

Well, it does depend whether it's a new system or it's an installed system. If it's already installed, this is where you're going to be able to get the actual numbers. You would gather some samples at each of the outputs or-- either the inputs or the outputs of each of those unit processes, get the analysis done and then you would be able to do your evaluation.

Now, if you have a proposed system, this is where you'd use the general assessment and you would follow that process of taking-- at this point, the numbers should be either high, medium or low. And then send it through the process. You need to have a basic understanding of what is happening within that unit process to determine what the results will be in the output characteristics for the generalization. I hope that makes some sense there.

All right. I'm going to move on to the next question. When you're talking about unit processes and you're diagramming out those processes, could you talk a little bit more about what level of detail we should be going to. You mentioned physical, chemical, biological. Could we be a little bit more specific? Would you have to take into account every pump, every valve, every motor? What kind of level of detail should we going to and how would you know when a unit process is critical to know what's going on?

OK. A very good question. The thing is, what you want to be looking at for these unit processes is if something is changing a characteristic of your waste stream. Whether that's changing something physically-- and that's where our physical processes will be coming in-- such as a screw press. What are we doing-- we're using the screw press to press the solids and separate solids from the liquids. So we're changing the characteristic of the waste stream. And so any time we change a characteristic, then

that's what we need to look at as a unit process.

So if you're putting just a pump to move something from point A to point B, you're not necessarily changing any of the waste characteristics. So that would not be considered a unit process. So it's something that's going to change the manure characteristics.

You look from a chemical standpoint, anaerobic digester. You change-- taking the volatile solids and converting those into a biogas. So that is having an impact on the material that's actually in-- that you begin with. So your waste stream is changed.

If you use chemicals like a metal salt or a polymer to add to the waste stream, you're changing the characteristics of those dissolved solids, and you're now making them into more of a suspended solid that can be separated with other processes. So that's what you want to be looking at, something that's changing the characteristics. That's how you're going to be looking at your different unit processes. Does that help out?

Yes. So is the idea behind the diagramming process, is that show-- that we can show we have a closed loop system or are accounting for every part of the manure as it goes through the system? What is the big purpose behind the diagramming process?

Well, the diagramming, as we'll see an in our example problem, it's going to be what happens to the nutrients. And it's not necessarily a closed loop because you may have some land application. So you're going to-- we're going to make a boundary of what's actually going to happen at the beginning. What comes in and what comes out.

And we need to figure out are there some other-- are there some leaks or are there other issues that come into play such as are we having some emissions? How are we addressing those emissions? Are we thinking about emissions? Maybe we didn't even know that there were emissions that were taking place. Here, this would be able to capture that so we get an idea of what's going on that's getting out of our boundary. And from there we can then look at, what can we do to address that? Or is that something that actually needs to be addressed? These-- many times through the diagramming, it allows us to see things that we never really thought about.

And it generates questions that we hadn't thought about either. And through that, we can begin to determine, do I need to make some changes, do I need to adjust my management, do I need to look at

some other processes? Why is this not doing what I thought? And through this whole diagramming process, this should bring those issues to the front so that people can begin to understand-- especially the landowners understand-- why this is working or why this is not working.

OK. I've got a couple questions here about manure analysis and manure characteristics. I'm going to kind of wrap these together. Where would you get them the manure analysis done? Does the NRCS use it's own labs or does that-- do we send it off? Or do we get the landowners to get that information. And then also, the initial manure characteristics out of the animal, are we using book values for those or how are we estimating the quantities that are produced?

Well, to answer the first question, NRCS does not have a manure analysis laboratory. We are going to rely on the landowner to get the analysis done on the various locations, various components. And this is where we would walk through the system with the landowner and say, we need a sample here, we need a sample here. And then we would have that sent off and we would be able to do the analysis of that information.

Now, there are a number of places that will do these analyses. Many states, at their land grant university, they may have a lab or least they would know what lab to use. They would make the recommendation as to where the manure should be sent to be analyzed.

Now, the second part of the question is-- and I really, I struggled on how to address this, this issue of dealing with book values and as excreted values. What we need to do is we need to get numbers as close to the unit process as we possibly can. And what that means is that most of the time the manure values that are excreted from the animal are not going to be the numbers that are actually going to be used in the analysis.

And that's why this gets difficult, especially with your new operations. Because the as excreted numbers will-- they could dry out some, they could be deluded, they could have additional factors added to them such as bedding. Other things could come into play. So I would not encourage using the as excreted. And I would use more of the general assessment to give you an idea of the trends that you would expect, especially for a new operation.

OK. Thanks. I think I'm going to give you one more question and then we're going to move on.

OK.

So how about-- you didn't mention the salinity as a waste characteristic. Is salinity something that we should be on the lookout for as well?

If you see that that's going to be an element or a factor that could be a concern, sure. I just gave a list of a few items. And it's really going to be dependent on where you are in the country, it's going to be dependent on what the critical factors are within your region or within your operation. So, yes, salinity could definitely be something that needs to be taken into account.

As we're getting out West, as we look at our different climates, different conditions. Those types of things could definitely be something we'd want to consider. Again, work with the landowner, work which your land grant universities, determine what those critical factors are, and then you would need to make sure that they gather that information.

Thanks, Jeff

All right. Let's move on to our example farm. So here's our farm for the evaluation we're going to do here. As we look from the big picture view, we can actually see some of the unit processes here. But that's not going to be enough. We've got to get closer and we've got to evaluate all of the unit processes.

I mean, here we can see the storage facility. We can also see some anaerobic digesters. But there are things here that need to be addressed and we need to get down on the farm to actually talk about these issues with the landowner.

Now, as I go through this example, I'm going to show this slide. And it's going to highlight the steps that will be addressed. And this is going to help those that desire, hopefully, to review the process or to refresh your memory at a later date.

As we know, we begin with diagramming the system. Here's an overview of the livestock operations. As we look here, we have a 1,500 cow dairy operation. There's an anaerobic digester. The manure consistency is 8%. The bedding is-- they use dried manure solids for their bedding. And they have adequate land to apply their manures.

So this is the information that you have. Of course, you're going to gather additional information as you

go on the farm. You may not have the analyses. And that's what you're going to find out here in just a little bit. We do not have a very thorough analysis of the information and we'll see how we address that.

So here's the initial diagram. And it kind of gives the big picture of the project. Here we see for this treatment system, manure enters the anaerobic digester, then the digestate is passed through a solid separator and it creates two waste streams. It creates a solid waste stream and a liquid waste stream. The solids are then composted so we could have other-- for other uses.

Now, many times they will actually combine steps one and two, because when you diagram the general system and then you diagram with the system components, they're very similar. And here you're going to see that that's going to be the case for this particular application.

With step two we identify the actual unit processes or the actual components that these processes represent. And it's good to know, at this point, as to whether the unit processes are physical, chemical or biological. Now, for this example farm, we're using a mesophilic continuous stir anaerobic digester. I typically call that a complete mix system. And it's going to be installed and this is a biological unit process.

Now, following the digester, we have a screw press-- which that is a physical process. And through that we will separate the solids from the liquid portion of the waste. The liquid portion is stored in a holding pond until it is land applied. And we know that we have adequate land to apply on so we don't have to really do anything else with the liquid portion. The solids are composted, which this is also biological process. Now once completed, the compost will be used as bedding for the cows in the free stall buildings.

Now we move to step three to characterize the system inputs. Remember, we didn't have all the information that was needed and the landowner had not, in this case, had not gathered all the information that was needed for a complete analysis with actual values. But we have to remember that this is the starting point and we have to have as good of information as possible for this starting point.

And so for this situation, again, we didn't have all the input characteristics. So we're going to use the general assessment approach. And here we're going to get an idea of the expected trends when we apply this given unit processes. And again, we are not going to have actual values at the end.

So now we begin to track what happens to the nutrients and the other constituents through each unit

process. Remember to follow in the order that the manure passes through the system. Now, for this example, the system is broken into three segments. We have the anaerobic digester, we have solid separation, and we also have composting.

I want you to note here that not only the characteristics of the input and output manure has been listed, but also any losses or movement of nutrients out of the system. This is where I was talking about a little bit earlier as I was answering those questions when you understand what's happening to the nutrients and some of these other components. Now, in this particular case, in the anaerobic digester, the movement of carbon dioxide, methane and hydrogen sulfide, they pass out of the system in a gaseous form.

Also note that through digestion, there is basically no change in the nutrient content of the manure. Now, what comes in, goes out. The form of the nutrients may change, but the overall amount does not. Now, even though it's not shown here, pathogens are reduced through the digestion process. And this may be something of concern that we may want to list in our items of consideration.

Here, for the second stage, we have the screw press and it creates two output streams. We have the solid stream and the liquid stream. Notice the difference in the general characteristics between the two waste streams. Even though two waste streams, they may complicate the handling of the manure. By doing this, it may provide added flexibility for the landowner in land application and other uses. So we can see the impact that, just by doing solid separation-- and in this case we're not doing any type of chemical enhancements, we're just running it right through the screw press-- these are the kind of breakdowns that we would expect to take place from digested dairy manure.

This example, showing the composting process, it shows here that we're going to have some gaseous releases of both ammonia and carbon dioxide. Other items that could be listed here are pathogen and volume reduction. These might be things of benefit that the landowner's looking for in the overall process.

Now, the final step is to review the nutrient and other byproduct levels, and the forms once the manure has traveled through the entire system. And for this step, one looks at what crosses this system boundary. That's what I mentioned a little bit earlier. One should consider the mass balance and make a very good estimate as to the magnitude and the distribution of the input nutrient mass in each of the output streams.

If the compost material is used as bedding, remember, that remains in the system. Also note that the gases that are produced from the anaerobic digester, they will likely be addressed in some fashion by other unit processes such as hydrogen sulfide scrubbers and micro turbines. That would be another step that could actually be added to this and should be added to this process of addressing those resource concerns of those gaseous emissions.

Now, from our example system, we can expect to generate outputs that include compost. Some or most of that is going to use as bedding. Also, a nutrient rich liquid manure fraction. And we're going to have emissions of ammonia and carbon dioxide from the compost. Now, remember, I did not include the emissions that came from the digester, and that should be something that we would add to this as we do a complete overall system unit process evaluation.

Now, one thing I guess would note on here, that this approach could be expanded to actually include land application as well. And see, there is where we would also address the fate of nutrients and crop utilization as to whether we are surface applying, we're injecting, how it's being applied. Those types of things should be taken into account as well. So these would be unit processes that could be added to the existing on farm application.

Well, that's the process. And the two references that are shown here hopefully would provide you some additional information as you perform the evaluations of these manure treatment systems. If you were to go onto the Livestock and Poultry Environmental Stewardship website, they have a number of these lessons that could be reviewed. But this lesson 25 is a good one for looking at manure treatment options. I especially like the tables that are at the end of this particular chapter. They give the general trends of these various types of unit processes to tell you whether it's going to increase, decrease, what impact they're actually going to have.

And then the other option-- other reference-- that you might want to take a look at again is the Agriculture Waste Management Field Handbook. Go to this particular website, this will take you to our directives within NRCS. Click on Handbooks and then go through the process to find the Agriculture Waste Management Field Handbook there within our resources.

Now, if one follows this evaluation process properly, it should help the landowners in selecting or updating a manure management system that should meet the goals and the objectives of the operation.

Just to let you know that much of the information from this presentation was derived from material that was presented at the Alternative Manure Treatment Systems training course which was held in 2006. The information provided today is basically a summary of the three day training course. And I want to give special thanks to the Farm Pilot Project Coordination group and to Dr. Robert Burns for the work that they put into preparing the initial training which was done back in 2006.

I want to thank you for your time and hope that you have found this information useful when evaluating manure management systems. And with that, we'll open the floor for any questions that we may have.

All right, Jeff. We've got a few. You didn't mention land application anywhere in your presentation. And I know that wasn't really the focus of what you were getting at, but could you talk about that and land availability for a minute or two.

Yes. Actually I touched on it at the very end there as one of the things that we could add to the evaluation process, is that of land application. Looking at how it's going to be applied, looking at the nutrient requirements for the crops that are going to be used, whether you have a rotation or not. You're going to see whether it's injected. Is it going to be sprinkler irrigated where you might potentially have gas emissions?

So, yes, that's definitely something that could be done. We could add this right onto the process of the overall-- and we could more increase the boundary of your system, I guess you could say, to include the land application area. And then apply the unit processes there in the same fashion as you would with the operations that are where the headquarters for the livestock operations actually held and operated.

When a producer comes to us with a problem that they want-- they want solved, a lot of times they have some ideas already about how they think that they want to solve that problem. And you mentioned that early on. How do you have that conversation with the landowner about his ideas and bringing in some alternatives into the mix?

Sure. And that's good that the landowner has some ideas. But then, I guess the way that the conversation that I would tend to have was I would ask them, what kind of impact is that going to have? And then let them see if they know what kind of impact, or if they know what that actual process does. Or if you're going to, let's say, we're going to do solid liquid separation with a screw press. Do you know

what the solids content is going to be? Do you have an idea? Do you know what you're going to do with the liquids?

Again, I throw it back to the landowner and have them work through it. And then you can say, well, have you thought about this and what impact it might have? And then let them-- there should be a discussion. As we mentioned earlier, we don't tell a landowner. We have a discussion with the landowner and we talk about different options and alternatives. Because, again, it's their plan and we've got to make sure that it is their plan.

What about economics? When does that enter the discussion?

Well, that should be-- that should be there from the very beginning. Because economics is going to be your big driver for these. Most of these technologies are not inexpensive. I mean, they are expensive. They are going to-- depending on what technology is used, you could be looking at five, six digit numbers for some of these, and maybe even higher.

So those types of things need to be in the discussion. The landowner needs to really put the pen to the paper and determine, is this really going to provide a benefit for the operation? Now, is it always going to be a positive benefit cost ratio? I can't say that it always will. We look right now with our current traditional holding pond, as people have put-- they've done the economic analysis, some of those are not actually saying that they're actually making money through the saving of the nutrients.

But what they need to figure out is, can they make the system work? Is it at least comparable with what they're currently doing? And also, how is it addressing the resource concern? The cost of these operations are definitely an issue. And that's one of the reasons we're not seeing a lot of these, especially the innovative technologies, being installed is because they are so expensive.

Now, I'm seeing that trend changing. But it's still going to take time because of the cost. And then also looking at, can we come up with some alternative uses of the byproducts to help offset some of those costs?

In your presentation you talked about getting measurements, samples, for anaerobic digestion. Could we just use the tables in Ag Waste Management Field Handbook chapter four, or do we have to get samples? When do we make that decision?

Well, again, I think this is whether you've got an actual system that's in use or you have one that's being planned. If it's being planned, again, I would struggle with using the book values when we're going through this entire process. Because if we're introducing error in the beginning, that error is going to continue throughout the system. Now, if you can come up with a system that's-- or have some numbers that are similar to your operation, say there's a farm down the road that has a similar-- they operate similar to what you do, then you might be able to use some of those numbers. But then I would also put the caveat saying, these are not my actual numbers, these are from another farm.

And it will give you the trends. But, again, I would not take the final numbers without having your operational numbers. This is where I like the general assessment approach, that you get that trend. This is what you think, this is where you think it's going within the system.

If nutrient recovery and an export from the farm is seen as something that's important, what processes should we be thinking about?

Well, there are a few of those that I can see. Number one is we could do our waste separation processes. That allows you to do some nutrient partitioning. So you can separate your liquids from your solids and you're going to be able to have certain nutrients, certain nutrient levels in each one of those, and you would be able to, say, the solids-- since you don't have as much liquid-- you can transport those a longer distance at a lower dollar amount and actually have those land applied.

Other applications would be some of those thermochemical processes. Whereas you are generating energy from those, but you're also reducing the volume significantly anywhere from 80% to 90% plus volume reduction, allows you to take those nutrients that are remaining off site at a more economical value.

Now, also to note, there are certain things that happen such as through the thermochemical processes you are going to be losing the vast majority of your nitrogen. So you have to think about that through the unit process. It's going to show that you're going to have nitrogen going off the system. Typically as N2 because it's gasification. But it depends on the process that you're using. If you go with incineration, you may actually have higher NOx discharges then you would with the gasification process.

So again, knowing the process and how that impact will have on the different components needs to be taken into account. But those are a couple of the practices that I would think about for allowing you to

transport manure off site.

All right. I got a couple more questions and then we're going to bring it to an end. Storage. Should you treat storage as a unit process and what kind of things should we be thinking about short term versus long term storage?

Definitely storage can be an issue and it depends on-- I think that's the critical element there, how long is the material going to be stored. Also, are you going to be developing crusts, what kind of gas emissions may you have, is it going to be an anaerobic type of storage facility where you will have anaerobic activity which will cause gas discharge of your nitrogen.

So, yes, it depends on the system that's being put in. It also depends on how the system is operated. And it also depends on how long the materials are actually going to be stored in that facility. Your short term storage, you might be able to get by with just using the values of what comes out of your last process. Now, you also have to take into account rainfall, you have to take into account evaporation. So the length of storage is-- I think that's really going to your critical factor is to whether you would need to take that into account as another unit process or not.

All right. Final question. OK, Jeff, this is a tough one. Is it stuff, is it material, is it waste, or is it manure?

Yes. How's that? It's actually whatever you want it to be. No. No, there are different things. You do have manure, and that's kind of the term that we're looking at. But when we have our handbooks, that's called the Agricultural Waste Management Field Handbook.

These terms are basically interchangeable. So I guess that's going to be my-- use whichever term you feel most comfortable with or use the term that the landowner would most-- would best respond to. I guess that's kind of the way I would go with that.

Yeah. I have to agree. The term waste kind of is unfortunate, but it's been kind of institutionalized. It's the term, the industry term, that we end up using a lot of the time. But, from a manure standpoint, we definitely-- from the standpoint of showing that this has-- this ti's not just a waste product, that it does have benefits, certainly a term that we need to use more. And that's evidenced by that fact that your position used to be called the waste management team lead position and now we call it the manure management team lead position.

That's right. That's right.

Well, Jeff, I want to say thank you for your presentation. I think you did an excellent job. For those of you that are interested in passing along information on this webinar, it will be archived here shortly to the Science and Technology Library on the Conservationwebinars.net site. There were a couple downloads that you could get. There was the presentation file and there was one other file that was up there. Jeff, did you talk about that other file?

The selection of guidance-- the selection guidance handout. Yes, I mentioned that earlier. It gives a good overview of the different technologies that are out there. It's actually separated by whether it's a physical, chemical or biological process. It gives the pluses, the minuses of the different processes. So it will give you some good guidance as to-- when you're working with landowners as to what type of system to select.

Thanks, Jeff. That brings us to an end. Our little discussion of is it stuff, manure or waste kind of brought in a series of comments. And I'll just say, I like Glenn's comment, it's liquid gold. So with that, Holli.

Yeah I see a question about the handouts, and I would say that is in the Today's Handouts pod in the upper right. And you just click on a title and then you can download that file. And other than that, I'm ready to call it a day if y'all are.

Just say, if anyone has any questions, feel free to give me a call.