IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W.A. DREW EDMONDSON, in his)
capacity as ATTORNEY GENERAL)
OF THE STATE OF OKLAHOMA and)
OKLAHOMA SECRETARY OF THE) 09:03:16
ENVIRONMENT, C. MILES TOLBERT) 09:03:16
in his capacity as the)
TRUSTEE FOR NATURAL RESOURCES)
FOR THE STATE OF OKLAHOMA,)
)
Plaintiff,)
)
vs.)4:95-CV-003290-TCK-SAJ
) (VOLUME I)
TYSON FOODS, INC., et al.,) 09:03:16
) 09:03:16
Defendants.)

- -
09:03:16

VOLUME I OF THE VIDEO DEPOSITION OF BRIAN MURPHY, Ph.D., produced as a witness on behalf of the Defendants in the above styled and numbered cause, taken on the 25th day of March, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, 09:03:16 before me, Karla E. Barrow, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

09:03:16

Exhibit D

A P P E A R A N C E S

FOR THE PLAINTIFF: MR. DAVID PAGE
Attorney at Law
502 West 6th Street 09:03:16
Tulsa, OK 74119 09:03:16

FOR CARGILL: MS. THERESA N. HILL
MR. JOHN TUCKER
Attorney at Law
100 West 5th Street
Suite 400
Tulsa, OK 74103
and
MS. MELISSA COLLINS 09:03:16
Attorney at Law 09:03:16
1700 Lincoln Street
Suite 3200
Denver, CO 80203

FOR GEORGE'S: MR. JAMES GRAVES
Attorney at Law
221 North College
Fayetteville, AR 72701
09:03:16

FOR SIMMONS: MR. JOHN ELROD 09:03:16
MS. VICKI BRONSON
(Via Telephone)
Attorney at Law
211 East Dickson Street
Fayetteville, AR 72701

VIDEOGRAPHER: MR. DEREK ANDERSON

ALSO PRESENT: DR. ROGER OLSEN 09:03:16

I N D E X

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(Whereupon, the deposition began at 9:07 a.m.)

VIDEOGRAPHER: We are now on the record for the deposition of Dr. Brian Murphy. Today is March 25th, 2009. The time is 9:06 a.m. Counsel, 09:07:05
please identify yourselves for the record.

MR. PAGE: David Page, representing the State of Oklahoma, and with me is Dr. Roger Olsen.

MS. COLLINS: And Melissa Collins from Faegre & Benson on behalf of Cargill Turkey 09:07:12
Production and Cargill, Inc.

MS HILL: Theresa Hill on behalf of Cargill, Inc. and Cargill Turkey Production.

VIDEOGRAPHER: And on the phone?

MS. HILL: Vicki? 09:07:19

MS. BRONSON: Vicki Bronson for Simmons Foods.

VIDEOGRAPHER: Thank you. You may now swear in the witness.

BRIAN MURPHY, Ph.D., 09:07:22
being first duly sworn to tell the truth, the whole truth and nothing but the truth, testified as follows:

DIRECT EXAMINATION

BY MR. PAGE: 09:07:22

Q Good morning, Dr. Murphy.
A Good morning.
Q Would you give us your name and address, please?
A Brian Murphy, 2033, Suite 210, -- 2033 Wood Street, Suite 210, Sarasota, Florida. 09:07:29
Q And have you ever given any sworn testimony like you're giving today?
A Yes, I have.
Q Okay. Would you please outline for us the testimony you've given in the past and the type of work you were doing? What I'm really interested in is not any matters that would be involved in domestic or criminal or any kind of -- what I'm focusing on here is just your testimony where you've operated as an expert witness. 09:08:10 09:08:21
A Well, I could give you more specifics looking at my resume.
Q Okay.
A Which outlines all the testimony. 09:08:26
Q Okay. Let's do that then. I've got a copy of your report, which has your resume or CV attached, and we'll mark that as Exhibit No. 1. What we'll do first is ask you if you would review that and tell me if that's a copy of your report. 09:09:06

MR. PAGE: I will note for the record, Melissa, that the copy that I'm using was the first copy you all gave us that had the -- it said something like privileged and confidential. The problem was that I didn't have another color copy to 09:09:15
make a copy from other than the one that I used myself.

MS. COLLINS: Okay.

MR. PAGE: So I went ahead and used that.

MS. COLLINS: Okay. 09:09:19

MR. PAGE: I think, though, that is the same exact report, except just a little caption on it.

MS. COLLINS: Exactly. The only difference between the reports was the fact that the 09:09:23
draft heading was removed. The text is the same.

Q (By Mr. Page) Okay. The first question I guess I have, Dr. Murphy, is that a true and correct copy of the report, except for the little disclaimer about attorney-client privilege? 09:09:32

A I believe it is.

Q Okay. And I see you've opened up to towards the end of that Exhibit No. 1. Is that your resume that you're looking at now, sir?

A Yes, it is. 09:10:05

Q Okay. My question was to you, is, where have you given testimony or even an expert deposition in the past, if you could identify that for me. And if you're referring to a page in Exhibit 1, if you could refer us to that, also, please. 09:10:13

A I'm referring to Page 19.

Q Okay.

A And I would note, first of all, that this list of depositions and testimony is not up to date. This is a December of 2007 version of my resume, and 09:10:18 I've given depositions since then. In particular, I've testified in three manufactured gas plant cases since then. I've also given deposition testimony in a super phosphate plant case since then. As far as the other cases here, some of them -- 09:11:01

Q Could you do me a favor? May I interrupt you, please?

A Certainly.

Q Would you please -- let's start with the ones that aren't on the resume first, and the most recent 09:11:05 ones. If you could outline for me, for example, the gas plant testimony that you provided, and what I'm interested in is is it deposition or trial testimony, and then the subject matters that you were giving opinions on. 09:11:12

MS. COLLINS: We are in the process of getting a more recent resume, and I can provide that to you later this morning, as well, just so you can see the actual cases since this time frame.

MR. PAGE: Thank you. 09:11:18

A The three gas plant cases are Fitchburg Gas & Electric in Massachusetts, Orange & Rockland Gas plants, I think there were five of them, in New York state, and Brooklyn Union Gas, which also was multiple gas plants also in New York state, and in 09:11:29 every case, the issue is -- that I've investigated is how did the contamination occur. In particular, was it through intentional acts or through accidental spills and leaks. These are all -- involved disputes between an insurance company or 09:12:07 companies and a utility.

Q And what type of evidence -- let me strike that. What kind of analysis did you perform in order to determine whether the releases, I guess, of the contaminants were intentional or accidental? 09:12:16

A I basically look at three lines of evidence. One is my knowledge of the history of the manufactured gas plant industry, the second is the history of the individual plants based on records that pertain to the plants, as well as newspaper and 09:12:24

magazine information, and then the third is the pattern of contamination based on most recent remedial investigations.

Q Okay. Did you employ any multivariate statistical analysis in your analysis of those three gas plant cases? 09:13:03

A Not those three, but in another gas plant I have.

Q Okay. So did you -- were you -- have you provided any expert testimony in a court of law in any of those three cases? 09:13:09

A No, they've all been depositions.

Q Okay. Did you issue a written report?

A In all cases I did, yes.

Q Okay. Now, and I think you mentioned then another piece of testimony you gave that did not make it to your December 2007 report or CV, and that was a super phosphate -- 09:13:15

A Yes.

Q -- plant? Could you describe that, please, in the same fashion? 09:13:24

A Again, it's a plant where super phosphate was manufactured for fertilizer, and it's in the Mid-Atlantic. There's lead and arsenic contamination, as well as some PCB contamination or 09:13:32

PAH contamination, and the issue was which of the successive owners had contributed the contamination and to what degree. It was an allocation case.

Q And what analysis did you employ to do your work in that case? 09:14:11

A I started with a multivariate analysis, and then after I saw what that was providing me, I did go into a different kind of analysis, which was basically a mass balance. I was able, through stoikiometry, to calculate how much lead and arsenic 09:14:19 each of the parties had contributed over time.

Q Was that -- when you say stoikiometry, were you talking about the mass balance approach in that case?

A Yes. 09:14:27

Q Do you find that mass balance is a probative line of evidence to determine sources of contamination?

A It can be.

Q And would you describe the multivariate 09:15:04 process you employed in this phosphorus case?

A It was a principal component analysis based on a number of metals to see if there were differences on different locations on the site and the composition of the contamination. 09:15:13

Q And what were the media that you investigated in this particular instance?
A Soils and groundwater, and I believe some sediment samples, as well.
Q And when you did your PCA analysis, did you do 09:15:19
your soils and groundwater analysis in the same runs as the same -- you combined the medias?
A I don't believe in that case that I did.
Q Why not?
A Well, I was really just trying to feel my way. 09:15:28
I find that principle component analysis is most useful for seeing what's going on in a site and not necessarily the best technique for explaining it to a judge or jury, and so I was really just trying to find my way, and my conclusion was that the 09:16:08
contamination was pretty uniform across the site. Wherever there was buried pyrite, you found this contamination.
Q What about in the groundwater?
A That was -- the contamination there was 09:16:14
downgradient of buried pyrite.
Q Were you able to establish any relationship between the groundwater contamination and the soils contamination that you investigated?
A Only that it was downgradient and it contained 09:16:20

arsenic and lead, which, again, were the contaminants of concern.

Q Did you issue a report in that case?

A Yes.

Q Would you have any objection to providing 09:16:27
counsel a copy of that report to turn it over to me?

A I believe the case is in mediation. I believe the report is confidential.

Q Would you check into that, please?

A Sure. 09:17:03

Q Does the report contain your PCA analysis?

A No, it does not.

Q Why not?

A Because I didn't find that to be the most useful way to deliver my results. 09:17:11

Q Did you primarily rely upon both the evaluation of the contaminants and where they were located along with mass balance to reach your conclusions?

MS. COLLINS: Object to form. 09:17:21

A That's roughly correct, yes.

Q (By Mr. Page) Was there anything else that you used to -- employed to reach your conclusions in that case?

A Well, I did fingerprinting of some PAH samples 09:17:27

to see what their composition reflected.
Q Okay. What do you mean by fingerprinting?
A Looking at the individual PAHs and seeing whether they were characteristic of fuels or urban runoff or what. 09:18:06
Q Is that an effective method to evaluate source with PAHs, fingerprinting?
A It can be.
Q And why is that?
A Well, different fuels have a composition 09:18:12 that's different than urban runoff, which in turn has a composition that's different than manufactured gas plant waste, which is also where it's commonly used.
Q Is there published literature that identifies 09:18:22 the fingerprints identified with those different sources?
A Yes, there is.
Q Is it also true that PAH fingerprinting analysis can be effective because the PAHs 09:18:28 structurally tend to maintain their structure as it processes through the environment?
A Well, they do maintain their structure, but they don't move together through the environment. Different PAHs move at different rates, for example, 09:19:09

in groundwater.
Q But the fingerprint, so to speak, doesn't change once it leaves the soil and enters the groundwater when you have a PAH; is that correct?
A That is not correct because the fingerprint is composed of ratios of different PAHs, and since they move at different rates through the environment and biodegrade at different rates, also, the fingerprint changes throughout the environment. 09:19:16
Q So how does one determine whether the fingerprint from a soil contaminant PAH is also present in a groundwater PAH? 09:19:23
A Primarily by looking at the location of the groundwater contamination, the direction of groundwater, and the velocity of the groundwater, and seeing whether the fingerprint makes sense. For example, the higher ring PAHs will move more slowly in groundwater. So if you're finding a preponderance of them far from your supposed source, you know that doesn't look like it's coming from that source. 09:20:02 09:20:13
Q So you look at kind of a gradation of contaminants from the suspected release points to determine whether or not the release point is the source of those contaminants? 09:20:19

A You could do that, yes.
Q Is that a method that's commonly employed in environmental investigations of sources?
A I don't know how common it is. I've done it in one case. 09:20:26
Q Did you find it to be effective in that case?
A I did.
Q Could you give me a little bit of an explanation of how you employed mass balance in this particular phosphate case? 09:21:02
A The plant had a manufactured sulfuric acid through burning pyrite, which is an iron and sulfur compound, and we knew how much super phosphate they were making, we knew how much sulfuric acid you needed to add to the ore in order to produce that 09:21:13 much super phosphate, and we knew how much pyrite you had to burn to produce that much sulfuric acid. And when you -- from that, you can calculate -- knowing the level of impurities of arsenic and lead in pyrite, you can calculate how much iron -- how 09:21:22 much lead and arsenic were being generated and disposed of on-site during different time periods.
Q Was that mass balance used to identify which of several owners had contributed the most to the contamination? 09:21:28

A Yes.
Q Have you ever employed mass balance analysis for source determination in any other action?
A Well, it depends on how broadly you define mass balance. I have a number of cases where I've 09:22:15
estimated emissions to air, and then estimated what the resulting concentrations would be downwind, and in a sense, that's a mass balance.
Q Have you ever employed mass balance to get an understanding or a sense at a particular 09:22:23
contamination site as to what the most likely significant contributors of a contaminant may be, and that's when you're investigating sources?
A I'm sure I have, but no case comes to mind.
Q Based on your experience with environmental 09:23:16
forensics, do you find that that is probative or helpful in identifying the likely significant contributors of a contaminant to a site?
A It can be.
Q We were talking about your testimony before I 09:23:26
got off on a little tangent there on mass balance. You've identified, I think, four pieces of testimony, the last one, I think was on phosphorus. In that particular case, did you give any court
testimony? 09:24:09

A No.
Q Are there any other sworn testimony as an expert that are not on your resume that you can recall at this time, sir?
A Not that I can recall at this time. There may be, but I'd have to check. 09:24:14
Q Okay. So, now let's maybe refer to Page 19 of your CV, which is in Exhibit 1 to your deposition, and I see there's quite a few listed here, so if you could just name a party and give us a brief statement as to the issue you were investigating in that case, sir. 09:24:25
A The first one, the Hoffman case, involves a toxic tort where the claim was made that a person had been made to wash floors with trichloroethylene, and as a result, had become ill. And my role there was to estimate what levels of trichloroethylene he would have been exposed to. So in a sense, that's a mass balance case. 09:25:04
Q Did you employ traditional risk assessment exposure of techniques in your analysis? 09:25:15
A My part of the case was to calculate exposures, and someone else then translated those into health risks.
Q And that involved only the contaminant 09:25:22

trichloroethylene?
A Yes.
Q I notice this is under depositions, so can I assume that the list of cases under depositions did not -- you did not give testimony in trial? 09:26:03
A That's correct. On Page 21 are the trials and arbitrations.
Q Okay. Then we can continue then with the next one on your deposition, sir.
A The next two, actually, Massachusetts Electric 09:26:08 and Consolidated Edison are manufactured gas plant cases. They involve the same issues as to how contamination occurred, and again, they occur in the context of an insurance coverage.
Q Okay. Did you employ PCA analysis in either 09:26:16 of those cases?
A Did not.
Q What analysis did you employ to do your investigation in those two manufactured gas cases?
A Looked at the historical records for each of 09:26:21 the plants, looked at the remedial investigation to learn the pattern of contamination, and combined those with my knowledge of how the industry operated.
Q And was this opinion relating to accidental 09:26:27

versus intentional contamination?
A Yes.
Q Thank you. Would you go to the next one, sir?
A United States versus Dravo, et cetera, is a
case involving chlorinated solvents, and it 09:27:04
involves -- actually, there are two cases there.
One was an insurance dispute, another one -- case,
which isn't listed here, is whether the City of
Hastings, Nebraska, had contributed in some way to
the contamination. 09:27:15
Q And with those two cases, sir, what analysis
did you employ with regard to chlorinated solvents?
A The -- the issue was how had chlorinated
solvents been released from a degreasing operation,
whether they had been released into a leaky city 09:27:23
sewer or whether they'd been released into a
privately owned storm sewer, and my analysis of the
contamination patterns led me to believe it was
through the storm sewer.
Q Could you give us a little more detail about 09:27:32
your analysis of contamination patterns in that
case?
A Well, I looked at the -- I looked at the
history of the operations, as well as contamination
patterns, but in the context of the contamination 09:28:09

patterns, I looked at the concentrations of various chlorinated solvents in wells that were near and downgradient of the city sewer, and near and downgradient of the storm sewer.

Q So was the pattern analysis primarily 09:28:19
associated with concentrations?

A Yes.

Q And did you employ an evaluation of the gradient or level of contamination from the source downstream, so to speak, to help identify the 09:28:25
source?

A Well, I looked at the size of the various chlorinated solvent plumes, and from that was able to make an estimate of when the releases had occurred. And since the degreaser had been moved at 09:29:03
various times in the past, from that I was able to identify where the degreaser was located when the releases had occurred.

Q And so did you determine that the releases that were in question in the groundwater had 09:29:09
occurred from the degreaser as opposed to a leaky sanitary sewer line?

A Well, the two aren't mutually exclusive, but I determined that the releases had occurred from the degreaser into the storm sewer line. 09:29:19

Q And did you employ PCA in that case?
A I did not.
Q When I say PCA, can we have an understanding that that relates to principal component analysis?
A Yes. 09:29:25
Q Thank you, sir. Would you go to the next deposition testimony?
A The Steven Woods versus Trico Mechanical involved an injury to an employee at a paper mill, and the issue was it was clear that there was 09:30:04 hydrogen sulfide released that had injured the employee, but the issue was where did the release come from. There were two possible locations, and so I plotted out the trajectory of hydrogen sulfide release from both possible sources to determine 09:30:11 which one it had come from.
Q Was this an air contamination issue?
A Yes.
Q So you did air modeling in that particular case? 09:30:17
A Yes.
Q Can I ask you, on the cases that we've covered so far, I apologize to have to back up, can you tell us in the manufacturing gas plant cases, the ones you testified that happened since your resume, who 09:30:24

you were working for in those cases?
A It's been a variety of law firms, but most commonly it's been the firm Mendes & Mount in New York.
Q And were you doing work on behalf of the 09:31:01
alleged polluter or the injured party?
A I was doing work on behalf of the attorneys for the insurers.
Q For the insurers. Who had a potential -- who
were defending a coverage claim? 09:31:09
A Yes.
Q Okay. And what about the phosphate case? Excuse me, it's a phosphorus plant case.
A My client was a law firm for the -- for one of
the parties that owned and operated the super 09:31:16
phosphate plant.
Q Okay. And who was the party on the other side?
A Other owners at other times.
Q I see. And then when we get over to your CV, 09:31:22
the testimony that was in the Hoffman case, who were you working on behalf of in that case?
A Attorneys for Monsanto Corporation.
Q And what about the manufactured gas plant case
in Massachusetts? 09:32:01

A Attorneys for the insurers of the utility.
Q So it was an insurance coverage case, and the call -- Consolidated Edison Company case?
A Are also for the attorneys for the insurer.
Q Again, on a coverage issue? 09:32:08
A Yes.
Q Okay. And then we're up to the Nebraska case with the City of Hastings. Who did you work for in that case?
A As I say, that was really two cases. In one 09:32:13 case, my client was the law firm representing the City of Hastings. In the other case, it was the law firm representing the insurers of Dravo Corporation.
Q And the party that -- was that a Superfund case, the United States of America as the party 09:32:25 plaintiff?
A Yes, I believe it is a Superfund case.
Q So it was a matter of who among the potentially responsible parties was responsible for the groundwater contamination, is that the focus of 09:33:03 the investigation?
A That's basically the gist of it.
Q Okay. And then I think we're at the Steven Woods case for the H2S release. Who did you represent in that case? 09:33:09

A Attorneys for Trico Mechanical.
Q And they were the employer defendant in that case?
A They were a private contractor who happened to be on-site when the incident occurred. 09:33:16
Q I see. Okay. I think we're now up to Atlantic Gas Light, sir. Could you give us the same explanation?
A That's a manufactured gas plant case, but it's not insurance coverage, it's a series of owners of 09:33:23 the utility, and so the issue was when did the contamination occur, during whose watch.
Q And who did you represent in that case?
A Attorneys for United Gas, UGI.
Q One of the succession of owners for the plant? 09:34:01
A Yes.
Q And what --
A Well, one of the -- it's a debate as to whether they were ever an owner. At least one of the operators. 09:34:07
Q Okay, sir. And what analysis did you employ in that case?
A Very similar to the insurance coverage cases, looked at the records from the plant to try to trace out that plant's history, looked at the remedial 09:34:14

investigation to learn the patterns of contamination, and combined that with my knowledge of how the industry operated.

Q Did you employ any PCA analysis in that case?

A I did not. 09:34:21

Q Are we now to Carol Antolovich case?

A Yes.

Q Could you describe that case for us, please, sir?

A That involved a solvents release at a site in Colorado, and the issue was that the solvents were degrading and then were going into people's homes in the indoor air, and the question that I was involved in was were the levels sufficiently high to be harmful. So that was more of a risk analysis case. 09:35:10

Q Involving chlorinated solvents?

A Yes.

Q And did you employ any PCA analysis in that case?

A I did not. 09:35:17

Q Okay. And who did you represent in that case? I can't recall if you told me or not.

A Brown Group Retail --

Q That was --

A -- through their attorneys. 09:35:20

Q I'm sorry to interrupt you there, sir. Was that the alleged polluter in that case?
A It was -- I think it was more a case of it was the present owner, and that the alleged pollution had occurred earlier prior to their ownership. 09:35:29
Q On the present owners' premises?
A Yes.
Q Okay, sir. The next case, LILCO?
A LILCO versus Alliance Underwriters was a -- involved disposal of transformers at a junkyard, and 09:36:06 the extent to which LILCO's transformers had introduced the PCB contamination that was found there.
Q And so PCBs were the chemicals of concern at that site? 09:36:17
A Yes.
Q And who did you represent?
A The insurers.
Q Was it an insurance coverage claim, sir?
A Yes. 09:36:21
Q And in that case, what analysis did you employ to determine the source of the PCBs?
A Actually, that's a mass balance case because what I did was I looked at how many transformers and what size had been disposed there, looked at what 09:36:28

the typical content would have been, and then compared that mass of PCBs with the mass that was actually found on-site.

Q And what did you determine?

A That LILCO had disposed of only a very small portion of the PCBs that had been found on-site. 09:37:04

Q And that was based on analysis of the PCBs on-site versus what you were able to calculate they would have disposed based on the, I guess the transformers that they employed and disposed there? 09:37:14

A Yes.

Q Did you also look at other sources of PCBs as part of your mass balance?

A Not as part of the mass balances. I did look at some of the other sources of PCBs that were on-site. 09:37:21

Q Did you employ any other analysis other than the mass balance analysis that you've described so far?

A I don't recall that I did. 09:37:25

Q Did you employ any PCA analysis in that case, sir?

A Not in that case.

Q Any fingerprint analysis for the PCBs?

A I think I looked at what the aroclors were 09:38:01

that were being found on-site and whether they were consistent with what LILCO used in their transformers.

Q And what did you determine?

A Well, again, my determination was that LILCO had contributed very little to what was found on-site. 09:38:08

Q Okay, sir. Can you go to the next, James Barnett case, please, sir?

A Right. 09:38:14

Q And give us a description of that case, please, sir.

A That's actually one of a series of cases all at the Brio site in Friendswood, Texas, and in each of those cases the issue is the same. It's buried tars in the ground. They were actually stored in pits, and then the theory was that the volatile compounds were emitted from the pits and drifted over into a near neighborhood. 09:38:24

Q Was it an air contamination case? 09:39:03

A Yes.

Q And what were the contaminants of concern there, sir?

A They were various products from vinyl chloride tars and styrene tars, including vinyl chloride 09:39:09

monomer, and I believe 1,2 dichloroethane.
Q Nasty stuff?
A Insufficient concentrations.
Q That's pretty much the same for everything, isn't it. Can you tell me, sir, in that case, did you employ any PCA analysis? 09:39:15
A Not in that case.
Q And did you employ air modeling analysis for your investigation there?
A I did, and also emissions modeling. 09:39:21
Q What do you mean by emissions modeling?
A Well, the -- say the vinyl chloride monomer is contained in a tar, and so in order to estimate the release of monomer, you have to model its transport through the tar to the surface of the tar and then through the soil. 09:40:02
Q And who did you represent in that case?
A Attorneys from Monsanto.
Q The alleged polluter in that case?
A Again, there was an issue as to whether they had contributed at all or whether it was a prior owner. 09:40:10
Q Okay. We'll go to the next case, sir. That was a group of cases, they all had similar circumstances -- 09:40:17

A Yes.
Q -- and facts. And your work was similar in all that group of Brio Texas cases?
A Yes. There was one of those cases that was different only in that the issue was when the tar 09:40:22
was being unloaded, what the emissions would have been from the truck that was doing the unloading, but with that exception, they were all very similar.
Q Okay, sir. Can we go on to the next page, I think it's the Frank Theo Scott case. Could you 09:41:01
describe that for us, please, sir?
A That involved a degreasing operation at the Longhorn Army Ammunition Plant, and my client was the Thiokol Corporation and the Department of Justice. It involved modeling the emissions in the 09:41:10
air transport to determine what concentrations people had been exposed to.
Q Was it a personal injury type case?
A I don't recall that there were actually any injuries that were claimed, but the exposure was 09:41:18
claimed.
Q Okay. And this involved contaminants of plenty of solvents?
A Yes.
Q And it was an air exposure evaluation that you 09:41:24

did?
A Yes.
Q Any PCA analysis employed?
A Not in that case.
Q Thank you, sir. Would you go to the next one? 09:41:27
A The Tutu Wells litigation was a chlorinated solvent case, and it was -- the issue was who had contributed to a groundwater plume.
Q Okay. And who did you represent?
A I would -- I was retained by attorneys for a 09:42:05 dry cleaner that was located in that area.
Q One of the potential PRPs?
A Potential PRP, yes.
Q What analysis did you perform in that groundwater analysis case? 09:42:13
A I looked at the kind of dry cleaning equipment that was used and whether there would have been releases from that equipment. I looked at the pattern of contamination going down our gradient along the plume, and whether there was any evidence 09:42:21 of multiple sources by sudden change in ratios of parent and daughter products.
Q Did you employ any PCA analysis in that case?
A Not in that case.
Q When you say about patterns, can you briefly 09:42:29

describe the patterns you investigated with regard to the chlorinated solvents?

A Well, the parent compound in that case was perchloroethylene. And under anaerobic conditions, it degrades to trichloroethylene, which then 09:43:06 degrades to 1,2 dicholorethylene, and then to vinyl chloride, and so I was looking at ratios of the parent and the daughter compounds. And if I had seen a jump in the ratio of, say, PCE to TCE, perchloroethylene to trichloroethylene, that could 09:43:15 be indicative of a new source, a fresh PCE.

Q And you looked at that by some proximity or location with respect to the alleged source?

A Looked at it going downgradient from what was known to be the primary source. 09:43:24

Q Okay, sir. Next case, sir?

A You know, that's another one of the Brio cases that we just discussed, the Janette Linck case.

Q Thank you. Next case, sir?

A The Allen case involved a facility that made 09:44:05 television cabinets, and was being sued because they had used various paints and varnishes in their operation, which had then been -- when they were used, then been disposed to an incinerator on-site, and the claim was that dioxins had been manufactured 09:44:16

in that incinerator and then had been transported by air into the various neighborhoods.

Q And who did you work for in that case?

A I worked for attorneys representing Akso Nobel Coatings. 09:44:24

Q And in that particular case, did you employ any PCA analysis?

A Not in that case.

Q And was this an air emissions case?

A Yes. 09:45:01

Q Okay. Would you go to the next one, sir?

A That is a -- relates back to the -- I told you there were two cases, actually, in the Dravo case, United States of America versus Dravo, that's the other case. 09:45:15

Q And would you identify that just for the record so we know which one you're referring to, reference --

A That was United States District Court for the Southern District of Alabama. 09:45:18

Q So it relates to the Dravo case on the previous page?

A Yes.

Q And the issues are the same with regard to that one as we already discussed? 09:45:22

A Yes.
Q All right. Then we'll go on to the next case, sir.
A Sierra Club versus Public Service Company of Colorado involved air emissions from a power plant, 09:45:28
and whether those air emissions were causing any harm downwind.
Q What were the chemicals of concern?
A My recollection is that there was a visibility issue, which would have been primarily related to 09:46:06
fine particulate and sulfate. I think that was the primary concern, the paucity of concerns.
Q And who did you work for in that case?
A Attorneys for Public Service of Colorado.
Q Did you employ PCA in that case? 09:46:14
A Not in that case.
Q Next case, sir?
A Juan and Alma Alvear versus Leonard Electric Products involved air emissions from a General Motors facility, and the issue was whether the air 09:46:22
emissions were responsible for birth defects that were found in -- over the border in Texas, it was in the Kiadora (phonetic) facility.
Q Who did you work for in that case?
A For General Motors. 09:47:02

Q And what were the chemicals of concern?
A Oh, there was a wide variety of chemicals. They were paints and coatings, glues, things like that.
Q Emissions from those types of products? 09:47:09
A Yes.
Q And it was an air case?
A Yes.
Q Did you employ PCA?
A Not in that case. 09:47:12
Q Okay. Next one, please, sir?
A Brown versus Brown versus Centerline Circuits was a groundwater contamination case involving people's wells that had become contaminated from a circuit board manufacturer, and my role in that case 09:47:21 was to determine whether the levels that were being seen were sufficiently high to be harmful.
Q Did you do any source identification in that case?
A Not really. It was pretty clear what the 09:48:01 source was.
Q More of a hazard analysis?
A Yes.
Q Did you employ any PCA analysis in that case?
A Not in that case. 09:48:08

Q Who did you work for in that case?
A I worked for the attorneys representing Centerline Circuits.
Q That was the alleged polluter in that case?
A Yes. 09:48:14
Q Okay. Next case, sir.
A Aydin Corporation was a case in Palo Alto, California, involved an electronics manufacturer who had released chlorinated solvents into the groundwater. 09:48:22
Q And who did you work for in that case?
A I worked for attorneys representing Aydin Corporation.
Q And what analysis were you employing in that case? 09:48:26
A My recollection is that it was primarily when the release occurred, that there was an issue of insurance coverage.
Q And what analysis did you employ to determine the date of the release? 09:49:02
A Well, there had been a pumping well installed at some point, and so we were able to look at the back edge of a plume, as well as the front edge. And by looking at how far the back edge had progressed from the time that the pumping well was 09:49:09

turned on, we were able to estimate the groundwater velocity, the retarded groundwater velocity, and, therefore, from the front edge, estimate where the release had occurred.

Q Did you employ a PCA analysis in that case? 09:49:14

A Not in that case.

Q Next case, sir, please.

A That is another -- Consolidated Edison, that is another case of the disposal of transformers. It's basically the same issue that we've already 09:49:32 talked about.

Q PCBs and --

A Yes.

Q -- the allocation to your client?

A Or not to my client, as the case might be. 09:50:04

Q Yes, sir. Whether there should be an allocation to your client?

A Well, no, my client was an insurance company.

Q I see.

A Whether their -- what the allocation was to 09:50:10 their client.

Q Thank you, sir. And did you employ any PCB -- excuse me, any PCA analysis in that case?

A Not in that case.

Q Okay. Next case, sir? 09:50:16

A Texas Eastern Transmission was an insurance coverage case. It involved PCBs that had been disposed of in pits along the transmission pipeline where -- at pumping stations.

Q And who did you represent in that case? 09:50:26

A The insurers for Texas Eastern.

Q And what was your issue to investigate in that case?

A Whether the PCB contamination, which was then located in pits, was likely to migrate. 09:51:04

Q And what analysis did you employ?

A I looked at the retardation coefficients for the PCBs and at the groundwater velocity, and at the height of the PCBs above groundwater.

Q So this was PCBs that were in pits that were submerged in groundwater? 09:51:13

A They were actually above groundwater. The issue was whether they could migrate into groundwater, and then migrate off-site from that.

Q Did you employ any PCA analysis in that case? 09:51:19

A Not in that case.

Q The next case, sir.

A James Slaughter was another one of the Brio site cases involving the storage of tars in pits.

Q Same issues in that case? 09:51:27

A Yes.
Q Next --
A That we discussed in the context of the earlier Brio site cases, yes.
Q Thank you for that clarification, Dr. Murphy. 09:52:02
Would you go to the next case, please?
A Remington Arms Company was an insurance coverage case, and it involved whether the contamination that was produced primarily, as I recall, lead contamination had been accidental or 09:52:10
resulted from intentional disposal.
Q And who did you represent in that case?
A The insurers of Remington Arms.
Q And what analysis did you employ to determine whether the lead was accidentally released? 09:52:18
A I looked at the various remedial investigations that had been performed, whether the lead contamination was found near the operating sites or whether it was found in a more remote location. I looked at the pattern of manufacture of 09:52:27
the shop that was being manufactured there.
Q What would your spatial analysis of the lead contamination indicate to you in your evaluation in that case?
A Well, if there was a lot acreage that had 09:53:06

never been used historically for any type of manufacture, and that's where you found the contamination, it would seem logical to think that that was very likely a disposal area.

Q And the media involved with the lead contamination in that case was soils? 09:53:13

A That's my recollection.

Q Did you employ any PCA analysis in that case?

A Not in that case.

Q Okay. Would you go to the next one, sir? 09:53:19

A The Anne Anderson versus W.R. Grace & Company is the infamous wells G&H of a civil action, and my role there was to estimate exposures.

Q Who did you work for in that case?

A W.R. -- the attorneys for W.R. Grace. 09:53:28

Q And were you doing exposure analysis in that case, is that what you said, sir?

A Yes.

Q What were the chemicals of concern, if you can remind us? 09:54:04

A I believe it was trichloroethylene.

Q And what analysis did you employ to do your exposure analysis?

A I estimated what the concentrations would be for chemicals volatilizing into people's homes, and 09:54:09

also what the exposure would be from the use of contaminated drinking water for purposes of bathing or showering or drinking.

Q So was it a transport analysis from groundwater into indoor air, is that part of your analysis? 09:54:20

A That was part of it.

Q And then the other analysis I guess would be what would happen to chlorinated solvents that were used in domestic waters? 09:54:25

A That were used within the home, yes.

Q Did you employ any PCA analysis in that case?

A Not in that case.

Q Okay, sir. We're on the top of Page 21 now; is that correct? 09:55:02

A Yes.

Q Okay. Could you tell us about that case, sir?

A That is a case involving contaminated groundwater flowing underneath a neighborhood from the -- a Hooker chemical exposure site along Love Canal, and the issue was what concentrations of chemicals would be in people's homes, again, from volatilization from groundwater into homes. 09:55:07

Q So it was an indoor air exposure issue you were focused on? 09:55:16

A Yes.
Q And it was chlorinated solvents, sir?
A Primarily. There were about a hundred different chemicals, but it was primarily chlorinated solvents that were the volatiles. 09:55:21
Q And who did you work for in that case?
A Attorneys for EPA and Department of Justice.
Q Did you employ any PCA analysis in that case?
A Not in that case.
Q Okay. Now I think we're in the trials and 09:56:03 arbitrations section. Are there any amendments to the trials and arbitration section that will be in your new, more current CV, sir?
A Not that I can recall.
Q Would you go through this list for me, please? 09:56:11
A These are actually repeats, in most cases, of depositions, because preceding the trial or arbitration, there was usually a deposition. The Thiokol case in which I represented Thiokol and the Department of Justice we discussed. Brown versus 09:56:19 Centerline Circuits we've discussed.
Q I'm sorry, just for the record, sir, just briefly, what were the chemicals of concern with Thiokol?
A They were chlorinated solvents. 09:56:23

Q And was it in groundwater or air?
A Air.
Q Okay. And it says here you testified at a Daubert hearing; in what respect?
A All the experts on both sides had Daubert challenges, including myself. 09:56:28
Q So you were defending your opinion in a Daubert hearing?
A That's basically right.
Q In that case, did you ever actually give testimony before the judge or jury on the issues that were actually before the court? 09:57:05
A Yes, because the Daubert challenge to me was that I had only critiqued the other witness and hadn't done my own analysis. 09:57:16
Q Okay. And you were defending that?
A Yes. Silly challenge, I agree.
Q And what was the court's ruling in that particular case?
A The court never made a ruling. 09:57:21
Q It was settled before a ruling?
A Yes.
Q Let's go to the next case, the Brown versus Centerline Circuits. Is that one that you've already talked about too? 09:57:28

A Yes, we have.
Q And I'm trying to recall, that was a case in Colorado in groundwater contaminated from a circuit board manufacturer?
A Yes. 09:58:04
Q Okay. And that was chlorinated solvents, sir?
A Yes.
Q And I guess for both the Scott and Brown case, there's no PCA work that was done in that case?
A Not in those cases. 09:58:10
Q And what was your testimony -- did you actually give testimony in trial at that case?
A I did.
Q And you were certified by the court as an expert in that case? 09:58:17
A Yes.
Q And that had to do with the fate of contaminants in groundwater; correct, sir?
A Well, I also testified in court on how EPA sets groundwater MCLs. 09:58:22
Q Okay. Any other areas of court testimony other than the fate of the chlorinated solvents in groundwater and the EPA's method of setting MCLs for chlorinated solvents?
A I was deposed in that case. I didn't present 09:58:29

at trial on what the indoor air exposures would have been, again, from showering, water use of different kinds, drinking and so on.

Q I'm sorry. Why did you not present that area of testimony at trial? 09:59:07

A It was the attorney's decision.

Q Not to present it?

A Yeah. I think their feeling was that saying any exposure would be viewed negatively, even if we said it was a very minimal exposure. 09:59:10

Q Was there a Daubert challenge in that case?

A Yeah.

Q The next case, sir?

A Aydin Corporation, we've talked about it, it was a groundwater case involving chlorinated 09:59:18 solvents.

Q Was that the one in Palo Alto that we talked about earlier or --

A Yes, that's the one.

Q Okay. And did you -- and you testified in 09:59:26 that case at trial?

A Yes.

Q There's no PCA analysis in that case; correct?

A Not in that case.

Q And what were the areas of testimony you gave 10:00:01

at trial?
A I testified on when the plume -- when the release had occurred that formed the groundwater plume.
Q Okay. And was there a Daubert challenge in that case? 10:00:08
A No.
Q And would you go to the next one, sir?
A Testimony before an administrative law judge regarding expansion of Flying Cloud landfill. 10:00:11
Q Flying Cloud landfill. We haven't talked about that case before, have we, sir?
A No, we haven't.
Q What were the issues involved in that particular matter? 10:00:17
A There was a move to expand the landfill, but at the same time to install various control equipment, flare stacks and so on, and the issue was what would -- how would the resulting emissions and downwind concentrations compare after the expansion with the current situation. 10:00:23
Q So your focus was on air contaminant transports?
A Yes.
Q Any PCA analysis in that case? 10:00:32

A Not in that case.
Q Okay. Next one, sir.
A The James Slaughter, et ux, is one of the Brio cases.
Q Okay. And the subject you testified at trial in that case? 10:01:06
A Emissions and downwind concentrations from pits in which styrene and vinyl chloride tars were stored. Also, I testified as to how the concentrations were measured in the neighborhood of various air contaminants compared with concentrations elsewhere in Texas. 10:01:14
Q So your testimony at trial in that case concerned air emissions and their transport?
A And the air concentrations, yes. 10:01:21
Q Any Daubert challenge in that case?
A No.
Q And I recall there was no PCA in that case; correct?
A Not in that case. 10:01:25
Q And the last matter, sir?
A That involved a proposal to bring oil tankers into Puget Sound from Alaska, and my role was to look at what an explosion of an oil tanker would look like in terms of the resulting damage. 10:02:06

Q That was before an administrative law judge?
A Yes.
Q Was there any PCA employed in that case?
A Not in that case.
Q Have you ever testified, either in deposition 10:02:13
or trial prior to today, where your
opinions -- expert opinions involved PCA analysis?
A I've testified at depositions where I had used
PCA to reach my -- in part to reach my conclusions,
but I wasn't deposed on the PCA analysis. 10:02:27
Q The only case that I recall from our just
going through these was the phosphate fertilizer
case where you said you employed PCA, but it didn't
ultimately end up in your opinion; is that correct?
A That would be the only deposition. I do have 10:03:06
one other case, not including this one, where I used
PCA analysis to reach my conclusions.
Q Is that identified in your CV that's before
you, sir?
A It is identified. It's not in the depositions 10:03:11
and trials because it hasn't reached that stage yet.
Q Could you show us on the CV that's before you
in Exhibit 1 that entry for that matter, sir?
A Well, I appear to have misspoken because it
doesn't appear to have made it into this version of 10:03:32

my CV, which is an older version.
Q Okay. Would you just describe that particular matter for us, sir?
A It involves contamination at a location in Maine, in a harbor in Maine, and the issue was 10:04:04
whether the contamination results from a manufactured gas plant that's located not too far away, whether it results from historical coal storage along the river front and/or whether it
results from some other type of source. 10:04:15
Q What are the chemicals of concern?
A The chemicals of concern are various tars containing PAHs, as well as mono-cyclic compounds such as benzine.
Q And what media has been contaminated? 10:04:23
A Sediments in the river, as well as soils, but I believe a remediation is mostly of the sediments in the river.
Q And how did you employ PCA in your analysis in
that case? 10:05:01
A I looked at the fingerprint of the various locations, locations associated with the manufactured gas plant, locations associated with the -- a historic pipeline leading down to the
harbor, looked at the fingerprint in the sediments, 10:05:10

as well as in the soils.
Q Did your PCA involve more than one media?
A It did, although not at the same time.
Q Okay. So you did a separate, let's say, liquids media PCA from a solids media PCA? 10:05:20
A Yes.
Q Why did you not combine them together in that case?
A Well, because the fingerprint isn't preserved going from one medium to another. Again, different 10:05:26 PAHs have different transport properties in the environment.
MR. PAGE: Let's take a break.
VIDEOGRAPHER: We are going off the record. The time is now 10:05 a.m. 10:06:04
(Following a short recess at 10:06 a.m., proceedings continued on the record at 10:27 a.m.)
VIDEOGRAPHER: We are back on the record. The time is 10:26 a.m.
Q (By Mr. Page) Dr. Murphy, before the break, 10:27:07 we were discussing some of your past experiences professionally, and my recollection is is that what you testified so far, and if you would confirm this, you employed PCA on two occasions that we've talked about, one at the phosphorus plant and one involving 10:27:18

a gas plant releases in a Maine harbor; is that correct?

A In addition to this case, yes.

Q Okay. So in all of your professional career, if you include this case, you've used PCA in your investigations three times? 10:27:27

A On specific cases, yes.

Q What about -- I want to make sure we're speaking the same language, so to speak. Have you employed PCA in any other professional investigations, may not have been associated with litigation or a case, other than what you've testified to so far today? 10:28:07

A Oh, I've edited a textbook that has a chapter on PCA, and I did edit that chapter and made various corrections, so that's part of my professional work, also. 10:28:14

Q Okay. Any other source investigations where you may not have been involved in litigation, but you employed PCA to determine or help identify the sources of contamination in the environment? 10:28:21

A Not that I can recall at this time.

Q And is it fair for me to understand that in the two cases prior to the present case, when you employed PCA, you did not use the multimedia PCA 10:29:04

evaluation that you employed in Section 5 of your report for this case?

A That's my recollection.

Q I want to ask you a few more questions on your CV, sir, which is Exhibit 1. If you would turn back 10:29:15 to that, I just have a couple of more questions, I think, on that. If you turn to Page 7 of your CV that's part of Exhibit 1, I think this is under your writings or your publications section, and there's an entry here, it's the fourth entry down, says, 10:30:01 Murphy BL, I assume that's you?

A Yes.

Q As the principal author, and it says, mathematical modeling, physical science issues in natural resource damage assessment. Did I read that 10:30:08 correctly, sir?

A Yes.

Q Okay. Could you describe briefly what the work you did in that particular presentation?

A My -- that was a long time ago and so my 10:30:14 recollection may not be complete, but my recollection is that the mathematic modeling involved was involved in describing the transport of materials from compartment to compartment, each compartment representing a different environmental 10:30:22

medium.
Q And why is that important, sir?
A Well, very often you want to make a connection between a source and a receptor that's of concern, and in order to do that properly, you need to have 10:31:01 both the source and the receptor in your model, and you need to be able to talk about how things transform or change as you go from compartment to compartment in order to make that connection.
Q And did this involve the chemical changes in 10:31:10 the constituents of concern, is that what you're talking about?
A That's my recollection, yes.
Q I'm going to go to the next one I've identified I'd like to ask a question about, sir, 10:31:18 it's a couple of pages forward on Page 10, about halfway down the page, 1, 2, 3, 4, 5, 6, sixth entry where it says, estimated chemical emissions, including metals and dioxins in Muskogee, Oklahoma; do you see that? 10:31:29
A Yes.
Q Would you describe that circumstance for us?
A That was an NPDES suit. I was retained by the Department of Justice, and the issue was the dioxins and furans that were being generated by wire burning 10:32:06

and their transport off-site and into nearby bodies of water. It -- my role, in addition to doing the modeling, was also to collect some samples and have them analyzed for dioxins and furans.

Q And where did you collect the samples? 10:32:19

A On-site, near the wire burning operation.

Q Were they in the soils on-site?

A They were in the soils, yes.

Q Did you do any sampling in the water bodies that were associated with the NPDES discharge? 10:32:28

A I did not.

Q If we could go forward, sir, to Page 12 of your CV, there's an entry towards the bottom of the page says, metal inorganics, and the first entry says, performed statistical analysis to identify 10:33:10 sources of lead and arsenic at a Mid-Atlantic phosphate plant. Is that investigation that's described there on Page 12 the one that we discussed earlier this morning concerning your phosphate analysis? 10:33:18

A Yes, it is.

Q Okay. If you would go forward now, sir, to -- let's see -- would you look at Page 15 of your CV, sir. Under solvents, the second entry, would you read that, please? 10:34:08

A Analyzed how and when chlorinated solvents entered the environment at a Kansas manufacturing facility.

Q Could you briefly describe the analysis you employed in that particular evaluation? 10:34:14

A In that particular case, there were a series of buildings that were built, one after another, and as each building was built, a degreaser was moved and the location where solvents were stored was changed, and we had the date of the buildings, and 10:34:24 so by identifying the source of various plumes, which building they emanated from, we were able to date the releases from each building.

In that case, I used what I call the plume reconstruction method, which is adding back the 10:35:02 daughter products to the parent product, and we also used an anisotropic creaking to try -- to describe the plumes, and we were able to get definite plumes coming from each of -- from different buildings.

Q Not necessarily in that case, sir, but in 10:35:13 other environmental investigations, is it generally important in source identification to be able to identify where the release occurred?

A I would say that's generally the case.

Q And that same page on Page 15, sir, I want to 10:35:25

go down under solvents, 1, the fifth down, that was the Nebraska facility. Was that the same facility that we discussed earlier as part of your deposition testimony involving TCE and 1,1,1-trichloroethane?

A That's the same case, yes. 10:36:07

Q And that's where you talked about using mass balance already; right?

A Yes, sir.

Q All right, sir. Next page, the second from the bottom on Page 16 of your CV, it involves a 10:36:15 Camden, New Jersey, site?

A Yes.

Q It says there, to determine the source of the contamination, both mass balance estimates and groundwater modeling were used. Would you please 10:36:23 describe the mass balance analysis you employed in that case?

A My recollection is that one of the issues was whether an electroplating facility had contributed to contamination of a nearby well field, and we were 10:37:01 able to estimate what the discharge of -- let's see, it was chromium and solvents were from that electroplating facility and see if it matched what was being found in the well field.

Q And could you tell me how mass balance was 10:37:11

employed, specifically?
A You compare the mass disposed with the mass contained at the present time in the well field and see if the two numbers make sense.
Q Okay. Did you do an evaluation in that 10:37:19
particular mass balance of other potential sources for the chromium and the chlorinated solvents?
A My recollection is that we did, but not in the same detail as the electroplating facility.
Q And was that mass balance analysis probative 10:37:28
in that particular circumstance?
A My recollection is that it was.
Q Where are you currently employed, Dr. Murphy?
A At Exponent.
Q And what is your title? 10:38:14
A Principal scientist.
Q What does that mean?
A That's the highest technical rank in our organization, and generally principals are also
stockholders in the company. 10:38:21
Q Okay. And how are you compensated?
A I'm paid a salary, and I get an annual bonus.
Q Okay. And what is the basis for your bonuses?
A Oh, you know, it's never really been explained
to me. 10:39:01

Q It shows up around Christmas and you're just happy to have it, huh?
A Yes. But I believe the basis -- my understanding is -- it's never been explained -- that it depends on how well the company has done, 10:39:08
how well my part of the organization has done, and whether I've met certain goals.
Q Okay. And is that like a -- when you talk about yourself personally, is that like a performance evaluation for yourself? 10:39:14
A Yes. I have goals, such as papers published and symposium attendance with papers presented and that sort of thing, yes.
Q How long have you been employed by Exponent?
A I think it's about five years. 10:39:25
Q To your knowledge, does Exponent enter into contracts with clients where they are paid a bonus based on the results they achieve in their work?
A I've never heard of that being the case. I'd be very surprised if it's the case. 10:40:03
Q Have you ever -- I just want to probe that a little bit more, been aware of a circumstance where Exponent received a bonus, and they were representing an alleged polluter at a site where they were able to demonstrate they reduced the 10:40:10

remediation costs through their work?
A I'm not aware of any such case.
Q And in this particular case, how have your services for the law firm representing Cargill been compensated? 10:40:21
A Exponent sends a monthly bill to Faegre & Benson, and that's all I know.
Q Do you know how much has been billed for your services in this case?
A I don't. It would be a very crude estimate on 10:40:29 my part.
Q Have others other than yourself -- let me strike that. Other than yourself, has anyone else from Exponent been employed with the work you've performed in this case? 10:41:07
A Yes.
Q And who are those people?
A Melanie Edwards, statistician; Randy O'Boyle, who is our GIS person; Cheryl Law has provided some information for me. Those are the people that come 10:41:18 to mind, and the reason I don't know much about how much has been billed is because Melanie Edwards handles all of that.
Q Do you have any idea how much the law firm has been billed from Exponent for the work on this case? 10:41:28

A I really don't know the number.
Q Other than these three folks you just identified at Exponent, did you have any assistance from anyone else on the work that you performed in this case that would be, I guess, people outside of 10:42:05 Exponent?
A Oh, I should have mentioned one other person, who is an Exponent employee, and that's Stephen Mudge.
Q Stephen Mudge. And he's an Exponent employee? 10:42:10
A Yes.
Q For how long?
A Oh, probably four or five months.
Q And what office does he work out of?
A He's in our Wales office. 10:42:17
Q And prior to that, was he a professor?
A He still is a part-time professor, I believe, but, yes.
Q Okay. Can you think of anyone else from Exponent that might have worked on this case? 10:42:24
MS. COLLINS: Object to form.
A Oh, boy, there is one other person, it's -- but I can't think of think of her name. She performed a role similar to Cheryl Law, she found me some information. 10:43:07

Q (By Mr. Page) Does the name Dr. Edinboro ring a bell?
A Oh, yes, of course, Charlene Edinboro.
Q Was that the person that you couldn't recall that provided you with -- 10:43:15
A No, that's another person I couldn't recall.
Q Okay. So let me see if I've got -- Cheryl Law provided you some information. Do you recall what kind of information she provided you?
A She put up on a website -- I believe it was 10:43:23 Cheryl Law put up on a website information about the specific measurements that were done at Cargill facilities.
Q Oh, she provided you that information by putting it on a website? 10:44:02
A Yes.
Q Why would she provide it that way to you rather than mail or E-mail?
A Well, I'm not certain I know. I was able to download it pretty readily. 10:44:08
Q Was that information that you downloaded that Cheryl Law provided included in your considered materials?
A It should be, yes.
Q And you mentioned Stephen Mudge. What work 10:44:15

did he perform with you in this case?
A Every Exponent report undergoes a peer review, and I had Stephen Mudge as my peer reviewer.
Q Okay. And then there was another person I think we've yet to identify that also provided you 10:44:27
some information?
A Yes. I think it may have been Kristi Kessel.
Q Kessel?
A Yeah, I believe it's K-E-S-S-E-L.
Q And what kind of information did she provide 10:45:04
you?
A Again, it was a case of putting things on the website. I can't recall who put the Apex reports from the Cargill growers on the website, but that's the kind of information that I received. 10:45:12
Q What were the Apex reports?
A Apex reports that I looked at were basically observations taken by a company named Apex at the time CDM was collecting samples as to the nature of the site, the presence of cows, that kind of thing. 10:45:22
Q Are you aware whether or not those observations were simultaneous to the actual collection of the samples or were they evaluation of sites that were identified as sampling locations by CDM? 10:46:01

A I don't remember if they were simultaneous. Certainly the CDM field notebooks, which I also looked at, were simultaneous. I don't recall if the Apex ones were or not.

Q Okay. And were those Apex reports included in your considered materials, sir? 10:46:07

A They should be, yes.

Q And you mentioned a Dr. Edinboro, also?

A Yes.

Q What kind of information did she provide you? 10:46:13

A She was a veterinarian, and I gave her the task early on, since all the Cargill growers are turkey growers, whether there were any compounds that we might look at to distinguish turkeys from chickens. 10:46:21

Q Did you find any or identify any?

A Not with the list of compounds that Dr. Olsen was sampling.

Q Did you identify that any compounds that were not included in Dr. Olsen's list of analytes he sampled for? 10:46:26

A Well, we mentioned esterols as being a compound that would have been useful to -- compounds that would have been useful to look at. Really, the way to do that is to take a clean soil sample and do 10:47:04

an SPLP test on it, and then compare that with a soil sample that has chicken litter in it or poultry litter in it and see what compounds pop out in one that don't pop out in the other.

Q Did you do that? 10:47:13

A Did not, nor did Dr. Olsen.

Q Did you identify, other than the sterols you mentioned, identify any constituents through your evaluation in this case that would distinguish turkey waste from other forms of poultry waste? 10:47:22

A My recollection is that there was some difference in estradiol.

Q Anything else?

A Those are the ones that come to mind.

Q And with record to estradiols, did you perform any evaluation to determine whether or not there is in fact a difference between estradiol levels in poultry waste as compared to specifically turkey waste? 10:47:29

A We did see a difference between chicken and turkey waste for estradiols. 10:48:07

Q And how did you make that observation, what information did you use for that observation?

A My recollection is it was looking at the solid waste samples, the poultry litter samples, and we 10:48:17

only had a couple of turkey samples, but comparing those with the chicken litter.

Q And this would be analysis and samples that were collected by CDM in this case?

A Yes. 10:48:26

Q Did you do any evaluation as to whether or not those constituents, that is, the estradiols, were present in sufficient amounts in environmental samples in order to make them useful for a source evaluation? 10:49:04

A Did not look at it beyond the poultry litter, is my recollection.

Q Would you identify -- I know we kind of got a little sideways on what I usually do, but we have Exhibit 1 before you, sir. Does Exhibit 1 10:49:21 essentially contain all of your opinions that you're going to provide in this case?

A Well, all the opinions at the time I wrote the report. Since then, I've developed additional opinions. 10:49:28

Q Okay. And have you submitted those in writing anywhere?

A Submitted to?

Q Anyone? Let me ask this question. Have you reduced those opinions to writing? 10:50:03

A Some I furnished Ms. Collins, but others I've only conveyed verbally.
Q Okay. And who is Ms. Collins?
MS. COLLINS: (Indicating).
Q (By Mr. Page) I mean, for the record, would you identify her, please? 10:50:14
A Ms. Collins is sitting to my right.
Q (By Mr. Page) And she's the lawyer for Cargill?
A Yes, Faegre & Benson attorney. 10:50:18
Q Okay. And so you provided her some additional written opinions?
A Provided her with some figures.
Q Okay. And let me do this. Would you identify for me both the unwritten and written additional opinions you've formed since you prepared your report? 10:50:26
A Certainly.
Q Okay.
A The first opinion is that it's very striking to me that Dr. Olsen never provides a calculation that includes both the source he believes to be the cause of contamination and the -- the receptor that he believes to be of concern, that is, there's no calculation that includes both the SPLP results for 10:51:01 10:51:13

poultry litter and the surface water results. That whole chain of causation is simply missing. He does pieces of the chain, but he never does the whole chain.

Q Okay. And what kind of a calculation are you talking about? 10:51:22

A Well, you wouldn't even have to do a multimedia. You can do -- take SPLP for poultry waste, then look at edge of field, then look at groundwater, then look at surface water all in the context of a PCA analysis. 10:51:29

Q Okay. And have you done that analysis yourself?

A Yes.

Q And do you have any results? 10:52:04

A Yes.

Q What are the results?

A That the SPLP results look completely different than the surface water results. They're just -- the PCA shows that they're not related. 10:52:11

Q So you ran a PC -- another PCA with SPLP results from chicken waste?

A Poultry litter.

Q Poultry litter?

A Yeah. 10:52:17

Q Altogether?
A Yeah.
Q And you compared that to what analysis?
A To all the other water measurements.
Q Okay. Has that been reduced to writing? 10:52:20
A It's been reduced to a figure.
MR. PAGE: Do the defendants plan on seeking to supplement this report?
MS. COLLINS: You have it in the considered materials. It's Murphy 000384 through 10:52:25 Murphy 000396.
MR. PAGE: Okay. But do you plan to include it as part of his report to testify in this case?
MS. COLLINS: There is no plan at this 10:53:03 time.
MR. PAGE: Okay. Would you give me those Bates numbers again, please, Melissa?
MS. COLLINS: Sure. It's Murphy 000384 through 000396. I have a copy of it, if you want. 10:53:09
MR. PAGE: Yeah, that would be nice. Thank you.
MS. COLLINS: I'll be happy to mark it as an exhibit, if you want.
Q (By Mr. Page) Dr. Murphy, can you advise me 10:53:17

as to any other opinions you formed that are not set forth in your report?

A Well, my second opinion is that --

Q And this was formed since you wrote your report? 10:53:25

A Yes. Going back and looking at Olsen's calculation SW18, that it very clearly shows that the poultry litter SPLP results are completely different than the surface water results, but the cattle manure SPLP results are not entirely 10:54:03 dissimilar from surface water results.

Q Okay. And did you run a PCA analysis on this?

A No, I simply looked at his chart.

Q Just looked at the chart?

A Yeah. 10:54:11

Q Okay. So that's not in writing anywhere?

A Well, it should be in his materials. I received it from --

Q Your viewpoint that you just expressed, is that in writing anywhere? 10:54:16

A No, I don't believe that is.

Q Is there any analysis of what you just testified to in writing anyplace?

A Not by me, but I think that Dr. Olsen's figure, his scores plot for that case speaks for 10:54:23

itself.
Q And you did this analysis after you submitted your report?
A I looked at that particular one after I submitted the report, yes. 10:54:29
Q Anything else?
A Well, the third opinion would be that he's looked at other possible sources, such as cattle manure and wastewater treatment plants and so on, but he hasn't looked at the most important other 10:55:04 source, and that is just native soils. It's clear to me that his edge of field samples are dominated by components of native soils, and he has no idea what the compound is because he's never done an SPLP sample on native soils without poultry litter, 10:55:12 without cattle manure, et cetera, just has no idea what background is.
Q Wouldn't the reference stream samples serve as a background for such an analysis?
A Not for the edge of field, no. 10:55:21
Q How would they be different?
A Well, the surface stream samples are going to be dominated by components that are dissolved in surface water or are, you know, found in surface water naturally, whereas the native soils analysis 10:56:02

is going to be dominated by components that are found in native soils, that are glommed particulates and so on.

Q Wouldn't the runoff of impacted native soils be representative of the leachate you would find in 10:56:12 the unimpacted streams?

A No. Again, the chemical signature changes going from medium to medium, and so looking at a stream, a reference stream is not going to do the same thing as looking at a reference soil. 10:56:21

Q Okay. But you were talking about looking at a leachate or a runoff from a reference soil; correct, sir?

A Yes.

Q Okay. And I understand how if you went from 10:56:26 the solids to the liquid medium medium that would -- could be a change, but I'm trying to understand. I thought your criticism was concerned with Dr. Olsen didn't look at runoff from a reference soil and compare it to the streams; is that correct? 10:57:05

A That is basically correct, yes.

Q So my question --

A Oh, not as compared to a stream, compare it to the edge of field samples.

Q Oh, so you would want the runoff from an 10:57:09

unimpacted field -- edge of field sample from unimpacted field to be compared to an edge of field sample from a poultry disposed field?

A That would be one example. Another example would be comparing an SPLP test on unimpacted soil with an SPLP test on supposedly poultry litter impacted soil. 10:57:17

Q So I guess what I'm trying to understand, then, Dr. Murphy, if we're talking about runoff from unimpacted soils that go into streams, how could there be any chemical composition change in the sense that the unimpacted stream would not be representative of runoff from unimpacted soils? 10:57:25

A Well, first of all, it's a great deal of dilution that happens when you enter the stream. Secondly, the partition in your variate chemicals is completely different, solid media and liquid media. It's controlled by things like solubility, like the soil water partitioning coefficient and so on, and so the chemical signatures, I'd say changes going from medium to medium. 10:58:05 10:58:14

Q Have you done any evaluation in the IRW to demonstrate the opinion you just gave us?

A I have not attempted to find background in the IRW. 10:58:22

Q Did you perform any analysis, SPLP analysis on unimpacted soils?
A I have not done that at this date.
Q Have you done any collection and analysis of an edge of field sample on an unimpacted field? 10:58:28
A I have not.
Q So you wouldn't be able, then, to compare what you think may be running off of an unimpacted field to a reference stream to see if there is, in fact, any chemical changes? 10:59:08
A Well, again, my comparison is edge of field sample from unimpacted field, to edge of field sample from impacted field, or SPLP from native unimpacted soil to SPLP from soils that are impacted. Again, I'm not making a comparison of 10:59:18 stream to soil.
Q But I guess -- I guess the same question, though, a similar question is that you don't have the analysis to demonstrate your point, do you, sir?
A And neither does Dr. Olsen. As far as I know, 10:59:25 none of his measurements tell you what background is.
Q Background for an edge of field?
A Yes.
Q Did you do any investigation of the components 11:00:01

of the reference soils in this case?
A Only what's contained in my report, pointing out that most of the -- or a number of the analytes that he's chosen are common in soils.
Q Did you look at the concentrations in the reference soils? 11:00:09
A I'm sorry, in the what soils?
Q Did you investigate the concentrations in reference soils in the IRW, that is, the concentrations of the different analytes? 11:00:15
A I have not.
Q Wouldn't that be important to tell you something about what would be expected to run off from those soils?
MS. COLLINS: Object to form. 11:00:21
A It would be less important than actually going out and making the measurement of the kind that I've suggested.
Q (By Mr. Page) But it would help you evaluate that? 11:00:26
A It would, but why do what's second best when you can do what's correct.
Q And, again, Dr. Murphy, you have not performed that analysis yourself; right?
A I have not selected any soil samples or SPLP 11:01:03

samples.
Q Any other opinions that are not -- that you've developed since you published your report and are not in the report?
A Well, I guess there are a couple of 11:01:10
corrections I would make to my report. I don't know if those fall into new opinions or not, but I can go through those, if you like.
Q Would you, please?
A The first is where I list three examples of 11:01:19
coliforms in the analysis. It should have been -- should not have been enterococci, it should have been total coliform.
Q Okay. Do you know the page that you're
talking about there? 11:01:27
A I think I can find it. Perhaps I can find it during a break.
Q Okay. So you just misidentified an enterococcus as a coliform bacteria?
A Yes. 11:03:04
Q Anything else? Any other corrections?
A Yes. I realized that I didn't explain what my multimedia analysis was very well. I said it represented a correct analysis when it should have
been a corrected analysis, because all I did was I 11:03:10

tried to simulate what Olsen did, just making correction to the development of the scores plots, where he had done it incorrectly, I did it correctly.

Q Was this the calculation you're referring to in the log transformation of the results? 11:03:17

A Yes.

Q Anything else with regard to the multimedia investigation?

A No, I just should have explained that it's what Olsen would have seen if he had done a multimedia analysis, and it's not being presented as being a -- my analysis, which I believe to be correct and perfect. I was trying to simulate what he did. 11:03:24 11:04:04

Q But Dr. Olsen didn't perform a multimedia analysis --

A No, but I did everything along the way the way he did it.

Q Okay. So you said -- your testimony is that you followed the PCA methodology that Dr. Olsen did when you did your multimedia analysis? 11:04:07

A To the extent I could, yes.

Q Used the same analytes?

A Yes, used half the detection level. 11:04:16

Q Well, we'll talk about that a little bit more later. Anything else? Any other corrections?
A That's what comes to mind.
Q Okay. Based on what's in this published report, could you provide us with a summary, and I'm not trying to pin you down, but if would you give me a summary of your key opinions, sir? 11:04:27
A Well, the key opinions in the report are -- start on Page 8 in the executive summary.
Q Uh-huh. 11:05:11
A The first opinion is that the Cargill contract grower data used by Dr. Olsen are too limited to draw any conclusions, or if you look at the few data that he does have, they draw conclusions that are the opposite from what he draws. 11:05:18
Q Okay. Could you explain what you mean by too limited?
A Well, there are 35 Cargill contract growers in the area, in the basin, and at one grower -- he only collected data from two growers, and at one grower, the only data he collected was a poultry litter sample. At the other grower, Mr. Schwabe, he did collect some environmental samples, as well, but Schwabe's farm is a square mile, and he only collected a handful of data, two spring samples, one 11:05:25 11:06:04

groundwater sample, and soil samples at four locations, but he didn't even use all that data. So it's really -- the number of data can be counted on one hand.

Q When you say Dr. Olsen did not use all the data, what data are you referring to specifically? 11:06:12

A Some of the soil data was not used, and he didn't have any edge of field sampling at either -- at any Cargill grower.

Q I'm asking you now what was it that he collected that was not used. 11:07:01

A There was Schwabe soil sample LAL16B, two to four inch.

Q Okay. Anything else of data that was collected that was not used by Dr. Olsen? 11:07:13

A Well, there's a bunch of other samples, LAL284, LAL286, LAL384, LAL 3B4, LAL 3B6, LAL1084, LAL15B4, LAL15B6, CL1A and CL1B.

Q Are those all soil samples that are below the surface, that is, two or more inches below the surface? 11:08:05

A They appear to be. I don't know about the C -- yes, they all are.

Q Okay. And when you say were not used by Dr. Olsen, are you referring to his PCA analysis or some 11:08:13

other --
A Yes, they were collected but not used.
Q Okay. In the PCA analysis?
A In the PCA analysis.
Q Okay. What other opinions do you have, sir? 11:08:19
A Well, on Page 8, the bottom opinion, I think, is very important, that he selected analytes that are commonly found in soil and elsewhere in the environment, and he failed to select sufficient analytes that were specific to poultry litter even 11:08:27 to living organisms.
Q And what particular analytes would you recommend be used that were not being used by Dr. Olsen?
A I would recommend doing the experiment that I 11:09:03 outlined, taking an SPLP sample of native soil and an SPLP sample of poultry litter impacted soil, and seeing what pops out as not common to the two samples, and basing your list of analytes on that rather than just using a standard list of analytes, 11:09:12 which are used for remedial investigations.
Q Other than leaching from soils, can contaminants from poultry litter transport off-site other than by leaching?
A It's possible that there could be some 11:09:20

1 particulate transport. I don't know that for a
2 fact, but it's conceivable.
3 **Q** It's reasonable to believe that could be
4 possible?
5 **A** Well, it would depend on the -- how deeply 11:09:28
6 into the soil the poultry litter was tilled, the
7 particle size and so on, but it's possible.
8 **Q** And the SPLP analysis would not capture those
9 particulate forms of contaminants that could be
10 leaving the unimpacted or the impacted fields; 11:10:11
11 correct?
12 MS. COLLINS: Objection to form.
13 **A** Well, I think you'd want to do another
14 analysis comparing suspended particulate from
15 impacted soils and unimpacted soils in order to 11:10:18
16 cover that.
17 **Q** (By Mr. Page) And I understand that you
18 haven't performed either of these analyses that you
19 just described; correct?
20 **A** Neither I nor Dr. Olsen. 11:10:23
21 **Q** And when you said you'd see what would pop out
22 for the SL -- SPLP analysis, what analytes would you
23 analyze for in SPLP?
24 **A** Well, based on a literature search, I would
25 analyze for things that are -- I believe are in 11:11:01

poultry litter, giving you two examples, the
esterols and the estradiol, and not in native soils,
things that are characteristic of living creatures.
Q Okay. So what analytes would you expect not
to be found in poultry litter that you would find in 11:11:13
native soils?
A Well, I think it's not just the presence or
absence, I think it's also the concentration.
Q Can you identify any analyte?
A I haven't really looked at it. I would be 11:11:23
surprised if things like silica are in poultry
litter, but they may be, I don't know. I haven't
looked at it. Actually, I'm going to take that
back. The way a chicken's gizzard works, it's
likely there is some silica in poultry litter. 11:12:05
Q So can you think of any analyte that would be
present in one -- either in poultry litter and not
be present in native soils or vice versa?
A Well, the two examples that I've given you
would be present in poultry litter and not -- at 11:12:14
least not at the same concentration in native soils.
Q And those two examples are?
A Well, the family of compounds, the esterols
and the diestradiol -- estradiol, excuse me.
Q Is it possible that the estradiols and the 11:12:22

sterols could be present in reference soils from sources other than poultry?

A Well, again, I would want to do this test in a field that's unimpacted by cattle, as well, but the only way to tell that is to actually do the 11:13:01 analysis, which hasn't been done, and that's why I say, you just don't know what background looks like.

Q And did you do any evaluation -- did -- Dr. Olsen did, in fact, test for estradiols in poultry waste; did he not? 11:13:09

A Yes, he did.

Q And I think you previously testified that you don't know whether or not those substances could be identified in any environmental samples at a sufficient quantity to be used for PCA? 11:13:16

MS. COLLINS: Object to the form.

A I don't recall if they carry over to his surface loading, surface water loadings, for example.

Q (By Mr. Page) And can you tell me, sir, 11:13:26 whether or not wild animals could be the sources of sterols or estradiols in reference soils?

A It's likely.

Q What about plants, can plants be sources of sterols in reference soils? 11:14:05

A Different kinds of sterols, yes.
Q Do you know whether or not the sterols can be distinguished between those found, let's say, in the natural wildlife or plants versus that which would be found in poultry litter? 11:14:14
A Well, distinguishing plant sterols from animal sterols I know is conventionally done. Distinguishing what's in wild animal waste from poultry litter waste, I have -- just haven't looked at it. I don't know. 11:14:25
Q Do you know whether or not wild animals excrete estradiols in their waste?
A I have not looked at that.
Q Okay. What other opinions do you have, sir, just the big picture? 11:15:05
A Well, that the -- this one farm, the Schwabe farm where he did take some environmental samples, the environmental samples don't support any allegation of chemical or bacterial contamination. The soil samples are very similar to the reference 11:15:16 soil samples, and the cattle were observed at the two springs which were sampled, one of which he acknowledges.
Q Can I interrupt you there?
A Yeah. 11:15:26

Q What was your evaluation to determine the soil samples taken at the Schwabe farm are similar to reference samples, how did you do that evaluation?
A I looked at the PCA results for solids and saw that they were clustered very close. 11:16:02
Q Did you do any other evaluation to determine whether or not the Schwabe soils appeared to be contaminated from poultry waste?
A Well, I know that some of the Schwabe samples were poultry waste, and so, therefore, it's likely 11:16:13 that there are -- there is poultry litter on the ground at the Schwabe farm, as well as the Masters' farm.
Q Okay. I believe you testified that one of your opinions is that the Schwabe waste -- excuse 11:16:20 me, the Schwabe soils are the same as the reference soils, and other than your PCA plotting of those samples, did you do any other evaluation to determine whether or not samples from Schwabe soils are the same as reference soils? 11:16:29
A Only the PCA results that Dr. Olsen produced. They weren't my results, they were his.
Q Oh, so you evaluated Dr. Olsen's?
A I simply identify which of the dots on his plot were of reference soils and which were of 11:17:08

impacted soils.
Q Using his PCA analysis?
A Using his PCA analysis.
Q And what did you find?
A That the reference soils plotted very close to 11:17:15
the impacted soils.
Q What do you mean by very close?
A Well, I think you'd have to look at the
figures to see what I mean by very close. One of
the problems with PCA is it doesn't give you a 11:17:23
quantitative description of what's near and what's
far.
Q Do you have a figure to look at in your
report?
A I believe I do. In Figure 3-3, the reference 11:17:28
soils are green boxes and the Cargill soils are
brown boxes, with red boxes growing around them.
You can see they are clustered in the same
neighborhood, and they're very different than the
poultry litter samples which occur on the same 11:18:18
figure.
Q Is there any overlap between the Cargill soil
samples that you've identified on 3-3 and the
reference samples?
A I don't believe there is. And not for the -- 11:18:26

not for the Cargill poultry litter samples.
Q But I'm asking you about the Cargill soil samples.
A Yes, I believe if you look --
Q Is there any overlap between that and the 11:19:02
reference soil samples?
A Yes. If you look -- there actually are, I believe, three boxes that are shown as Cargill samples, and if you follow down from the two that
are easily distinguished, you'll see there's another 11:19:09
red box below those that is overlapping some of the green boxes.
Q Okay. Anything else?
A Well, the second major opinion is that Dr. Olsen's interpretation of his PCA results is 11:19:20
unconventional and, I think, improper.
Q In what respects?
A Well, the first respect is identifying principal components as specific sources. They
don't represent sources. They represent 11:19:27
mathematical entities.
Q Can you use principal components to identify sources?
A I believe he did. I believe he says principal
component 1 is associated with poultry litter, 11:20:03

principal component 2 is associated with wastewater treatment plants.

Q Have you ever seen that type of analysis performed by other investigators in published literature? 11:20:11

MS. COLLINS: Object to form.

A I've seen people take a particular sample and say this is an archetype sample for principal component 1, if you like. It's near the zero of principal component 2, and it only has -- it's only 11:20:19 composed of principal component 1, and therefore, if we look at this specific sample, we can say, this is -- you know, this represents principal component 1.

Q (By Mr. Page) And have you seen investigators 11:20:26 use principal component analysis to assist in identification of which samples are likely to be impacted by the same source?

A Yes.

Q And how is that different than what Dr. Olsen 11:21:03 employed in this case?

A Over --

Q If it is?

A I think the loadings plots tell you which analytes go up and down together and therefore 11:21:09

behave as if they had a common source. You have to look at the analyte plots on a multidimensional space, but that is a way to tell which things have a common source. It doesn't tell you what the source is, but it tells you if they're behaving as if they 11:21:17 did come from a common source.

Q Isn't that how Dr. Olsen employed PCA in this case?

A As I say, it doesn't tell you what the common source is. It doesn't tell you if it's runoff from 11:21:23 native soils or if it's from poultry litter. For that, you have to go to the scores plots, and his analysis is based solely on the loadings plots, or almost solely, and very little on the scores plots, and it's really the scores plots that are 11:22:01 conventionally used to identify sources.

Q And you're talking about the plots where you look at groups of sources on an X Y plot analysis and see if the samples are in particular groups, is that what you're referring to when you say scores 11:22:10 plots?

A I'm referring to the plots that show the sample locations in principal components base.

Q And did Dr. Olsen in addition to using -- you're saying Dr. Olsen did not employ that analysis 11:22:17

to determine --
A Not uniformly. If there were a single scores plot that showed all the way from his supposed source to his receptor, that, to me, might have been meaningful because it would show there is no 11:22:25
relation between the source and the receptor, and that's -- you know, that's what I've discovered in my own analysis, as well as looking at his analysis, but he never did that.
Q You're saying that your multimedia analysis 11:22:32
shows that?
A That's one way of showing it, but other ways exist, also.
Q But it is true that Dr. Olsen employed a scores plot analysis as part of his investigation to 11:23:06
determine sources in this case, did he not?
MS. COLLINS: Object to form.
A Sometimes, but never all the way from source to receptor.
Q (By Mr. Page) A multimedia? 11:23:12
A Well, it doesn't have to be multimedia. It could have been restricted just to liquids, all the way from SPLP to surface water or solids.
Q Are you suggesting that Dr. Olsen did not include edge of fields along with all the other 11:23:18

liquid media to determine -- to evaluate a scores plot?

A Yes, but to me, that's not going from source to receptor. You start with the SPLP result as a source, and you go to the surface water as a 11:23:25 receptor, and you could have edge of field in there, as well.

Q Would you expect SPLP results to exactly mimic what goes on in the environment, the leaching perspective of poultry litter? 11:24:02

A Not exactly, but I'd say they're the best representation that you have unless you do the side by side comparison of what poultry litter impacted soil looks like and what unimpacted soil looks like.

Q You do not believe that edge of field samples 11:24:12 from known poultry applied fields are a means to determine what is actually leaching and running off a field from poultry application?

A Not from poultry application. I believe that it's dominated by the native soils. 11:24:20

Q And that's based on what?

A That's based on the analytes that show up, the -- you know, the total organic carbon, the aluminum, the iron, et cetera, things that are found in soil. 11:25:01

Q It's not based on any analysis you performed of the actual conditions?
A I haven't taken any samples and analyzed them.
Q Did Dr. Olsen employ any spatial and temporal analysis to identify sources along with his PCA 11:25:08
loadings and scores plots?
A My understanding is that he did.
Q And have you seen that methodology employed with PCA to identify sources of contamination?
A I'd say yes. 11:25:17
MR. PAGE: Let's take a short break now.
VIDEOGRAPHER: We are off the record, 11:25 a.m.
(Following a short recess at 11:25 a.m., proceedings continued on the record at 11:33 p.m.) 11:25:28
VIDEOGRAPHER: We are back on the record, 11:33 a.m.
Q (By Mr. Page) In your experience, Dr. Murphy, how representative are SPLP tests to what actually occurs in the environment? 11:33:32
A I'm saying that they are very commonly used. I don't know that I've ever seen a reference, side-by-side reference test.
Q So you've never made that comparison yourself?
A I have not. 11:34:10

Q Do you know whether or not SPLP simulates soil water interactions as water runs off, for example, from a field?

A Well, it's intended to do that. It's intended to be a leachate precipitation test, not just for 11:34:17 soil runoff, but also for what infiltrates into the ground.

Q But you've never seen any comparison on how effective it does actually imitate that?

A I don't recall seeing a comparison. 11:34:24

Q And is there any soil used in SPLP, do you include soil typically in your evaluation of SPLP?

A Well, you certainly can. I don't know that in this case that it was done, and that's one of my criticisms. 11:35:09

Q And you've never seen anyone actually do a comparison of SPLP and actual leachate to see if there's any relationship between SPLP and what is actually occurring in the environment?

A I'm sure that those reference tests have been 11:35:16 done by EPA and others, but I don't recall seeing them now.

Q And you don't know what they found or have any information about their relative relationships?

A Just based on the fact that it's been commonly 11:35:22

used for many years, I would say that comparison tests have indicated that these are useful tests.

Q Isn't the SPLP test a test to determine the leaching of hazardous waste in the environment?

A That's what it can be used for. 11:36:03

Q And it's a very conservative test, is it not?

MS. COLLINS: Object to form.

A That may be. I'd have to look to make sure.

Q (BY Mr. Page) In your experience, doesn't the SPLP test typically show much more leaching of 11:36:13 contaminants than would normally occur in the environment?

A I can't say that.

Q You don't know one way or the other?

A I haven't investigated it. 11:36:23

Q Just to -- would you continue on now with your summary of your opinions?

A Well, first, we left off with the unconventional and improper interpretation of PCA, and the first I noted was identifying principal 11:37:03 components with specific sources.

The second that I believe is unconventional is adding an arbitrary number to the PC score -- PCA scores so that they're all positive, and then interpreting the high scores as being 11:37:12

evidence of the high concentrations.
Q And why is that a problem, that standardization process so that all scores will be positive?
A Because the negative scores are as important 11:37:20
as the positive scores in telling you what's happening. You need to focus on both types of scores.
Q Did Dr. Olsen, when he employed that technique
of making them all positive, change the relative 11:37:28
distances between the different scores?
A He didn't change the relative distances on the PC axis, no.
Q Okay. What else?
A Dr. Olsen only looked at the loadings 11:38:09
individually, and you really have to look at loadings in a multidimensional space to see which analytes behave as if they had a common source.
Q And do you have any references for that
particular opinion, sir? 11:38:19
A Oh, I don't recall if Dr. -- it's such an obvious opinion, I'm not sure it is in any books, but I don't know if Dr. Johnson covers it or where I'd have to look in some PCA textbooks to see. I
say it's so obvious, that's why you're calculating 11:39:06

multiple PCs.
Q So what do you mean by comparison in multidimensional, what did Dr. Olsen not do that you contend needs to be done?
A He looked at the loadings on PC1 and the 11:39:11
loadings on PC2, didn't look at them at the same time, which would have been a cross-plot of the loadings, and should have looked at loadings on PC3, et cetera.
Q And did you do that to determine whether it 11:39:19
made any difference in the analysis?
A I did in the section of the report where I critique what he's done, I point out that it looks very different if you look at the loadings -- multiple loadings at the same time. 11:39:25
Q Can you provide -- can you show us where that is in the report, sir? Let me help you.
A 28.
Q Page 28?
A Yes. 11:40:05
Q Thank you. And do you illustrate your point on pages 28 and 29 in Figures 4-1 and 4-2?
A For the first two PCs, yes.
Q Okay. Do you have any other illustrations in your report, the comments you make on pages 28 and 11:40:26

29?

A Figure 4-3 on Page 40, as well, and Figure 4-4 on Page 41.

Q And is it your contention, sir, that those Figures 4-1 through 4-4 indicate that Dr. Olsen's PC analysis is incorrect? 11:41:09

A I think they indicate one of the flaws in his analysis of looking at only one PC at a time, and you really -- I should have really shown more than PC1 and PC2, I should have shown PC3 and PC4 and so on, but I was just trying to make a point that you can't just look at one PC at a time. 11:41:19

Q And based on your analysis, what, in particular, in Dr. Olsen's report is mistaken?

A Well, if you look at Figure 4-1. You see that aluminum, iron, E.coli, phosphorus, all have the same loading on PC1 of .8, but then when you look at PC2, you see that the loading of phosphorus on PC2 is completely different between phosphorus and aluminum, so they don't behave as if they had a common source, whereas if you only look at one loading PC at a time, you might conclude that there is a common source. 11:41:29 11:42:10

Q Is there more than one source of phosphorus in the IRW? 11:42:17

A I haven't investigated it, but there probably is.
Q Do you know whether or not -- what does PC2 represent, sir, in Dr. Olsen's analysis?
A In Dr. Olsen's analysis, he identifies it as 11:42:22
being related to wastewater treatment plants.
Q Are wastewater treatment plants a source of phosphorus in the IRW?
A It's possible, but I haven't investigated it.
Q Are poultry litter -- is poultry litter a 11:42:29
source of phosphorus in the IRW?
MS. COLLINS: Object to form.
A I think that phosphorus is found in poultry litter.
Q (By Mr. Page) Could you continue on now with 11:43:08
your summary of your opinions, sir?
A I think we left off saying that large loadings aren't -- don't represent high concentrations, and so to comment that something with a large loading is
also found in high concentrations in poultry litter 11:43:21
is just nonsensical.
Q Can you explain why you believe that's nonsensical?
A One reason is that the PCs are based on
variability concentration, not on concentration. So 11:43:27

if I have measurements of a hundred, a hundred and a hundred, that will show up as zero on my PC plot, whereas if I have measurements of 2, 3 and 4, that will show up as a higher loading on my PC plot. It's all about variability, not concentration. 11:44:05

Q If you make -- if you use the actual samples and concentrations rather than normalize them as you did or analyze them as you did when you did your analysis by fractionalization, won't the PC scores reflect concentrations? 11:44:14

A If I understand your question, you mean if you don't take the Z score as part of defining the PC?

Q No, if you -- if you use the Z score, but rather than -- use that standardization rather than the fraction standardization I think that you 11:44:25 employed in your analysis in this case on the multimedia analysis, would the Z score standardization still maintain relative concentrations so that the PC scores, individual sample PC scores would be a measure of 11:45:07 concentration, also?

A Well, in the correlation matrix, you've subtracted the mean from each value, you've divided by the standard deviation squared, and so you basically have taken the magnitude of the 11:45:16

concentration out of it because things that have values of about a hundred are going to have standard deviations that are much larger than things that have values of about 10. So it's all been normalized to be very similar numbers again, 11:45:25
comparing in the correlation matrix.

Q But there's still a distinction between relative amounts of concentrations based on the standardization Z transformation that Dr. Olsen employed, is there not? 11:46:02

A I don't know that I agree with that.

Q What else, sir?

A I did note the mathematical error which Dr. Olsen made where he used -- developed the correlation coefficients using log transform data 11:46:12
and then calculating PC scores using untransformed data, so it was internally inconsistent.

Q Okay. Did you see the errata that Dr. Olsen has prepared in that regard?

A I was shown some pages that purported to be 11:46:20
errata. I didn't see any backup calculations, so I don't know if the issue has been corrected or not, and the pages that I saw only mentioned a couple of his figures, so I don't know if the errata is intended to apply to everything he did, which it 11:47:01

should, but I don't know that for a fact.
Q Did you do any evaluation to determine whether or not this calculation error had any impact in the PCA results?
A Well, I give you a table of the scores, I 11:47:08
believe, on Page 26, showing the results reported by Dr. Olsen and the results that we calculate by hand, and they are a very different sets of numbers. The scores plots would look completely different.
Q Did you do any evaluation in comparison of the 11:47:22
two different scores plots based on the change of the calculation and without the change of the calculation to determine if the plots -- if there's any change in the -- in the scores plots themselves such that it would affect the PCA evaluation? 11:48:01
A This is the only evaluation change that I've made.
Q Just recalculated the numbers to show the different calculations?
A But the numbers are very different, yes, the 11:48:09
scores are very different.
Q Did you do any evaluation of how those scores plot?
A I did not plot the scores, no.
Q So I would assume that you have done no 11:48:19

comparison of the two plots either with the change calculation and without?

MS. COLLINS: Object to the form.

A I haven't done that. Actually, I should rectify my statement because I have done, in the most recent plots to have been furnished, I have done calculations with the corrected -- corrected algorithm. 11:48:25

Q (By Mr. Page) That Dr. Olsen provided an errata statement to this, is that what you're testifying to, sir? 11:49:05

A I haven't looked to see if my results are the same as his. I haven't done a side-by-side comparison.

Q What else, sir, as a summary of opinions? 11:49:10

A Well, as I say, that it's -- he doesn't do a true pathway analysis, and it just seems to me, if you're going to do cause and effect, you've got to do a calculation that involves your supposed cause, and a calculation that involves your supposed effect, and he never does it. He does pieces of it. He'll do edge of field, poultry litter, SPLP and cattle manure SPLP, for example, in SW18, but he never carries that through to the surface water, which is supposedly impacted, and to do that most 11:49:18 11:49:27

effectively, I think you've got to do a multimedia calculation. But that's not the only way to do it. You could do a --

Q Are you talking about -- let me just interrupt for a second, a multimedia PCA calculation, is that 11:50:02 what you're saying?

A Yes, as I did.

Q Okay. Is there any -- okay. Anything else?

A You can do it just using your liquid samples, starting with SPLP for poultry litter and carrying 11:50:08 it all the way through edge of field, groundwater, surface water.

Q Is your testimony that Dr. Olsen did not perform that analysis?

A I've never seen a scores plot for that. 11:50:14

Q Okay.

A In my multimedia analysis, the poultry litter samples look completely different than the surface water samples. They don't -- they don't look as if there's any relationship at all. 11:50:22

Q Can you -- can you account for that by some chemical process that may be going on?

A I think the processes are dilution and deposition. Whatever signal might be there is being masked by a native soil signal by the way chemicals 11:51:03

partition in water bodies, it just -- there's just no evidence of any effect from poultry litter.

Q Isn't it true, sir, that the same issues you had with chemical transformations of PAHs when you did your PCA analysis there would be similar issues 11:51:14 you would have in the IRW with poultry waste?

MS. COLLINS: Object to form.

A I think the issue you're referring to is the way the different chemicals are transported in the environment. 11:51:23

Q (By Mr. Page) Yes, sir.

A And my conclusion from that is that to the extent that's true here, PCA is a very unsuitable technique to try to identify sources with because what's controlling this is not the sources. It's 11:51:32 the differing transport and the fate of the different chemicals. Shouldn't have applied PCA analysis to this problem.

Q Other than your work in this particular case, can you provide any references for multimedia PCA 11:52:08 analysis that you're suggesting?

A I think I give you a couple of references in the text to multimedia PCA.

Q You provide two; that's correct?

A Yes. I haven't tried to be exhaustive. I'm 11:52:14

sure I could come up with many more.
Q What were the chemicals of concern there?
MS. COLLINS: Page 30, sir.
A Yes, thank you. I -- in both cases there are
dibenzodioxins and dibenzofurans. 11:53:23
Q (By Mr. Page) Can you identify any multimedia
investigation where the contaminants of concern were
nutrients?
A Not nutrients, but I know other people at
Exponent have done multimedia for various metals. 11:53:32
Q What else, as far as your summary of your
opinions?
A In the multimedia analysis, the edge of field
samples from pastures with cattle but no poultry
litter don't look any different than the edge of 11:54:28
field samples where poultry litter has been applied.
Q Were those cattle edge of field samples
actually edge of field samples, runoff samples?
A This may be the case where one of the samples
was actually not at the edge of the field, but 11:55:08
upstream from the field, and the other one was from
a ponded location.
Q So did you actually critique those as not
being representative of edge of field in the report?
A I believe I did. 11:55:19

Q Were those on the Pike property, sir, do you recall?
A Yes, they are.
Q So is it still your opinion that those samples from the Pike property are not representative of 11:55:24
edge of field runoff samples?
A They are representative of samples that are -- were collected, liquid samples that were collected from locations where cattle were present, but not
poultry. 11:56:03
Q Are they representative of runoff samples, sir?
A One of them would be -- well, they both probably are, because what that ponded water
represents is remnants of runoff. 11:56:09
Q Are you aware of any information that indicates that those samples have been impacted by poultry contamination?
MS. COLLINS: Object to form.
A Not as I sit here, no. 11:56:16
Q (By Mr. Page) Anything else, sir?
A I think we've covered everything.
Q I want to make sure I understand the scope of your work in this case, Dr. Murphy. Did you perform
your own investigation as to sources of bacteria in 11:57:03

the IRW?
A No, other than asking Charlene Edinboro to look at what -- what would be in poultry litter, including bacteria.
Q And -- okay. What about sources of phosphorus, did you perform any investigation of sources of phosphorus in the IRW? 11:57:17
A I have not.
Q Your opinion does critique the work of Dr. Olsen; correct? 11:57:27
A Yes.
Q Are you offering any opinions to critique any of the other State of Oklahoma experts in this case?
A Right now, not -- I have not been asked to in any case. 11:58:06
Q You're not aware of any opinions that you've provided them in your report that would be critical of any other state witness other than Dr. Olsen?
A Well, you know, the only two other witnesses that I've looked at are Chris Teaf and -- what's his name? 11:58:14
MS. COLLINS: I'm not sure which one.
A The geologist.
MS. COLLINS: Dr. Fisher?
A Yes, Bert Fisher, of course, I don't know why 11:58:21

I'm drawing a blank, I used to work with him, and I really just glanced at those. And I guess the only comment I can make is that neither one seemed to me to really be supporting a weight of evidence approach, which I understand is one of the claims in 11:58:29 this case.

Q And why do you say that?

A Well, I think Dr. Fisher is looking at geochemical signature, which is really very similar to the PCA analysis in terms of looking at native 11:59:05 soils and how they're transported in the environment. And Dr. Teaf, as I recall, talked about various health effects that could occur, but didn't draw any conclusion about -- again, it's all about sources and receptors, and I didn't see that 11:59:14 either one of them added to the weight of evidence in that case, but I just scanned those reports.

Q Would, under your statement of transport mechanisms, like geological and soil transport mechanisms, be important to a weight of evidence 11:59:20 approach for evaluation of sources and receptors?

MS. COLLINS: Object to form.

A It would be important to do that, but it wouldn't add to a weight of evidence approach unless it draws some conclusions about sources and 11:59:29

receptors.

Q (By Mr. Page) Would the amount of waste produced by a potential source add to the weight of evidence to link sources and receptors to contamination? 12:00:08

MS. COLLINS: Object to form.

A I don't think that -- that would be something that might be of value on its own, but I don't think that it relates to linking sources and receptors.

Q (By Mr. Page) The amount of waste that is disposed of on land would not be relative to whether or not that particular source has an impact on receptors? 12:00:13

MS. COLLINS: Object to form.

A To me, the only thing that's really relevant to the source receptor question is if you can find some indication that unique chemicals or bacteria or something that you find in the source are also being found in the receptor, or at least a unique pattern, and I'm not saying that the amount of waste isn't important to look at, I'm just saying that it isn't relevant to the source receptor issue directly. 12:00:20 12:01:05

Q (By Mr. Page) It provides indirect evidence of impact, does it not?

A I suppose you could say that the smaller 12:01:11

amount of waste, the less likely there is -- there is an impact.

Q And the opposite would be true, also, the larger amount of waste, the more likely there is an effect? 12:01:17

MS. COLLINS: Object to form.

A As a theoretical construct, yes.

Q (By Mr. Page) What about the location of waste disposal, would that be probative in determining whether there's a relationship between 12:01:24 source and receptor?

MS. COLLINS: Object to form.

A As a general matter, it could be. In this particular case, I don't think a demonstration has been made. 12:02:03

Q (By Mr. Page) What's your basis for that statement?

A Reading Dr. Johnson's testimony about the red dots and green dots.

Q Did you understand that Dr. Johnson did not 12:02:07 use the proper concentration maps? Let me ask this question. If Dr. Ol -- if Dr. Johnson's evaluation was not based on the actual concentrations of poultry houses in the watershed through his evaluation -- evaluating, would that affect the 12:02:16

validity of his opinions in that regard?
MS. COLLINS: Object to form.
A It could.
Q (By Mr. Page) Are any of your opinions unique to turkey waste or do they all involve poultry waste 12:02:29 in general?
MS. COLLINS: Object to form.
A Well, they are unique to turkey waste in Cargill -- specifically of the Cargill growers and what samples have been taken there and whether there 12:03:05 were enough samples and the right kind of samples to support any opinions regarding those growers. I looked at that as a separate issue from critiquing Dr. Olsen's PCA analysis.
Q (By Mr. Page) So your PCA analysis does not 12:03:10 break out turkey and poultry sample?
A It does, it breaks out Cargill growers' samples separately.
Q It shows them specifically on the same PCA analysis? 12:03:17
A Yes.
Q Anything else that you've identified as unique to turkey in your opinions?
A No. I think the whole point of the exercise with Charlene Edinboro was that we came to the 12:03:23

conclusion that based on the analytes that Dr. Olsen was looking at, you couldn't distinguish turkey waste and poultry waste, and, in fact, you couldn't distinguish poultry litter from soil, and so just the wrong analytes had been chosen. 12:03:32

Q And what analytes would you have chosen, sir?

A Again, I'd have to do that experiment, the side-by-side comparison of native soils and poultry litter impacted soils.

Q As you sit here today, you cannot tell us 12:04:05 whether or not the wrong analytes were actually chosen by Dr. Olsen, can you?

A Oh, I think I can make that statement, yes.

Q Based on what?

A Based on the fact that many of the analytes 12:04:12 are found in native soils, and there's no attempt to correct for background.

Q And can you tell us here today, sir, of any analyte where you're confident there's a difference -- can you distinguish between poultry 12:04:19 waste in general and turkey waste in particular?

A I've given you two possibilities, but I don't have -- I haven't really researched the question and I don't have a definitive answer. If there isn't, if there are no analytes that permit you to 12:04:26

distinguish poultry litter from natural soils, then PCA is not a good type of analysis to use on this problem.

Q No, I was asking you as to whether or not there's a distinction between turkey waste and other chicken -- other poultry waste. My question goes to whether or not you've identified any means to distinguish between poultry and turkey waste? 12:05:03

A Not in the list of analytes that Dr. Olsen looked at. I did make the suggestion that if one were to try to do that, one might look at things like sterols. 12:05:12

Q But you don't know whether that would impact -- distinguish the poultry waste from turkey waste, do you? 12:05:19

A I haven't not done that analysis.

Q Have you worked on any environmental source identification other than this case where there were nonpoint sources of pollution?

MS. COLLINS: Object to form. 12:06:01

A Well, the case in Maine is -- involves runoff into a river, and from multiple sources probably.

Q Any other investigations?

A Oh, I'd have to look. I know that I've done runoff calculations in the past, but it was so long 12:06:21

ago I can't recall what the case was.
Q So --
A As I recall, I used the MCEL model.
Q In your recent or other than the Maine case, have you been involved in any nonpoint source 12:07:02
pollution where you've been evaluating sources of nonpoint source pollution?
A I guess it partly depends on how you want to define nonpoint source. I'm working at a uranium mine in Colorado where the materials have just been 12:07:28
spread all over the -- quite a large location, so it doesn't really resemble a point source.
Q Anything else?
A I'm working at an asphalt refinery in Florida where -- again, where there are multiple sources at 12:08:16
the refinery there, a large number of storage tanks and releases from those tanks, and so the contamination is spread over a wide, wide area.
Q Was that discharged into a waterway?
A There is a ditch that receives the discharge, 12:08:26
yes.
Q Okay. Is it through a storm water discharge point?
A The ditch is a storm water drainage ditch.
Q So in that case, are you identifying the 12:08:32

sources of nonpoint source pollution in ambient waters?

A No, what I'm doing is identifying the release points on-site, which of the tanks and what period of time the releases occurred. 12:09:07

Q Anything else?

A Well, several mining sites where, again, the mine waste is spread over large areas and the drainage from the mine waste then is spread over large areas. 12:10:02

Q Are there -- other than -- is there more than one source of the contamination in those mining sites other than the one mining operation?

A No, it's generally the one mining operation.

Q Have you been involved, Dr. Murphy, in any cases where you were identified -- looking at sources of contamination where agricultural operations was one of the potential sources? 12:10:07

A Not for feed lots and that kind of thing, but just that super phosphate plant is an agricultural operation of some sorts. 12:10:19

Q It's a chemical processing facility, is it not?

A Making fertilizer.

Q Okay. Other than that. 12:10:25

A No, I don't believe I have.
Q Have you ever been involved in a case where the chemicals of concern were nutrients?
A Oh, I think that's true in a large number of cases. I mean, there are various metals, including, 12:11:07
some people think, things like arsenic that are believed to be nutrients.
Q Have you ever been involved in a case where the chemical of concern was phosphorus?
A I don't believe so. 12:11:16
Q Bacteria?
A I did one case for a water treatment company looking at various bacteria and other agents that could be added to water supplies by terrorists, that would be the only case. 12:11:24
Q Nothing involving bacteria pollution in the ambient waters?
A I don't believe so.
Q Have you been involved in doing an investigation of sources of pollution in a whole 12:12:01
watershed, such as the IRW?
A No. For the -- for the Hooker Chemical case, we looked at the chemicals going down the Niagara River and going into the Great Lakes, and looked at the sediment loadings that were in the Great Lakes. 12:12:27

That would be the closest I've come.
Q Anything else other than the Hooker case?
A Not that I can recall.
Q I believe you testified that you performed no
field investigation or sampling itself to support 12:13:03
your opinions in this case?
A In this particular case, no.
Q And the only field investigation that you
relied on other than the work by Dr. Olsen or the
State's experts was the Apex evaluation; is that 12:13:10
correct?
A I'm not sure if that would be a field
investigation. Those were field observations, yes.
Q Okay. So do you know whether the
defendants -- have you received any information from 12:13:16
the defendants, other than the Apex, that would be
related to a field investigation or observation that
was performed by the defendants' experts?
A I have not.
Q Are you aware of any? 12:13:22
A I'm not.
Q Have you ever been to the IRW?
A I have not, unless I've traveled through
inadvertently, but not in connection this case.
Q You don't have any recollection of ever being 12:13:32

to the area that's now known as the Illinois River watershed?

A I don't have any recollection, no.

Q Did you perform sampling and analysis of poultry waste from Cargill farms? 12:14:11

A I have not.

Q Poultry litter from Cargill farms?

A I have not.

Q Turkey feces from Cargill farms?

A I have not. 12:14:17

Q And would the same questions be no with regard to poultry litter, feces or waste from the farms of the other defendants?

A I have not done any sampling in this case.

Q Did you do any investigation as to where poultry litter is disposed of in the IRW from the poultry farms? 12:14:27

A Well, I looked at maps for the two Cargill growers, which, as I recall, Randy O'Boyle pointed out to me where he thought there were -- there had been poultry litter disposal. 12:15:09

Q Who is Randy O'Boyle?

A He's our GIS person.

Q And how did he determine where poultry litter disposed -- I guess it was poultry litter disposal 12:15:13

that lead to those two Cargill farms that were sampled by Dr. Olsen?

A Yes.

Q How did Mr. O'Boyle determine where poultry litter was disposed of from those two farms? 12:15:20

A I do not know.

Q Did he identify it for you someplace on a map?

MS. COLLINS: Object to form.

A He showed me a map, yes.

Q (By Mr. Page) Do you know what information 12:15:25 Mr. O'Boyle used in order to come to those conclusions as to locations of poultry litter disposal?

A I do not.

Q Do you know how many Cargill farms, either 12:16:01 company owned or independent contractor farms, there are within the IRW watershed?

A The number I used in my report was 35.

Q And where did you receive that?

A I'm thinking it probably was from Cheryl Law. 12:16:11

Q Do you know where she got that information?

A I do not.

Q Did you do any investigation as to the locations where poultry litter from the other 33 or so Cargill farms within the IRW have been disposed? 12:16:21

A Only to the extent of identifying locations in surface water and groundwater and so on that are downstream or downgradient from the Cargill growers.

Q But you don't know whether or not the litter from those particular growers was actually disposed of in the location where their barns are located; correct? 12:17:02

MS. COLLINS: Object to form.

A I have not investigated that.

Q (By Mr. Page) So you don't know? 12:17:06

A I don't know if the litter was used on the farm where the poultry was being grown or whether it was taken off-site, I don't know.

Q Would that be important in your evaluation as to whether or not Cargill farms are impacting certain segments of water and groundwater within the IRW? 12:17:17

MS. COLLINS: Object to form.

A If we were to start all over and do a proper study, that would be one factor. 12:17:23

Q (By Mr. Page) Did you do any investigation as to when poultry litter is disposed of within the IRW?

MS. COLLINS: Object to form.

MR. PAGE: What's wrong with the question? 12:18:04

MS. COLLINS: Disposed of. I object to the term disposed of. There's been no evidence that litter is disposed in this case, rather it is applied as to fields as fertilizer. It's simply used, not disposed of. 12:18:09

Q (By Mr. Page) You can answer the question.

A I think I may have been told the time of year when litter applications occur, but I do not -- I do not recall it.

Q Would that be important to an investigation as to whether or not Cargill poultry litter has an impact on the waters of the IRW? 12:18:18

MS. COLLINS: Object to the form.

A It could be, if combined with sampling data.

Q (By Mr. Page) Did you do an investigation as to how poultry litter is land applied in the IRW? 12:18:28

A I've been told that it's tilled, but other than that, I really don't know.

Q It's your understanding that poultry litter is tilled? 12:19:05

A That's what I've been told, but it doesn't factor into my analysis at all.

Q Have you worked with any environmental datasets in your professional experience where nonpoint sources are significant contributors to 12:19:19

surface water pollution?
A Well, just the cases that we've already discussed in terms of my nonpoint source experience.
Q Okay. What about for groundwater pollution, same question? 12:19:27
A I don't recall. I recall cases where there were multiple sources of groundwater pollution, but not where you would really characterize it as an area source or anything other than a collection of point sources. 12:20:07
Q In this case, did you propose to perform any field investigations in the IRW?
A I did not propose any field investigations.
Q Why not?
A I was asked to conduct a specific task, and I did that. I reported back to my client that, you know, what kind of field investigations might be useful, but I was not asked to conduct them myself. I have no idea if someone else has conducted them. 12:20:21
Q What did you tell your client as to useful field investigations that might be employed? 12:21:01
A That since native soils were an important source, that it would be useful to have -- to be able to characterize that source, that background source. 12:21:09

Q And what investigation did you recommend?
A I don't think I recommended anything specific beyond that.
Q Anything else? Any other field investigations you recommended to your client? 12:21:13
A Not directly. I think indirectly the fact that we've got such a small amount of data for the Cargill growers that if one wanted to look at cause and effect, you'd really have to collect a lot more data. I mean, that's implicit in my report. 12:21:27
Q Did you ever specify that to your clients?
A I think we've talked about it, yes.
Q Okay. Anything else?
A I've also remarked on the paucity of his SPLP poultry samples and suggested that if one were to do a proper study, that there would be a great deal more poultry litter SPLP information that would be desirable. 12:22:04
Q Anything else?
A That's what comes to mind. 12:22:11
Q And with regard to all of those investigations that you discussed with your client, today -- as to today, you're unaware of any of those investigations being performed?
A I'm unaware of a lot of what's going on, but 12:22:17

yes, that's true.
Q Let me hand you what's been marked as Exhibit No. 2, and Dr. Murphy, I'll represent to you that these are a collection of e-mails that I put together, tried to do it in chronological order from 12:23:08
your considered materials. Could you take a look at this and see if my identification is correct?
A Well, it's not completely chronological, but I see what's happened. Some of it is e-mail in response to e-mail, and that's why it's not 12:23:24
completely chronological.
Q I tried to put the collections of e-mails together in a chronological order. But do you recognize these as e-mails that you either received or sent in this case? 12:23:29
A Yes.
Q Okay, sir. At the bottom of Page 1 of this exhibit, and then on the second page, that's an e-mail from you to Melanie Edwards; correct?
A And to Charlene Edinboro. 12:24:09
Q Okay. It identifies another person by the name of Walt Shields?
A Yes.
Q Who is Walt Shields?
A Walt Shields is the head of the environmental 12:24:13

group.
Q Was he involved in this case?
A Not to my knowledge.
Q Okay. Let's go to the next e-mail in that
chain, which I guess is from Charlene Edinboro to 12:24:23
you; is that correct?
A Yes.
Q On July 14th. Would you read the first and
second sentence, please?
A Starting, thanks, Brian? 12:24:29
Q No, I think I'm --
MS. COLLINS: Back on the first page.
A On the first page.
Q (By Mr. Page) I'm sorry. On July 14th,
there's an e-mail to you from Charlene. Would you 12:25:06
read the first two sentences?
A I don't see any veterinary forensics included,
but perhaps you had thought to put that in the task
four. Certainly even if there are no chicken
samples, the turkey samples can be analyzed, yes, if 12:25:13
so, that portion of the budget would need to be
increased.
Q Okay. What was Ms. Edinboro referring to when
she sent this to you?
A Well, I think she had in mind that we would do 12:25:21

some of our own laboratory analysis, and I was -- you know, subsequently the e-mails will reflect that I was redirecting her toward can we tell anything from Dr. Olsen's analytes.

Q Okay. Did you do any veterinary forensics with regard to turkey samples versus other poultry? 12:26:01

A Only what's reflected here in my report.

Q I don't recall any forensics being done.

A Well, we investigated whether there were various laboratories that could do tests to distinguish chicken and turkey. That was as far as it went. 12:26:10

Q Okay. Your response, would you read the first sentence in your response on Page 1? I think it's a July 15th response to Ms. Edinboro. 12:26:22

A Right you are on causation and our role in critiquing their logic.

Q What do you mean by that statement?

A As an epidemiologist, I must point out -- it refers to her sentence. Epidemiology can never demonstrate causes, it can only demonstrate correlations, and then other information has to be supplied as to whether there's a cause involved. 12:27:01

Q And what does the second part of your sentence mean, our role in critiquing their logic? 12:27:09

A Well, it's in response to hers where she says but she can point out where others' logic may be breaking down in that regard.

Q Okay. Would you read the second sentence of your e-mail to her, please? 12:27:17

A If there is some particularly useful test, we can --

Q I'm sorry, I think you skipped one, Dr. Murphy.

A Oh. 12:27:23

Q I would rather --

A I would rather framed the forensic issue as what they could have done to distinguish turkeys and chickens but failed to do. I will revise the text to reflect this. 12:27:27

Q So are you suggesting there that rather than determine whether there is a way to distinguish between turkeys and conditions, your report is going to focus on what may have been done but was not?

A I could see the two things as linked, you know, what refers to determine what could be done that would be useful, and then to critique whether or not it was done. 12:28:08

Q Is there any text in your report that reflects this? 12:28:15

A Only to point out that the analytes that were chosen were not specific to poultry litter.
Q Will you provide that in your report that distinguishes turkey and poultry litter, do you have any text? 12:28:24
A Other than what we've discussed, no.
Q Would you read the next sentence then?
A If there is some particularly useful test, we can propose it with a request for additional funding. My sense, however, is that Cargill will be 12:29:04 adverse to collecting and analyzing samples. Instead, they prefer to critique what the other side has done.
Q Would you explain what you mean when you said, my sense, however, is that Cargill will be adverse 12:29:10 to collecting and analyzing samples?
A Well, my sense was based on what I had been asked to do, and that was solely critique. If -- no one had ever said to me if there's some particularly useful test that can be done, you should tell us and 12:29:18 we might consider funding it. And I was just passing that on to Charlene, who was new on the project.
Q If Cargill was -- in your opinion, sir, if Cargill was truly interested in being able to 12:29:32

distinguish poultry litter in general from turkey litter specifically, is there additional work they could have asked you to do to make that determination?

MR. PAGE: Object to form. 12:30:06

A Well, I never suggested doing additional work to them.

Q (By Mr. Page) I just asked --

A We never had that conversation.

Q That wasn't my question. 12:30:10

A There may be, but as far as we got with the -- with what Charlene was investigating, nothing popped up that said this would be particularly useful.

Q Would you turn to the third page, sir? Do you see your reference there to the Harwood report in 12:30:28 that e-mail?

A Yes.

Q What was the purpose of this e-mail?

A Transmittal of the Harwood report to Charlene Edinboro. 12:31:04

Q Did you do any evaluation of the Harwood report?

A I have not.

Q Do you know whether or not Harwood does identify a poultry specific constituent in poultry 12:31:08

waste?
A I haven't looked at the report so I don't know, but I was sending it to Charlene just to see if it would suggest some things to her.
Q Did she make any comment? 12:31:15
A If it's not reflected in this e-mail, I don't recall it.
Q If Dr. Harwood did identify a specific biomarker unique to poultry, wouldn't that satisfy your unique constituent issue that you've raised in 12:31:23 this case?
MS. COLLINS: Object to the form.
A If that were truly the case, if there was a true solid scientific basis for that finding, that could be important. 12:32:03
MR. PAGE: I see my time is out, so let's take a break.
VIDEOGRAPHER: We are off the record, 12:31 p.m.
(Following a lunch recess at 12:32 p.m, 12:32:11 proceedings continued on the record at 1:37 p.m.)
VIDEOGRAPHER: We are back on the record. The time is 1:37 p.m.
Q (By Mr. Page) Dr. Murphy, I want to refer, again, to Exhibit 2 to your deposition. Would you 01:37:27

turn to the sixth page, which I think is labeled Murphy 000005 at the bottom right-hand corner. And there is -- are you there with me, sir?

A Yes.

Q At the bottom, there's an e-mail July 18th, 2008. Would you read that for the record, please? 01:38:07

A They asked that I not send them anything. I read the version you drafted to the client over the phone. I'm sure they would prefer that we not keep the letter you drafted. 01:38:17

Q Who are you referring to when you say they asked that I not send them anything?

A My recollection is that it would have been -- I believe it was someone at Faegre & Benson.

Q Okay. And what were you referring to, if anything, when you said not send them anything? 01:38:27

A An engagement letter.

Q Did you end up sending them an engagement letter?

A I do have an engagement letter for this work, yes, but, you see, this engagement letter had been drafted by Jennifer Martinez, not by myself. 01:39:03

Q The one you're referring to in this e-mail?

A Yes.

Q The last sentence says. I'm sure they would 01:39:11

prefer that we not keep the letter you drafted.
What do you mean by that?
A I don't recall the content of the letter so I
don't know why I said that. I guess that, you know,
since I was going to provide a new engagement 01:39:19
letter, the old engagement letter would be -- would
be void.
Q Did you produce more than one -- did you
prepare -- did Exponent prepare more than one
engagement letter? 01:39:26
A Well, there was apparently the one that
Jennifer Martinez prepared, and then I have one in
my file, which was turned over to you, which is a
second engagement letter.
Q So those aren't the same document? 01:40:01
A I don't believe they are, no.
Q Do you have a copy of the original engagement
letter that was prepared?
A I do not.
Q Did you produce it -- I guess you didn't 01:40:07
produce it in your considered materials?
A Not that -- I don't know if I did or not, but
I don't recall doing so.
Q I assume Exponent still has a copy of that
letter? 01:40:12

A I don't know.
MR. PAGE: I'm going to ask that they be produced as part of the materials in this case that were considered.
MS. COLLINS: To the extent that it exists, we'll look for it. I think the issue is simply that Exponent may have had some sort of engagement letter that they usually use, but we have a letter that we use and that's what was delivered, so there was no purpose for them to have a separate 01:40:22 engagement letter. I think that's the difference in --
MR. PAGE: Are you confident of that explanation?
MS. COLLINS: Yes, I am. 01:40:26
MR. PAGE: You're making that representation as an officer of the court?
MS. COLLINS: Yes, I am. I'm happy to investigate it further to see if there was anything drafted on their side, but -- 01:40:32
Q (By Mr. Page) The engagement letter you have in this case was drafted by whom?
A Well, I think I hear Ms. Collins saying that it was something that Faegre & Benson drafted. I know I have an engagement letter. I'm not sure, as 01:41:09

I sit here today, who drafted it, whether Exponent drafted it or Faegre & Benson did.

Q It's on an Exponent letterhead, is it not?

A I don't know. If you show me the document, I'll be able to identify it. 01:41:17

Q Let's go four pages further in, it's a document provided as Murphy 000213. Can you identify that page of this group of e-mails, sir?

A Yes. This is something that Charlene Edinboro sent me to tell me what she had been doing. 01:41:32

Q This is when she was trying to determine if there was a difference between poultry and turkey waste; correct?

A Between chickens and turkeys, yes.

Q And was there any other work product other than this page produced by Ms. Edinboro on that subject matter? 01:42:06

A Not that I recall, but if there was, it would have been turned over.

Q Do you recall whether or not she discovered any difference between poultry -- excuse me, turkey and chicken diets? 01:42:14

A I don't believe she had. At this point when this was drafted, she was more identifying sources she could turn to to find out more information. 01:42:26

Q Did she ever identify any distinguishing constituents between chicken and turkey diets?
A I don't believe that she ever did. It's not that we concluded that they were indistinguishable, it's just that we didn't find any information. 01:43:09
Q You didn't make a conclusion one way or the other on diets between poultry and --
A That's correct.
Q Could you turn over to page -- it's about four or five pages later, it's Murphy 000220. It's an 01:43:15
e-mail from you to Charlene, subject for our 2:00 p.m. EST call, and then a response from her on the same date; do you see that?
A Yes.
Q What was the subject of this e-mail to her? 01:43:28
A I'm not sure.
Q Would you read the subject line, please, or what she says to you in response to your conveyance of something for the 2:00 p.m. call?
A Very nice, though not helpful for our 01:44:21
evaluation.
Q Can you tell me what she's referring to?
A I can't. I could speculate, but, you know, as I sit here today, I'm not sure.
Q What's your speculation? 01:44:26

A That it would have been an early version of my report.
Q Okay. Why did you tie that together, between that comment and this date in your early version of your report? 01:45:06
A Well, because I was trying to bring her up to speed on the project, and, you know, where I was setting off so that she could do -- you know, do what she had to do within that context. And I think what makes me think that's what it was is though not 01:45:15 helpful for our evaluation is that she's saying it's not helpful for distinguishing turkeys and chickens, because what I had sent her at that time covered a number of other topics, including the PCA analysis, but didn't address turkeys and chickens because that 01:45:23 was her job.
Q Okay. Turn to the next page, sir. There's an e-mail here from Kristen Carney. Who is that?
A Kristen Carney was an employee of Faegre & Benson, and she's taken another job since then. 01:46:03
Q Is she a lawyer?
A She's a lawyer, yes.
Q What information was she providing you here?
A Well, apparently it's a website that she thought may be of interest to Charlene Edinboro, 01:46:17

since she provided this kind of thing to Charlene, and I see it's USGS information having to do with arsenic.

Q Did you investigate arsenic as part of your investigation in this case? 01:46:25

A I don't remember that specifically. I don't know whether Charlene did or not.

Q Did Ms. Carney provide you any other information that you evaluated in this case?

A It says that she provided some additional 01:47:01 information to Charlene Edinboro, but I don't recall what that additional information was. I think it's similar, it's other website sources or other sources of information.

Q Did other lawyers at Faegre & Benson provide 01:47:10 you information for your analysis in this case?

A Other than expert reports and deposition transcripts, no.

Q Would you go to the next e-mail, sir? And could you take a minute to look at this and tell me 01:47:20 what the subject is of these e-mails on Page 000227?

A The subject was I was looking for a way to explain what PCA is in a simple manner, and I developed a simple PCA, which involved familiar compounds, like benzine, cocaine, tobacco, and I did 01:48:09

a PCA on those based on presence of oxygen, nitrogen and carbon. We wound up not using it because -- Melanie is critiquing my effort here, saying she doesn't think it's useful, and I agreed with her. 01:48:21

Q Why not?

A It wasn't of any help in explaining what PCA is.

Q What does Melanie mean when she says in this -- would you read the second sentence of her 01:48:26 e-mail to you? It's just with only --

A I'm still not convinced this shows what we're after. With only four variables, it is difficult to make Olsen's point.

Q Do you understand what she's referring to in 01:49:05 that comment?

A I understand the with only four variables part, but I don't know what Olsen point she's trying to make or she's referring to. The four variables were carbon, oxygen, et cetera. 01:49:12

Q Were you trying to demonstrate by this evaluation that it's inappropriate to look at loadings to help identify sources?

A No.

Q That's not the point? 01:49:23

A No. The point was we were trying -- I was trying to develop a simple story, and I sort of titled this story, raid on a crack house, using common substances to illustrate how PCA works.

Q What error in Olsen's interpretation were you trying to demonstrate by this example? 01:50:03

A I don't recall trying to demonstrate any error.

Q Well --

A As I recall it, I was simply trying to find a way to indicate how PCA works. It was going to be an introductory section describing PCA. 01:50:08

Q Okay. Would you read the second sentence of her e-mail to you at the top, right under attachments, result output.PDF? 01:50:15

A With only four variables, it's difficult to make Olsen's point.

Q Would you --

A I'm sorry, am I looking at the wrong spot?

Q Well, are you on Page 227? 01:50:24

A Yes.

Q It would be the second sentence in that e-mail to you, would you read it, please?

A Her 6:41 p.m. e-mail?

Q No, no, I'm looking at 11:17 a.m. e-mail. 01:50:28

A Okay. It's just with only four variables, it is difficult to see Olsen's error in interpretation.
Q Does that refresh your recollection as to what area you were trying to point out through this analysis? 01:51:07
A Not really. You know, there's half a dozen different errors it could be.
Q Would you read the second paragraph, sir, following that?
A Olsen discusses how the largest positive 01:51:14 scores identify the variables that are important to PC1, and thus that those variables are associated with the waste source in PC1 can be associated with the waste source.
Q Can you stop there? 01:51:22
A Okay.
Q Do you understand that she's referring there to Olsen's method of using loadings to help identify sources?
A Well, no, because it refers to scores, largest 01:51:25 positive scores, not loadings.
Q Okay. Would you continue, sir?
A In our example, with only four variables, PC1 is generally dominated by one variable, thus making his point more clear rather than showing the flaw of 01:52:06

it. Am I missing something?
Q What by your example that you chose not to use was making Olsen's point more clear rather than showing a flaw?
A That when you have a limited number of 01:52:12
analytes, it is possible for an individual PC, PC1, PC2, to be dominated by a single analyte.
Q And how would you use that in your interpretation of source, if at all?
A I'm not sure I would because, you see, the PC1 01:52:25
loading is dominated by carbon, on Page 228, but all the compounds I'm using have carbon in them.
Q So would you read the comment under PC1 there on this example on Page 228, Murphy 228 of this e-mail? 01:53:08
A Only carbon has large positive loading; therefore, if carbon can shown to be related to a source, then samples high in PC1 can be related to this source.
Q So doesn't this exactly -- this example you've 01:53:14
got here exactly demonstrate how Olsen is using loadings to relate to a source of contamination?
MS. COLLINS: Object to form.
A Well, if there were only one of these sources
that had carbon or was particularly higher in carbon 01:53:29

than the others, then you could make that identification, but that isn't true.

Q (By Mr. Page) But that's what Olsen did, did he not?

A No, I don't think so. 01:54:04

Q Would you read the comment under PC2?

A Only hydrogen has large positive loading; therefore, if hydrogen can be shown to be related to a source, quote, unquote, then samples high in PC2 can be related to this source also, per Olsen 01:54:18 report, top of Page 653. So I'm referencing Olsen for both of these statements.

Q And doesn't your example actually validate on what Olsen says on Page 6-53 of his report?

A No, because I say alcohol, ethyl, has the 01:54:26 highest hydrogen component, but the next highest, benzine, is not related to alcohol at all.

Q But if they were, wouldn't that help identify the source in your example?

A If you -- if you have a source that is a 01:55:02 unique -- has a unique analyte or a couple of analytes or is dominated by a couple of analytes, that will show up in the PC analysis.

Q And looking at the next page, 229, this is again part of this example that you chose not to use 01:55:16

in your report? Is that true, sir?
A Is there a question?
Q Yes. Is this also part of the analysis that you put together?
A Yes. 01:56:15
Q Okay. And on this page, do you show that an example with oxygen, that if it's related to a particular source, then PC1 then could be also related to that source?
A Yes, but, you see, I'm quoting Olsen there. 01:56:21
I'm giving a reference to his page number. So what I'm saying, in Olsen's methodology, if oxygen can be shown to be related to a source, then samples high in PC1 can be related to the source.
Q And isn't that also what your particular 01:56:28
example demonstrated?
A I think several of these compounds have oxygen in them.
Q Yeah, but not in the same concentrations; correct? 01:57:05
A Not the same proportions.
Q And that would account for the higher loading, correct, in your example?
A No, the loading is based on all of the samples, not a particular sample. 01:57:08

Q Right. But if the samples, in general, from a particular source had higher concentrations of oxygen, then the loading for that particular set of samples would be higher for that PC; correct?

A In this particular case, I think that would be correct. 01:57:17

Q In your investigations, did you determine whether or not hormones were added to feed of turkeys?

A We probably had some discussions about that, but I don't recall any particulars. 01:57:28

Q Well, the next page is a -- it's Murphy 222 of this exhibit, seems to be a discussion about whether or not growth hormones had been added to feed. Does that refresh your recollection? 01:58:09

A 222?

Q Yes. It's an e-mail dated September 15th, 2008.

A Oh, okay.

Q And it's from Charlene to you. Top of the page. 01:58:16

A Okay. I sent her an e-mail saying, why did we expect to see a difference in estradiol between chickens and turkeys. It has something to do with the age at which they are harvested. 01:58:24

Q Okay. Would you read her response, please, out loud?
A Some of this was discussed vis the dairy cattle in the area. Tom turkeys shouldn't have high estradiol unless it was supplemented in the diet, 01:58:28
while lactating cows might leave this. If chickens are layers versus broilers, their ages at the time of either laying or slaughter would dictate maturity and estradiol concentrations, again, as long as it's not in the feed. I think I made a reference to it 01:59:07
potentially being a feed additive, and there was much harumphing on the call. Short answer, sex of species of interest not growing lots of roosters, for example, I don't remember your results. Does this answer make sense? 01:59:13
Q Okay. Do you know -- were on you on a call where Ms. Edinboro mentioned that estradiol concentrations might be potentially a feed additive?
A I was on a call where that subject was discussed. I don't know if she was the one who 01:59:22
brought it up.
Q Okay. And who else was on the call?
A Several Cargill employees, and I believe Kristen Carney.
Q Okay. And in this conversation, were you 02:03:32

discussing what the constituents are for turkey feed?

A That was one of the subjects, yes.

Q Okay. And were the Cargill employees able to give you any constituents of feed that would 02:00:05 distinguish it from other types of poultry feeds?

A Nothing that we found useful.

Q Well, what did they -- did they provide any suggestions as to distinguishing feed additives?

A It would all be contained in Charlene 02:00:14 Edinboro's e-mails.

Q Do you recall anything that was mentioned by Cargill employees to you as to a constituent added to feed that would be unique in turkey feed as opposed to other types of poultry feed? 02:00:23

A I do not recall that.

Q Do you recall whether or not there was -- any of the Cargill employees mentioned that growth hormones, such as estradiol, are added to turkey feeds? 02:01:01

A I don't recall, but I -- but the estradiol discussion was based on my saying that I did see a difference between chickens and turkeys for estradiol, and what could be the reason for that, and as you can see, a number of different 02:01:08

possibilities were thrown out.
Q Is it your testimony, sir, that the Cargill employees did provide you with some constituents that might be unique to turkey as opposed to poultry feed? 02:01:16
A I don't recall that being the case.
Q But you did investigate that issue with your client, Cargill?
A That was one of the subjects we brought up on the phone, yes. 02:01:20
Q And do you recall whether they were able to provide you with any specific information that would indicate that turkey feeds are unique in any constituent to other types of poultry feeds?
A I don't recall that, other than what's in 02:01:27 Charlene Edinboro's e-mail here discussing what was discussed on the call. I don't have any separate recollection.
Q Did you discuss with your Cargill client whether there would be any distinguishing 02:02:04 characteristics of turkey waste as opposed to poultry waste?
A We did discuss that, yes.
Q Okay. And were they able to identify any constituents that would be unique to turkey waste as 02:02:11

opposed to poultry waste?
A Nothing that was helpful. Again, I raised the fact that we were seeing a difference in estradiol in the waste.
Q What did they tell you that would be 02:02:18
distinguishing, if anything?
A I don't recall that they told us anything.
Q For your analysis in this case, Dr. Murphy, did you compare the constituents in poultry waste to the constituents in reference soils? 02:03:04
A I believe that some of the principal component analyses that we did had both poultry waste and reference soils in them.
Q Did you do any other comparison other than through PC analysis? 02:03:13
A I don't believe so.
Q So as you sit here today, sir, you would not know whether or not there are constituents in poultry wastes that are present in much higher concentrations than they are in reference soils? 02:03:20
A I haven't investigated that specific question.
Q Would that be important to determine a potential source of constituents in ambient waters?
MS. COLLINS: Object to form. Excuse me. Object to the form. 02:03:32

A It could be one component, but you really have to talk about the difference in partitioning during the transport and the fate of different components to see, you know, what winds up contributing in the end. 02:04:08

Q (By Mr. Page) Do you know whether or not there are constituents in poultry waste that leach -- that leach?

A Well, the synthetic leach precipitation tests produced leachate with measurable concentrations of various compounds from poultry waste, so I'd have to say yes. 02:04:20

Q Do you recall if some of those concentrations were very high of any particular analysis.

MS. COLLINS: Object to form. 02:04:27

A I don't recall the specific concentrations.

Q (By Mr. Page) Do you recall if the concentrations that were leaching in poultry waste related to phosphorus?

A I don't recall that. 02:05:02

Q What about copper?

A I don't recall.

Q Zinc?

A No, because I've worked with PCA which deals with variants, not pure concentration. 02:05:06

Q And I believe you testified that you did not ever investigate the concentrations -- what were the constituents in soils in the IRW from the reference soils?

A I have not looked at that. 02:05:17

Q I'll give you a hypothetical question, Dr. Murphy. If constituents are in poultry litter and that poultry litter is added to fields, would you expect that such land applied constituents to have higher concentrations in the runoff of those 02:06:03 constituents than non-land applied fields?

A All other things being equal, I would. Whether it would be measurably different or not, I do not know.

Q Did you do any comparison of the constituents 02:06:14 that are found in land applied fields where poultry waste has been land applied to reference soils in the IRW?

A Only through the PCA analysis.

Q No side-by-side comparison of the number of 02:06:22 analytes and their concentrations?

A No, only the scores on loading plots.

Q Did you do any examination as part of your work in this case of the edge of field samples in the sense of what their constituents were and the 02:07:05

concentrations for those constituents?
A The only analysis was through the PCA analysis.
Q So you didn't actually look at what individual constituents were present in the analytical results 02:07:11
from an edge of field sample and look at those concentrations?
A No, I dealt strictly with variances.
Q Wouldn't such an evaluation be helpful to determine whether or not land applied poultry waste 02:08:02
could be a source of constituents in edge of field samples?
MS. COLLINS: Object to form.
A If it was combined with other analysis, including analysis of how chemicals partition in the 02:08:08
environment, transport and fate, it could be.
Q (By Mr. Page) You're capable of doing that analysis concerning partitioning of elements in the environment?
A I am, but I guess the way I'd really have to 02:08:15
answer it is if you wanted to do this properly, you'd have to go back to square one and take a new set of measurements. The measurements you have just don't support a PCA analysis to try to find sources.
Q And you didn't do that analysis, go back? 02:08:22

A I haven't. I understand it takes several million dollars.

Q In your analysis, did you do any comparison of reference stream samples in the analysis, so that would be analysis of samples taken from reference 02:09:03 streams, did you ever compare those analysis with samples taken from streams that are located in areas of poultry operations?

A That would be in my PCA analysis.

Q Other than in the PCA analysis, did you 02:09:11 actually look at the different analytes and the concentrations between those two sets of samples?

A Only for one of the -- well, for the Cargill stream sample, I compared what the loadings were with what Dr. Olsen says the poultry litter loading 02:09:23 is, so that's a little bit different than the straightforward PCA analysis, but that's all I did.

Q Did you review any of Dr. Engel's report in this case?

A I don't believe so. 02:10:02

Q Are runoff models of -- a method by which one can determine a source of contamination?

MS. COLLINS: Object to form.

A In some cases, it may be possible.

Q (By Mr. Page) Would you turn to Page 11 of 02:10:11

your expert report, sir? The first bullet on that page, would you read that for the record, please?

A I was asked to examine the following issues: Bullet one, what Cargill contract grower specific data did Dr. Olsen use; are these data sufficient to 02:11:13 support Dr. Olsen's implied claim that Cargill's contract grower litter is making a detectable contribution to the chemical and bacterial content of downstream water bodies.

Q Okay. Would you explain what you mean by that 02:11:20 first bullet?

A Well, in the Section 2 of my report, I believe it is, or maybe it's Section 3, I guess it's Section 3, I discuss all of the samples that were taken at Cargill contract growers, which are only two of the 02:11:32 35 growers, and what those data show, whether they fit Dr. Olsen's model for PC1 representing poultry litter, and is there any evidence that it's making -- that the Cargill contract growers are making any detectable contribution to chemical or 02:12:12 bacteria content of downstream water bodies.

Q What do you mean by detectable contribution?

A Well, I am willing to concede that there might be a molecule of something that was in poultry litter that eventually finds its way into a 02:12:20

downstream water body. What I'm saying is that there's no evidence that I've seen that shows that it's happening. That is, there's nothing detectable which leads to that conclusion.

Q What do you mean by detectable? Are you talking about a sample with an analysis of constituents where you determine concentrations of the constituent? 02:12:28

A That could be an example, if it was a unique constituent. 02:13:06

Q Did you do any of that evaluation?

A No. My evaluation has been strictly in the context of PCA.

Q So you're referring to your -- when you justify this bullet number one here, you're justifying that with your PCA analysis? 02:13:10

A Yes.

Q Any other analysis?

A Well, the other analysis would be the analysis of the data that was collected at Cargill contract growers, whether that reflects cattle versus poultry, whether it is representative of this -- of the Cargill contract growers either in toto or even a single one, now that would be the other part of the analysis. 02:13:19 02:13:32

Q Okay. Well, do you have any information to suggest that the samples that were taken at Cargill facilities, that is, the litter samples, are not representative of Cargill operations in the IRW?

A For the litter samples, no. 02:14:06

Q What about for the soil samples taken at the land application areas for the soils, do you have any evidence to suggest that those land application area soil samples are not representative of soil samples where Cargill poultry litter has been land 02:14:16 applied?

MS. COLLINS: Object to form.

A Well, you know, I'm sure there's some variation in the prevalence of cattle at the various Cargill contract grower locations. 02:14:22

Q (By Mr. Page) What's your basis for that statement?

A Well, I think that there's no information either way on 33 of the growers, and on the two where we do have sampling, we do know that there 02:14:32 was -- there were cattle present.

Q Okay. So what's your basis -- do you have any basis that indicates that the Cargill soil samples are not representative of other Cargill land applied areas? 02:15:09

MS. COLLINS: Object to form.
A I haven't investigated that, but the two factors that you would need to look at is the prevalence of cattle in other Cargill locations and the variation in native soils at various locations. 02:15:14
Q (By Mr. Page) But you have not investigated either one of those?
A I have not investigated that.
MS. COLLINS: Is there anyone on the phone? It's been on mute this whole time. 02:15:24
Q (By Mr. Page) Who provided you your objectives for your work in this case?
A I would say it came through conversations with Faegre & Benson.
Q So they gave you your objectives? 02:16:09
A I'd say it came from conversations. It wasn't a case of them giving it to me, it was a case of a discussion.
Q Okay. And did your objectives ever change during the course of your work in this case? 02:16:16
A No, I don't believe so.
Q Were you able to complete all the work that was set forth in your objectives between you and Faegre & Benson in this case?
A I believe so. I'd have to look at the 02:16:24

retention letter to see if that's the case, but I believe that's the case.

Q Let me hand you what's been marked as Exhibit No. 3, and if you can identify that for me, please, sir? 02:17:07

A It's a letter from me to Kristen Shults Carney at Faegre & Benson.

Q And what is this?

A This looks like a retention letter.

Q Was this drafted by Exponent or Faegre & Benson? 02:17:15

A It was drafted by Exponent.

Q Okay. And did Faegre & Benson do any commenting on this letter?

A I don't recall that they did. This is unsigned, incidentally. I'm not sure if this is the final version or not. 02:17:23

Q This is the version that we were able to find in your -- in your considered materials. It is signed by you, is it not? 02:18:06

A Yes.

Q Was this document ever signed by anybody at Faegre & Benson?

A If it was, it may be in our contract files. Not the files I keep personally, but our contract 02:18:14

files.
Q So you didn't produce the contract files in this case?
A No.
MR. PAGE: I'd ask for that to be 02:18:18
produced, also.
MS. COLLINS: Duly noted.
Q (By Mr. Page) Would you look at the tasks? Did you identify tasks in this letter?
A Yes. 02:18:25
Q Were those -- would you consider those to be your objectives for your work in this case?
A Yes, although Task 3, as I indicated, we cut short when it looked like it wasn't going to be productive. 02:19:02
Q So you would agree with me that Task 3 on Exhibit No. 3 was not completed because you were unable to distinguish turkey from chicken waste?
A Within the context of these analytes that Dr. Olsen had chosen. 02:19:10
Q And I believe the record is pretty clear that you haven't been able to identify any specific additional analytes that could have been useful in that determination; right?
A Well, we've mentioned a couple today, but 02:19:15

it -- when we reach the point of concluding that we couldn't do it within the context of Dr. Olsen's analytes, there was no point in continuing the investigation.

Q You mentioned a couple today that you had -- 02:19:22
that you suspected may produce, but you never did an investigation as to whether those suspected sterols would actually prove to distinguish between the different type of wastes; correct?

A That's correct. 02:19:32

Q No. 4. Did you do a comparison of Cargill litter samples with chicken litter samples using PCA?

A Yes.

Q And were your results reflected in the report? 02:20:14

A I believe they are, yes. We've indicated which litter samples are Cargill litter.

Q Okay. And were you able to distinguish your Cargill litter samples from other chicken litter samples using PCA? 02:20:22

A Not within the context of the analytes selected by Dr. Olsen.

Q And you didn't do any other analysis to be able to distinguish them, did you?

A Other than what we've discussed that Ms. 02:20:27

Edinboro did.
Q You didn't do another PCA analysis to distinguish chicken litter from turkey litter, did you?
A That's correct. 02:21:03
Q Would you read objective 5, please?
A To the extent that suitable data exists, redo Olsen's analysis comparing poultry chemical and bacterial analysis to wastewater treatment plants, cattle manure in septic systems for Cargill 02:21:14 facilities.
Q Did you do that work?
A I would say yes, it's included in the figures in my report where all of those entities, including the specific Cargill facilities, are broken out. 02:21:19
Q Do you recall whether any of these tasks in this letter were different than the original letter that we discussed earlier that was referencing an e-mail about not keeping the letter?
A I do not. 02:21:29
Q Did you ever formulate any hypothesis to be tested as part of your work in this case?
A Well, the -- there would be two hypotheses; one would be sufficient data was collected at the Cargill locations to form opinions as to whether 02:22:12

Cargill poultry litter is contributing to detectable surface water concentrations, that would be opinion hypothesis one, and hypothesis two would be that Dr. Olsen's PCA analysis has been conducted in an appropriate -- and interpreted in an appropriate 02:22:21 manner, and shows that there is a connection between poultry litter and surface water.

Q Were those hypotheses stated anywhere in your report?

A I think they're implicit. 02:22:28

Q Not explicit?

A I didn't make them explicit, no.

Q Were they stated anywhere in your considered materials explicitly?

A No. Again, I think it's implicit. 02:23:04

Q Did you produce all e-mails and communications with counsel and other experts and consultants in this case?

A I produced everything that either I or Melanie Edwards had by way of e-mails since the date of this 02:23:12 retention letter.

Q What about prior to the retention letter?

A Periodically, I'm asked to purge my e-mails, and I do that as a mass purge. So, for example, I don't think I have anything from 2007 or 02:23:24

thereabouts.
Q Do you have any e-mails that were related to this case that were not produced?
A This case being the specific retention letter case? 02:23:32
Q No, the work you performed in this case.
A I've been retained twice, and I'm not sure which case you're referring to.
Q Okay. When were you retained the first time?
A Late 2007. 02:24:06
Q Okay.
A And -- yeah, about then.
Q And what was the purpose of that retention?
A Retention was basically as a consulting expert to look at what Dr. Huber was doing, and to provide 02:24:15 other opinions to Faegre & Benson as to the worthiness of Dr. Olsen's analysis.
Q And did you prepare any written report in that regard?
A Not that I ever furnished to my client, no. 02:24:27
Q And that work as a consulting expert, how is it different than the work that you performed as a testifying expert in this case?
A It was much more preliminary.
Q What was the subject -- was it similar subject 02:25:08

matter?
A Similar subject matter, looking at Dr. Olsen's PCA and did it tell the story in successive towns.
Q Is it your position that that's not part of -- should be considered part of the considered 02:25:14
materials for this work that was done?
A No, I --
MS. COLLIN: No, that's not our position. In fact, the second set of considered materials
includes all of his work in that first phase of the 02:25:19
project related to the facts or opinions in his ultimate report.
MR. PAGE: So that was the additional considered materials that were provided?
MS. COLLINS: Correct 02:25:25
MR. PAGE: About a week or two ago?
MS. COLLINS: That's correct.
Q (By Mr. Page) Did anyone review your expert report?
A Steve Mudge did. 02:26:06
Q Did he provide you any comments?
A He provided me -- yes, he provided me with some comments.
Q In what form; were they verbal or written?
A They would have either been by phone or by 02:26:12

e-mail.
Q Okay. Did you make a record of those comments?
A No, I simply incorporated them into my report.
Q So -- 02:26:22
A And the e-mails, if they exist, were turned over.
Q Okay. So Dr. Mudge comments you did accept and make the revisions pursuant to --
A Some of them I did, yes. 02:26:27
Q Do you recall what comments he made?
A The comment about using sterols was his comment.
Q He was the one who came up with the possibility of sterols -- 02:27:05
A Yes, he said, why -- why is he doing this analysis based on things that are found in soil? He said, why not use things that are found in animals, like sterols.
Q Okay. And so it was Dr. Mudge who made the 02:27:11
suggestion that you might be able to distinguish poultry waste from soils with sterols?
A That was an example, yes.
Q Okay. Anything else?
A He suggested using a specific figure which 02:27:18

shows a three-dimensional view of PCA analysis that he's used in some of his reports, and I think he may have been using it in a book chapter that he thought helped explain what PCA was, and I chose not to use that. 02:27:29

Q Did you get -- did you ever prepare such a 3-D view?

A I have not, no.

Q And why did you choose not to use that?

A Well, I didn't think that it helped that much in explaining what PCA is. 02:28:04

Q Okay. Anything else?

A No. I asked him at one point could he point me to some multimedia PCAs, and he gave me a lead which I didn't follow up. I found -- I had papers in my office already that did multimedia PCA, so I used those as references instead. 02:28:17

Q Were you having a hard time finding multimedia PCA examples?

A No, but, you know, I thought since I had access to them, I'd see what he had to say. Like I say, I found these papers in my own files. I already had them. 02:28:26

Q Anything else, any comment on them?

A That's all I recall. 02:29:03

Q I'm going to hand you what's marked as Exhibit No. 4 to your deposition. Can you identify that for us, please, sir?
A It's e-mails between Dr. Mudge and myself.
Q Okay. I think I tried to put them in 02:30:07
chronological order. Is this first e-mail where you just mention that you were looking for some examples of multimedia PCA?
A Yes.
Q These both waters and solids? 02:30:14
A Yes.
Q You've performed PCA in your work three times; correct, sir?
A Three different cases, yes.
Q And in two of those cases, you employed -- you 02:30:19
separated water from solids; correct?
A That's correct.
Q And only in this case is where you did -- you put them together, the water and the solids
together; correct? 02:30:26
A That's correct.
Q The second page is an e-mail from you to Stephen Mudge. Is this where you request him to do the peer review?
A Yes. 02:31:03

Q Okay. Let's go to the next page. I guess this is a chain of e-mails. Maybe we should go to the back page and kind of work forward. Page 242, Murphy 242.

A Okay. 02:31:14

Q Could you read your first sentence to Mr. Mudge, please?

A My draft of the key analysis section of the other side's report.

Q And continue, please. 02:31:21

A Melanie will be fact checking, and she can answer any questions about data or the PCA analysis we've done.

Q Okay. So is this a draft of your report that you've sent to Dr. Mudge? 02:31:27

A Yes.

Q Did you produce that draft of your report in your considered materials?

A I don't believe so. I don't have the draft. It's been overwritten. 02:32:03

Q Because you didn't keep a copy of the draft?

A That's correct. I don't know if -- I don't know where the draft came from. It may have come from our publications department and then I forwarded it to him. 02:32:11

Q Isn't it possible to get previous drafts of a document from the computer?
A I don't know how to do it, but it is possible, I suppose. My understanding is that things stay on your computer even after they're deleted, and if 02:32:18 you're a computer expert, you can find them.
MR. PAGE: I would ask for that earlier draft to be produced, please.
MS. COLLINS: Duly noted. It's my understanding that the draft existed on a server and 02:32:25 was routinely overwritten, so it wasn't that a draft was generated, it was just that that document was accessed.
MR. PAGE: Could you evaluate that and confirm it, please? 02:32:32
MS. COLLINS: I will do that.
MR. PAGE: Thank you.
Q (By Mr. Page) Let's go to Page 241 and start this e-mail from Mudge to you dated September 24. Does this e-mail contain Mr. Mudge's comments to you 02:33:05 about your report?
A It's some of his comments. It's his first round of comments.
Q Okay. Would you read the second paragraph, please? 02:33:14

A The purpose of PCA is to reduce a large number of potentially correlated variables with a small number of uncorrelated PCs.

Q Continue.

A It is inspection of these PCs that shows the 02:33:19 controlling factors that lead to aggregations in the PC figures. This is variation on the interpretation of what Olsen says in his PCA introduction.

Q Do you understand what Mr. Mudge is saying there? 02:33:28

A Yes. He's saying that when you look at a scores plot and you see an aggregation of samples in the PC figure, that that indicates that they have similar signatures.

Q And is he commenting on the dissimilar levels 02:34:04 as it says in his introduction?

A He says this is a variation on what Olsen says in his introduction, but Olsen relies on loadings plots, not scores plots.

Q You're saying that Olsen provided no 02:34:10 evaluation of cluster analysis from the scores plot in his PC analysis?

A Certainly not one that links sources and receptors.

Q Would you read the next statement, please? 02:34:18

A Your analyses are consistent with my PCA and show there is little effect of logarithmic transformation, and the story, quote, unquote, is still the same.

Q What is he referring to when he says, my PCA came out? 02:34:26

A He did some PCA calculations to check my calculations.

Q Did you produce those as part of your materials? 02:34:29

A If they were in my computer, I would have.

MR. PAGE: I'm asking for those materials, also.

MS. COLLINS: Okay.

A We can see if Mudge has a copy. 02:35:03

Q (By Mr. Page) So what does it mean when he says there's little effect of logarithmic transformation and the story is still the same?

A That the clustering of the different samples is still the same, with or without logarithmic transformation. 02:35:10

Q Does this mean that the -- does this relate to the log transformation mistake that you identify in your report?

A Only indirectly. 02:35:15

Q So is Mudge suggesting that the logarithmic mistake does not really change the clustering patterns on the PC plots?

A No, he isn't. He's saying if you do it in a consistent manner and don't take a log 02:35:23 transformation, you get the same story as if you do it in a consistent manner and do take a log transformation, but Dr. Olsen did it in an inconsistent manner. Mudge isn't commenting on that inconsistent manner at all. 02:36:01

Q Oh, he's not. Okay.

MR. PAGE: I see that it's time to take a break. Let's take a short break.

MS. COLLINS: Can you just -- I want to be clear on what you just asked us for. Are you asking 02:36:05 for -- can you repeat that?

MR. PAGE: Well, it mentions here that Mr. Mudge did his own PCA.

MS. COLLINS: To the extent that that was reviewed by our expert, we'll get you that. 02:36:11

MR. PAGE: Well, this was a person who viewed Dr. Murphy's report, he's with the same company, providing peer review and comments on it. I think it's appropriate to produce it as a person who assisted him with his report. 02:36:19

MS. COLLINS: Well, to the extent that that was reviewed or relied upon by Dr. Murphy, I would agree with you; but I will investigate it further to find out what the nature is of the reference in this e-mail. 02:36:24

MR. PAGE: Let's take a break.

VIDEOGRAPHER: We are off the record, 2:36 p.m

(Following a short recess at 2:36 p.m., proceedings continued on the record at 2:42 p.m.) 02:36:28

VIDEOGRAPHER: We are back on the record, 2:42 p.m.

Q (By Mr. Page) Dr. Murphy, would you look at the reply above where we were just looking on the September 24th, the third sentence down, would you 02:43:02 read that for the record, please? This is your reply to Stephen Mudge.

A I believe that he did use MCUV input so that the concentration versus loadings is not obvious.

Q Would you explain that comment to me, please, 02:43:11 sir?

A MCUV input is the same thing as what we've been calling Z score.

Q Okay.

A Subtracting the mean and dividing by the 02:43:16

standard deviation.
Q Okay, sir. And what do you mean by the concentration versus loadings is not obvious?
A That high loadings don't necessarily imply high concentrations. 02:43:23
Q Is it your testimony, sir that once you use Z transformation, you cannot determine the differences between concentrations of samples?
A My testimony is that doing the Z transformation obviates, tends to erase differences 02:44:01 in concentrations.
Q But you can still tell differences in concentrations after you've done a Z transformation; is that not correct?
A In some cases you may be able to. 02:44:08
Q Do you know what the formula is for the Z transformation?
A It's subtracting the mean and dividing by the standard deviation.
Q Could you write for us the formula for Z 02:44:13 transformation, sir?
A (Witness complies.)
Q Okay. And what is the XI you have here?
A It's a measurement of a parameter, the EF parameter at a particular sample location. 02:45:08

Q Is that the -- is that the Z score that you're trying to determine?
A I'm saying replace that measurement, that measured value with what I show on the other side of the arrow. 02:45:16
Q Okay. Which of these constituents are constants?
A None of them, really. X bar and SD, the mean and the standard deviation depend on the measured values of the XIs. 02:45:24
Q So those -- so for all of your Z transformations, you would have a different mean and standard deviation?
A Yes, for each analyte.
Q Would they be constant for the same analyte? 02:46:01
A Yes.
Q So because of that, couldn't you tell, for at least among the same analyte, differences in concentrations after you've done your Z transformation? 02:46:10
A If you look at the individual value, that -- individual Z transformed value, you would be able to see differences in the initial concentration.
Q Okay. Let's go back to Exhibit 4, sir, which is a set of e-mails. Would you read the bottom 02:46:21

paragraph on Page 241?
A In any good EF case, it is necessary to ID a range of potential sources, their proposed pathways, and the receptor sites. I assume this was done in the CSM. 02:47:04
Q Would you stop there, sir? What do you mean EF case?
A Environmental forensics.
Q Okay. And was that done by Dr. Olsen in this case? 02:47:10
A I don't believe so, no.
Q You don't believe so?
A No, I'm sure it wasn't. He did his own PC analysis, but none of the other things.
Q Okay. So when Mr. Mudge says it's necessary to ID a range of potential sources, their proposed pathways and the receptor sites, I assume this was done in the CSM, do you know what Dr. Mudge is referring to? 02:47:14
A I believe he's referring to the work done by CDM. 02:47:24
Q And what does CSM stand for? Does that stand for conceptual site model?
A Yes, I believe it does.
Q Okay. So did Dr. Olsen, with CDM's 02:48:05

assistance, prepare a conceptual site model for this case?

A My recollection is he did.

Q And did that conceptual site model identify a range of potential sources, the proposed pathways 02:48:10 and receptor sites?

A Not all the potential sources, but some, yes.

Q Do you know how Dr. Olsen selected the potential sources?

A Well, he selected poultry litter because he 02:48:16 believed from the start that that was the important source. He selected cattle manure because that seemed unavoidable, that everybody knew there were cattle in these poultry field, applicated fields. The wastewater treatment plants, I don't know why he 02:48:29 focused on those, but -- and I don't know why he neglected native soils as a source.

Q Okay. Dr. Murphy, did you review any of the mass balance work that was performed by Doctors Engel and Meagan Smith in this case? 02:49:08

A I don't recall doing so.

Q Did you -- does it help your recollection to know that they did mass balance work for sources of phosphorus in the IRW?

A I recall that somebody did some comparison 02:49:15

between cattle and -- and poultry litter. I don't recall if the analysis included wastewater treatment plants or not.

Q Or other sources beyond that, also?

A Or other sources. I don't believe it included 02:49:22 native soils.

Q Do you know whether or not there was an analysis done in this case -- mass balance analysis for sources of bacteria?

A I don't know. 02:50:04

Q Would you read the next sentence, please?

A If this was the driver for the collection of data and samples for the PCA, as indicated in the Olsen report, why did they not use more specific markers for fecal material derived from poultry. 02:50:16

Q Okay. Did Dr. Mudge review the site conceptual model in this case?

A I sent him key sections of Olsen's report, and I'm not sure if that was one of the sections I sent or not. 02:50:25

Q Did Dr. Mudge have the mass balance work that was performed by the other experts for the State in this case?

A I sent him only Olsen materials.

Q Okay. Did you review any of the runoff 02:51:01

modeling work in this case.

MS. COLLINS: Object to form.

Q (By Mr. Page) Performed by the State?

A It would refresh my memory if you told me who it was by. 02:51:08

Q Dr. Engel.

A No.

Q Did Dr. Mudge have that available?

A I didn't send it to him, so the answer is no.

Q Okay. Would you read the next sentence, please? 02:51:13

A The most sensible approach I would have thought was to analyze and assess for range of sterols and a few other key organic compounds.

Q Did Dr. Mudge ever tell you what the other key organic compounds would be? 02:51:23

A I never asked and he never told me, but the idea is clear. You look for things that are symptomatic of poultry or at least living creatures.

Q Do you know whether or not sterols from poultry would be any different from sterols from humans? 02:51:32

A I have not investigated that.

Q Do you know whether or not sterols from poultry would be any different from sterols from 02:52:03

cattle?
A I have not investigated that.
Q What about any other warm blooded animal in the IRW, do you know whether or not sterols from poultry would be any different from any other warm 02:52:09 blooded animal that may be present in the IRW?
A I have not investigated that.
Q If they were all similar, would that then make Dr. Mudge's suggestion unhelpful?
A No, because what he's pointing to is he's 02:52:16 saying, don't use things that are found in the earth's crust. He's saying at least use things that are symptomatic of living creatures. You reduce the complexity of the issue by at least one level by saying, ah, we've got something that's due to 02:52:23 somebody's fecal matter, and now we just need to sort out whose it is, whether it's cattle or poultry or whatever.
Q Would you read the next paragraph -- I guess it's the first full paragraph on the next page, 242? 02:52:32
A As you also state, you cannot use PCA to quantify the amount of signature in other samples. PCA just indicates which samples co-vary and, therefore, are likely to have the same source or sources. 02:53:09

Q Do you agree with Dr. Mudge that PCA indicates which samples co-vary and, therefore, are likely to have the same sorts of sources?

A The loadings plots do, yes, in a multidimensional space. 02:53:15

Q Would you read the next paragraph, sir?

A One thing I may have issue with in your report is large loadings don't mean large concentrations. If he has done the PCA incorrectly and used raw concentrations, larger loadings do represent large 02:53:24 concentrations. This has nothing to do with signature, though.

Q So is it possible for PCA to have -- be run in such a fashion so that larger loadings would represent larger concentrations? 02:54:03

A In this particular paragraph, Mudge is characterizing that as doing the PCA incorrectly by using the raw concentrations, but in that case, if you did it correctly, yes, it would show up that way. 02:54:09

Q Doesn't Mudge in his published materials actually state that you can do PCA using the original concentrations?

A You'd have to show me that. I don't recall it. 02:54:16

Q We'll get to it. Do turkey waste materials contain bacteria?
A I would think they would.
Q Have you done any investigation of that?
A No, I have not. 02:55:04
Q Do you know what bacteria turkey waste would include?
A No, I have not done an investigation of that.
Q Do you know whether or not turkey waste -- well, let me just ask this. Do you know whether or 02:55:10 not poultry waste includes organic carbon?
A I would think it would.
Q Nitrogen compounds?
A I would think it would.
Q Phosphorus compounds? 02:55:15
A Very likely.
Q Calcium compounds?
A Likely, although I haven't investigated it.
Q Sodium compounds?
A Likely. 02:55:20
Q Potassium compounds?
A Likely, although I haven't investigated it.
Q Chloride compounds?
A Likely.
Q Copper compounds? 02:55:24

A Likely. I haven't investigated it, but it's likely.
Q Zinc compounds?
A I would think that's also likely.
Q And arsenic compounds? 02:55:32
A At some level, it's likely.
Q Do you know of any other waste that has this chemical bacterial composition?
MR. PAGE: Object to form.
A I haven't investigated it and so I don't know 02:56:07 the extent to which all those compounds can be found in native soils, particularly the bacterial compounds. But all the others, certainly the metals you've mentioned can be found in native soils, and I haven't investigated the overlap with cow manure. 02:56:17
Q (By Mr. Page) Would you turn to Figure 3-1 in your report, please? What is Figure 3-1?
A It is Olsen's Figure 6.11-20c where we simply have added information about the nature of each of the samples, that is, what kind of sample it is. 02:57:24
Q Okay. And these are all solid samples; correct?
A Yes.
Q Okay. Are the Cargill poultry litter samples identified on this Figure 3-1? 02:58:02

A They are. They are the brown rectangles with red boxes around them.
Q Would you put a small circle around those and label them Cargill poultry litter, please?
A (Witness complies.) 02:58:09
Q Okay. And so you put a small circle around the two samples that are Cargill poultry litter?
A Yes.
Q And are they found in relationship to any other samples on this chart? 02:58:20
A They have a PC1 and PC2 score that's similar to other poultry litter samples.
Q Okay. Would you put a circle around all the poultry litter samples shown on this PC plot and then label it all poultry? 02:58:28
A (Witness complies.)
Q Are there reference soils shown on this plot?
A The reference soils are the green squares.
Q Are they separated or close to the poultry litter locations? 02:59:14
A They are separated.
Q Does that indicate to you that the reference soils have a different composition than poultry litter?
A No, because they are located in the same 02:59:19

location as the surface soil samples.
Q Okay. I've asked you between poultry litter and reference soils, are they located in the same area of the plot?
A No, they're not. 02:59:27
Q So does that indicate to you that reference soils have the same composition as poultry litter?
A No, they do not.
Q Would you go to Figure 5-1, please, sir? And what is Figure 5-1? 03:00:23
A It's a multimedia principal component analysis that I conducted.
Q Okay. And does it show Cargill poultry litter samples?
A It shows at least one as an orange dot with a 03:00:32 red square around it.
Q Weren't there at least two poultry litter samples?
A There were, but the multimedia analysis was run only on samples where all the analytes had been 03:01:16 looked for.
Q Okay. Were there not two poultry litter samples where all the analytes were analyzed for Cargill?
A If there were, I'm missing one. 03:01:24

Q So it's possible you might have left one off by mistake?
A Oh, it's possible that not all the analytes were there.
Q You found two samples on 3-1, did you not? 03:01:32
A Yes, but Dr. Olsen didn't follow the methodology of only using samples where all the analytes were looked for.
Q Do you know whether or not both of the Cargill samples that were used by Dr. Olsen had all the 03:02:09 analytes in them?
A My surmise from comparing these two figures is that one of them did not.
Q They weren't tested for all of them?
A Yes. 03:02:13
Q So when you did your analysis, you only used samples where all of the analytes had been tested for?
A Yes.
Q Regardless if they had nondetects? 03:02:18
A That's correct.
Q And so what did you do for nondetects?
A I followed Dr. Olsen's methodology because I was trying to simulate what he did, and I used half the detection level. 03:02:25

Q Well, you didn't simulate it exactly then if you left off some of the samples, did you?
A That is correct.
Q So what things did you depart from in Dr. Olsen's methodology for your multimedia analysis 03:03:01
other than, I guess, using the same samples where not all the analytes were tested?
A The different classes of analytes were considered as a fraction of their class, that is, a particular metal is the fraction of all the metals 03:03:12
that were considered, that was the second deviation.
Q Anything else?
A And I also did not take the log of the analytes because -- since I was doing fractions.
Q Anything else? 03:03:21
A That's what comes to mind.
Q So your standardization was through fractions, whereas Olsen's was through Z transformation and log transforms?
A These are -- these are Z transformed, but not 03:03:29
log transformed.
Q The ones that you were using?
A Yes.
Q I mean, you use Z transformed and then took the fractions on both? 03:04:05

A No, I think we took the fractions first.
Q And then you Z transformed the data?
A Yes.
Q So you took fractions, and then you Z transformed the data? 03:04:10
A That's my recollection, yes.
Q Okay. On the Figure 5-1, can you identify the Cargill sample by drawing a small circle around it and labeling it Cargill?
A (Witness complies.) 03:04:19
Q Can you identify the rest of the poultry samples, sir, by drawing a circle around that and identifying all poultry?
A Just the solid samples or the SPLP samples, as well? 03:05:03
Q The solid samples, sir.
A (Witness complies.).
Q And where does -- did the Cargill poultry litter sample fall within the same group as the rest of the poultry litter samples? 03:05:12
A It's on the edge of the group, but it's not distant from it.
Q So would you characterize them as being similar, from your analysis?
A Within the context of the analytes that Dr. 03:05:16

Olsen has chosen.
Q You mean analytes you chose for your own PCA; correct, sir?
A Which were the ones that Dr. Olsen had chosen.
Q I'll hand you what's marked as Exhibit No. 6, Dr. Murphy, and let me tell you that these are from Dr. Olsen's errata where he made the corrections from the log transformation mistake, calculation mistake, so these are corrected. 03:05:23
A I haven't seen these before. 03:07:05
Q You hadn't seen this as part of the errata that Dr. Olsen filed in this case?
MS. COLLINS: Just to be clear, you're referring to the February 10, 2009 disclosure?
MR. PAGE: I believe so, yes. 03:07:11
MS. COLLINS: So these same Pages 1, 2 and 3 of Exhibit 6 were actually attached to the February 10, 2009 disclosure?
MR. PAGE: Yes.
A That's not my recollection. 03:07:21
Q (By Mr. Page) Well, we believe so.
A The ones that I saw from the February whatever disclosure were different figures. They weren't the figures that were in my report.
Q Okay. Let me ask you this, sir. I can't tell 03:08:01

you for sure whether they were part of the exhibit or not, but these were figures that have been recalculated, produced based on the corrections to the calculation error that you pointed out.

MS. COLLINS: Objection. I don't believe 03:08:10
that these particular exhibits have been produced before.

MR. PAGE: Okay. I'm going to continue.

Q (By Mr. Page) Dr. Murphy, given that, that this shows Dr. Olsen's PCA for Figure 6-11-20c using 03:08:15
the correction from the log transform that you pointed out, we've put a red box around the Cargill; do you see that, sir?

A Yes, I see the red boxes.

Q And do you see whether -- can you tell us 03:08:25
whether or not the Cargill poultry litter samples fall within the rest of the poultry litter in this analysis?

MS. COLLINS: Are you representing to him
that this exhibit contains figures that reflect 03:09:01
corrections made by Dr. Olsen in connection with forming his February 10, 2009 disclosure but never before disclosed? Are you asking him to accept that basis?

MR. PAGE: Yes. 03:09:10

MS. COLLINS: Okay. And I object to the extent that this is new information that Dr. Murphy hasn't had a chance to view the underlying analysis of, much less these actual documents.

MR. PAGE: I understand. I'm using it for cross examination of this witness. 03:09:15

Q (By Mr. Page) Dr. Murphy, does the Cargill litter samples fall within the group of poultry litter samples shown on the first page of Exhibit 6 to your deposition? 03:09:24

A The samples that are identified as Cargill fall within the percent of all poultry litter samples identified as all poultry litter.

Q Okay. Do you see where the -- the cattle samples fall, sir, cow manure samples? 03:10:02

A Yes, I do.

Q Are they separate from the poultry litter samples?

A On this figure, they are separate.

Q Let's look at the second page of this. This is a similar document that was corrected using the analysis, the corrected analysis, but it's similar to Figure 3.2 of your deposition -- of your report. 03:10:10

MS. COLLINS: Same objection.

Q (By Mr. Page) Can you identify whether or not 03:11:04

the Cargill poultry litter samples fall within the rest of the poultry litter samples on this exhibit?

A The samples identified as Cargill are within the same portion of space. It's the other samples identified as poultry litter. 03:11:15

Q And are they separate, are the poultry litter samples on this separate from the cow manure samples?

A The samples identified as cow manure are at a different portion of the space. 03:11:23

Q Are the poultry litter samples on Exhibit -- second page of Exhibit 6 similar to the sediment and soil samples, they fall in the same locations?

MS. COLLINS: Object to form. Just for clarification, when you say sediment, can you be more specific? 03:12:07

Q (By Mr. Page) Well, let's ask just one question at a time. Are they similar to the surface soils, all at the same location as the surface soils? 03:12:12

A The poultry litter samples are occupying a different portion of the PC2, PC3 space than the surface soils.

Q And that's on the second page. What about on the first page, the second sentence there? 03:12:21

A There they are also occupying a different portion of the PC1, PC2 space.

Q Okay. On the second page, sir, of Exhibit No. 6, would you take that red pen and circle all the poultry litter samples, sir, and label poultry, all poultry, please? Sir, did you happen to -- oh, you've got that one up there, too. Okay. And would you circle the cow sample area of the location, sir, on this same page of this exhibit? 03:13:02

A (Witness complies.) 03:13:20

Q Label it cow manure. Pass me this, please.

A (Witness complies.)

Q Does this analysis on Page 2 of this exhibit indicate that some of the sediment samples are similar to poultry litter? 03:14:17

A Within the context of Dr. Olsen's analytes, some of the sediment samples are in the same part of space as the poultry litter, that is, PC2, PC3 space, not PC1, PC2 space.

Q If you'd turn back to Exhibit 3-1, sir, of your report. Can you identify the cow manure samples on that? Yes, sir. Would you circle those and label them cow manure? 03:15:03

A (Witness complies.)

Q And in your opinion, sir, does this plot 03:15:19

indicate that the cattle manure are a different type of samples than the poultry litter?

A It indicates that they do occupy a different portion of the space, in Dr. Olsen's uncorrected figure, and also within the context of Dr. Olsen's 03:15:32 analytes.

Q Did you investigate any -- did you investigate whether or not the soils in the IRW have phosphorus in them in excess of agronomic needs?

A Repeat the last word. 03:16:18

Q Agronomic needs?

A Oh. I did not.

Q Do you know whether or not the United States Geological Survey has designated the IRW as among the U.S. watersheds having the highest P 03:16:28 concentrations in surface waters?

A The highest what concen --

Q Phosphorus.

A P concentrations.

Q Sorry for the abbreviation. 03:17:03

A I'm not aware of that.

Q Okay. If that was the case, sir, would you have any understanding of why the IRW would have such high concentration of phosphorus in its surface waters. 03:17:11

MR. ELROD: Object, object to the form.
A Not without doing an investigation, a proper investigation.
Q (By Mr. Page) Is it your understanding that the USGS performs proper investigations? 03:17:15
A I would think --
MS. COLLINS: Object to the form.
A -- that's generally the case, but as you presented it to me, they were only identifying concentrations and not sources. 03:17:20
Q (By Mr. Page) Let me hand you what's marked as Exhibit No. 7. Have you investigated -- have you ever seen this document before, sir?
A I have not.
Q Have you done any investigation of phosphorus sources in the IRW? 03:18:07
A I have not.
Q Would you read the first sentence under the abstract on Page 1 of this report, sir?
A The Illinois River and tributaries, Flint Creek and Baron Fork, are designated scenic rivers in Oklahoma. 03:18:16
Q Do you know whether that's true or not, sir?
A I have no independent information.
Q Okay. Continue. 03:18:23

A Recent phosphorus levels in streams in the basin have resulted in the growth of excess algae, which have limited the aesthetic benefits of water bodies in the basin, especially the Illinois River and Lake Tenkiller. 03:18:28

Q Do you know whether or not that's true, sir?

A I have no independent information.

Q Let's skip down to the next paragraph, first sentence. Would you read that, sir?

A Phosphorus concentrations in the Illinois River basin were significantly greater in runoff samples than in base flow samples. 03:19:04

Q Do you know whether that's -- if that's true, sir?

A I have not investigated that. 03:19:10

Q Assuming that is true, hypothetically, would you have any explanation for why phosphorus concentrations would be significantly greater in runoff samples than in base flow samples?

MS. COLLINS: Object to form. 03:19:16

A That there is a source that's being captured by runoff samples, whether that's native soils, cow manure or poultry litter, I couldn't say, or some other source, wildlife.

Q What's the time period for this report, sir? 03:19:29

A The report carries a date of 2006.
Q And can you tell from Page 1 when the investigation occurred, what year they were investigating phosphorus?
A Well, the last year appears to be information 03:20:06
for 2004.
Q Would you read the last paragraph on the second column just above introduction, sir?
A The estimated mean annual phosphorus load entering Lake Tenkiller ranged from about 391,000 03:20:24
pounds per year to 712,000 pounds per year, and from about 83 to 90 percent of the load was transported to the lake by runoff.
Q Do you know whether or not that's true, sir?
A I have no independent information. 03:21:03
Q If most of the phosphorus was from native soils, would you expect the USGS to have concluded that there's a growth of excess algae, which has limited the aesthetic benefits of the water qualities in the basin, especially the Illinois 03:21:12
River and Lake Tenkiller?
MS. COLLINS: Object to form.
A I don't have any expectation.
Q (By Mr. Page) Do you know whether before people activities began occurring in the IRW, 03:21:18

whether or not there was any problem with algae growth in the rivers within the IRW?

MS. COLLINS: Object to form.

A I do not have any information.

Q (By Mr. Page) If you had that information, 03:21:25
would that help you determine whether or not natural soils are the source with the contaminants that are being investigated in this case, that is, phosphorus?

A It could be a factor. Increased population 03:22:01
could mean increased deforestation and increased tilling and so on, so it's not a clean-cut analysis, but it could be a factor.

Q Above the last paragraph you just read, could you read where it begins, estimated mean flow 03:22:16
weighted concentration?

A Estimated mean flow weighted concentrations are more than 10 times greater than the medium [.022 milligram per liter] and were consistently greater than the 75th percentile of flow weighted phosphorus 03:22:20
concentrations in samples collected at relatively undeveloped basins of the United States.

Q Can you tell me what that means, sir?

MS. COLLINS: Object to the form.

A They're comparing this basin with relatively 03:22:29

undeveloped basins and stating that the concentrations are higher in this basin.

Q (By Mr. Page) If that's true, sir, do you know of any reason why that would be the case in the IRW? 03:23:09

MS. COLLINS: Object to form.

A I don't know if it's related to population or to some other factor.

Q (By Mr. Page) Could it be related to poultry land application of litter? 03:23:15

MS. COLLINS: Object to form.

A It's conceivable that would have a role, but before concluding that, I'd have to investigate other possibilities, as well.

Q (By Mr. Page) Do you know whether or not phosphorus in natural soils is significantly soluble? 03:23:20

MS. COLLINS: Object to form.

A I have not investigated that.

Q (By Mr. Page) Do you know whether or not phosphorus in poultry litter is significantly soluble? 03:23:26

A I --

MS. COLLINS: Object to form.

A -- have not investigated that, but again, you 03:23:32

1 know, we had the earlier discussion about
2 transporting particulate matter as well, so solubles
3 phosphorus doesn't cover everything.
4 **Q** (By Mr. Page) So it's your opinion, sir, that
5 particulates on the land would also transport into 03:24:08
6 the adjacent rivers and streams?
7 MS. COLLINS: Object to form.
8 **A** I think that's likely, yes. There's going to
9 be erosion both from land and from river banks,
10 particularly during high flow conditions. 03:24:16
11 **Q** And would you suppose, sir, that erosion or
12 particulates from litter would be the -- would run
13 off in land applied litter areas?
14 **A** I don't know what the relative proportions
15 would be. 03:24:26
16 **Q** They would both likely run off in your
17 scenario?
18 **A** It's possible for both to run off, yes.
19 **Q** Do you know whether or not -- and this may be
20 redundant, I apologize for this, I just want to make 03:25:05
21 sure I've covered it, do you know whether or not
22 poultry waste is typically applied within a few
23 miles of the poultry house where it's produced?
24 MS. COLLINS: Object to form.
25 **A** I don't believe I have any information on 03:25:12

where poultry waste was applied, and in saying that, I want to correct my early statement that Randy O'Boyle indicated to me where it was applied on the Cargill growers. He, in fact, did not. It was the poultry houses he identified for me. 03:25:21

Q And so you don't know, when you try to determine a downstream impact, whether or not the litter from those houses had been applied in the same areas those houses are located in?

A I don't know where the litter was applied. 03:25:28

Q In order to determine impact from Cargill operations, which is more important in your opinion, where the litter is land applied or where the chickens are grown?

MS. COLLINS: Object to form. 03:26:05

A They're turkeys, not chickens.

Q Where the poultry is grown?

MS. COLLINS: Same objection.

A Well, if the turkey litter is a source, a significant source, then you'd want to know where it's applied, and look downstream from that. The house, per se, is not a source. 03:26:12

Q It's still released from the house, as far as you're aware of?

A I haven't seen any discussed. 03:26:19

Q If there is a release from land application, if there is any release from poultry growing operations, it would more likely be where the land application is located; is that correct?

MS. COLLINS: Object to form. 03:26:26

A That seems reasonable to me, but I haven't looked into it.

Q (By Mr. Page) Have you evaluated the chemical composition of cattle waste?

A Only to the extent that it's in my PCA analysis. 03:27:09

Q You've not done any evaluation of the constituents compared to the poultry waste constituents to see if there are any differences?

A Only through the PCA analysis. 03:27:15

Q Did you compare the SPLP analysis between poultry and cattle?

A Only through the PC.

Q Did you ever look and see whether there's a difference in the leaching characteristics between poultry and cattle waste? 03:27:20

A Only through the PCA.

Q Can you tell us what your understanding of the native soils are in the IRW?

A I've seen them described as turkey soils. I 03:28:02

don't know the extent to which that applies, to the entire IRW or just a portion, but that's the description I've seen.

Q Okay. Do you know anything about the geological formations in the IRW? 03:28:09

A I know that it's a limestone and that it's a limestone that has gaps in it, fractures and pits and so on.

Q In your experience, would such a geological formation be conducive to infiltration of water in subsoil areas? 03:28:17

A It could be.

Q Have you heard -- have you -- have you heard the IRW geology to be referred to as a mantled Karst? 03:28:28

A I've heard the Karst part of it. I don't know if I've heard the phrase mantled Karst.

Q What is Karst, sir?

A Karst is the situation I just described of limestone that's fractured, punctured and so on. 03:29:02

Q Would turkey soil facilitate runoff?

A Probably not as much as some other soils.

Q Which soils would have greater runoff in your opinion than turkey soils?

A I think high organic soils, farming soils. 03:29:14

Q And what --
A Topsoil.
Q Excuse me for interrupting. And why do you say that?
A Because you'd be making mud more readily, and that's what's running off into the streams is mud. 03:29:19
Q Is that -- is that because of the plowing of the soils?
A That would certainly be a factor, yes.
Q Are there any cultivated soils in the IRW? 03:29:29
A I haven't investigated that.
Q Do you know the relationship between cultivated soils and pasture soils in the IRW?
A I haven't investigated that.
Q Let's turn to Page 13 of your report, sir. 03:30:07
Under the background section to the third paragraph, would you read that out loud, sir?
A Following precipitation events, water can run off fields. Precipitation also percolates through the soil and may recharge groundwater. Exchanges of water occur between surface water and groundwater. 03:31:04
These exchanges manifest in the form of springs in both gaining and losing streams.
Q Is this your understanding of the physical processes that occur in the IRW? 03:31:12

A That is my understanding of physical processes that occur in some portions of the IRW.
Q Are you aware of any location in the IRW where such processes don't occur?
A I'm not, but this was meant simply as a 03:31:21
general paragraph to give the reader some background.
Q Can you think of any land where there's not -- like a concrete or asphalt cap on it where there
wouldn't be an infiltration through that soil in the 03:31:32
IRW?
A I haven't investigated that. I mean, what you really want to know is whether or not the transpiration is less or greater than infiltration.
Q Have you evaluated that, sir? 03:32:07
A No, I have not.
Q If there are particulates from poultry litter on the surfaces of fields, given this explanation of processes you provided, would you expect those
particulates to infiltrate into the soils, along 03:32:16
with infiltrating rainwaters?
A It really depends on the size of the particulate. I would suspect that they would not infiltrate to the extent that the rainwater does, as
particulate. 03:32:26

Q You would expect some particulates, depending on their smaller size, to travel and infiltrate into the soils?
A I don't know whether they'd ever reach groundwater or not, at least not in a particulate form. 03:33:01
Q What about dissolved materials, would you expect them to transport into the subsurface?
A It's possible.
Q What about particulate materials from poultry litter that you expect from the runoff of the fields or rainfalls? 03:33:08
A It's possible.
Q And what about dissolved materials from poultry litter, would you expect that to be part of runoff from fields? 03:33:14
A It's possible.
Q Do you recall in any of your environmental investigations, sir, whether it was either a spill or some kind of disposal of some type, accidental or intentional, of a contaminant on a ground where at least a portion of that contaminant did not run off with the rainfall? 03:33:23
A Well, that's a common finding at gasoline stations when there's a spill. 03:34:06

Q That it will not run off?
A Some will run off, but some will infiltrate into the ground.
Q Okay. Can you tell us of any circumstance where you did not find those circumstances to exist, 03:34:11
that is, it wasn't runoff or infiltration of the contaminant that was spilled or disposed of on soils?
MS. COLLINS: Object to form.
A Well, if you have a small enough spill of a 03:34:18
volatile substance, you can get it all evaporating before it infiltrates too deeply or runs off.
Q (By Mr. Page) Can you think of any other example that involves a small volatile spill?
A Well, a desert setting. 03:34:28
Q Other than that?
A I think that exhausts my other possibilities.
Q Would you look back on Exhibit No. 3, sir?
MS. COLLINS: Which one was that?
MR. PAGE: It's the retainer letter on 03:36:11
Exponent letterhead.
A Yes, thanks.
Q (By Mr. Page) Would you look at the second page and read the seventh task there?
A Prepare an expert report summarizing whether 03:36:22

or not Olsen's analysis provides evidence of a causal link between Cargill's operations and contamination of the Illinois River watershed.

Q What would be the most important operation in conducting this evaluation? 03:36:28

A Well, since it's to analyze Olsen's analysis, it would be to check his PCA and to run my own PCA, if necessary.

Q All right. What's the most important Cargill operation in that evaluation? 03:37:10

A Identifying the Cargill growers in the PCA analysis, and also locations that are downstream of those growers.

Q Wouldn't it be, rather than the growers' barns themselves, a location where the land applied litter occurred, and then compare locations downstream from land applied litter? 03:37:19

MS. COLLINS: Object to form.

A I don't have that information, and so the downstream locations of the growers' properties was the best that I could do. 03:37:25

Q (By Mr. Page) It would have been better if you would have had locations where Cargill litter had been applied; is that not true?

A Better for both me and Dr. Olsen's analysis. 03:38:02

Q Did you ask for this information, that is, information as to whether -- where Cargill operations or their contractors had land disposed of the litter?

A I did. I asked Randy O'Boyle when he was 03:38:12
showing me the photographs of the poultry houses, and I remember asking him, but my recollection now is that he said he didn't know where it was, where on the property it was.

Q And Randy O'Boyle is somebody at Exponent; 03:38:20
correct?

A Yes.

Q Did anyone from Exponent ask Cargill for this information?

A Not that I'm aware of. 03:38:24

Q Wouldn't that be logical to try to determine where the disposal sites are and determine whether or not there's any impact downstream from those disposal sites?

MS. COLLINS: Object to form. 03:38:32

A I would say it would be possibly useful information. I don't know whether anyone has asked for it or not.

Q (By Mr. Page) It would be more useful -- that type of analysis would be more useful than just 03:39:08

looking at where the barns for the poultry are drawn out to determine if there's an impact; is that not true?

A Well --

MS. COLLINS: Object to form. 03:39:12

A It might show you that the barns were a perfectly suitable surrogate.

Q (By Mr. Page) The best way to determine impact from land applied poultry litter would be to look at the location where the litter was applied 03:39:26 and then look immediately downgradient on any streams draining in that location; is that not correct?

MS. COLLINS: Object to form.

A If you broaden that to include looking at 03:40:02 other sources that are in that downstream location, that would be correct, and looking at suitable analytes.

Q (By Mr. Page) Do you think phosphorus is a suitable analyte to investigate whether or not 03:40:12 poultry contamination has occurred in ambient waters of the IRW?

MS. COLLINS: Object to form.

A I haven't done an investigation of the sources of phosphorus and so I can't respond. 03:40:18

Q If phosphorus is a chemical concern, wouldn't that be a focus of your investigation?

MS. COLLINS: Object to form.

A It would depend on the other sources. If you could form a connection between the source and 03:40:27 receptor through some other set of chemicals, you could use that relationship as a surrogate for a phosphorus relationship.

Q (By Mr. Page) Is there other ways you can determine that relationship other than the 03:41:03 association with other chemicals?

A Well, it might be possible to plan a measurement program where you could determine that relationship for a specific location.

Q Any other way? 03:41:16

A There may be, but since I haven't investigated it, I don't really have anything else to proffer.

MR. PAGE: Let's take our break.

VIDEOGRAPHER: We're off the record, 3:41 p.m. 03:41:26

(Following a short recess at 3:41 p.m., proceedings continued on the record at 3:55 p.m.)

VIDEOGRAPHER: We are back on the record, 3:54 p.m.

Q (By Mr. Page) Dr. Murphy, would you look at 03:54:32

Page 13 of your report that's Exhibit 1 to this deposition, under background of one, two, three, fourth paragraph down, would you read that paragraph for the record, please?

A The basic question is whether or not chemicals and bacteria found in poultry litter are released to the environment through precipitation in sufficient concentrations and then subsequently are transported with insufficient dilution or loss so that identifiable concentrations exist downstream in 03:55:08 03:55:16 recreation or other areas in any amount significant enough to cause harm.

Q Okay. In your evaluation in this case, sir, did you do any evaluation of concentrations downstream of poultry waste constituents? 03:55:22

A Nothing outside the context of principal component analysis.

Q And in your principal component analysis, you don't evaluate concentrations; correct?

A That's correct, I evaluate relationships. 03:56:03

Q So is it true to say that you do nothing in your evaluation of this case to evaluate identifiable concentrations from poultry waste in any downstream location?

MS. COLLINS: Object to form. 03:56:08

A Well, if there had been a poultry waste signature showing up in the PCA, then I would say there's something identifiable. The failure to see that signature, I would say, well, it isn't identifiable. 03:56:16

Q (By Mr. Page) So you're saying that only the PCA is the only method by which you can identify concentrations of a poultry waste constituent downstream from the land -- where it's land applied?

A Not the only way that one could in principle, 03:56:23 but the only way I can since that's the only analysis tool I used.

Q And you did not evaluate concentrations in streams; correct?

A Not raw concentrations. 03:56:29

Q Well, any other kinds of concentrations?

A Z score concentrations.

Q Okay. Those from Dr. Olsen's analysis?

A Yes, and also my own multimedia PCA.

Q And so it's your opinion that those Z scores 03:57:05 do have -- do tell you something about concentration; correct?

A I would say if the PCA analysis had shown score plots where the source and the receptor were in the same part of the multidimensional principal 03:57:12

component space, that that would be a good start on demonstrating a connection. It's the failure to do that that makes me feel there is no connection.

Q To do the Z transformation, sir, is it possible that the higher the PC score for a 03:57:20 particular sample does reflect a higher concentration?

A It is possible.

Q Did you do an evaluation of what level of contaminants would cause harm? 03:57:27

A No, I did not.

Q Are you offering any opinions in this case concerning the fate and transport of poultry waste within the IRW?

MS. COLLINS: Object to form. 03:58:07

A Well, only in pointing to the idea that you can't have poultry waste runoff without having native soil runoff, too, and also looking specifically at locations downstream and downgradient of Cargill growers, that's the only 03:58:18 transport and fate analysis I've done.

Q And what analysis did you perform that demonstrates that you can't have poultry runoff from a field without also having native soil runoff at the same time? 03:59:03

A That's the analysis where I looked at what was contributing to the loadings at the edge of field samples and saw that they were dominated by native soil components.

Q That's the poultry edge of field samples? 03:59:10

A Yes, as well as the cattle, no poultry, and so on.

Q Had you ever visibly observed runoff from a field into the IRW?

A Not in the IRW, no. 03:59:17

Q Did you ever compare -- let me strike that. Do you know of any pasture within the IRW that has not been a location where poultry litter has been land applied?

MS. COLLINS: Object to form. 03:59:28

A I don't have any information about that since I don't know where poultry litter has been applied.

Q (By Mr. Page) Let's look at Page 15 of your report. The third paragraph under 2.2, would you read the first sentence of the third paragraph, sir? 04:00:14

A As indicated in Table 2-1, it does not appear that Olsen's reference samples represent true background or reference conditions, that is, unaffected by poultry litter, but affected by other factors, such as wastewater treatment plants, urban 04:00:21

runoff, septic tanks, et cetera, to the same degree as other locations.

Q Would you stop there, please, sir? Do you know whether or not any such locations exist that could be sampled within the IRW? 04:00:28

A I have not investigated that.

Q And why would it be important in your mind to evaluate as a reference condition an area that's unaffected by poultry litter but affected by other factors such as wastewater treatment plants? 04:01:06

A To find out what background is.

Q Couldn't you find out what background is by locating an area that has no sources whatsoever contributing to it?

A You could, particularly if you took edge of field samples in those locations. 04:01:15

Q What about streams in those locations, do they also represent background in streams?

A They represent stream background, yes.

Q Do you know whether or not wastewater treatment plants, urban runoff or septic tanks are significant sources of phosphorus to the IRW rivers and streams? 04:01:23

A I have not investigated that.

Q If a chemical of concern is phosphorus, would 04:02:01

that information be important to how you construct your evaluation as to source contributions?

A Not from my evaluation, which is strictly in the context of principal component analysis. Someone else could do that evaluation. 04:02:11

Q Would that be important, based on your knowledge of environmental forensics, for determining source?

A It could be.

Q Isn't it true, sir, that principal component analysis, the best types of samples are those that are ambient water samples from which you can determine, or sources based on the ambient waters themselves? 04:02:17

A I either don't understand the question or I'm drawing a complete blank on the answer. 04:02:29

Q Would you agree, sir, that in environmental forensics investigations, the investigator rarely has a priori knowledge of all sources?

MS. COLLINS: Object to form. 04:04:13

MR. ELROD: Object to the word a priori.

A It sounds like you're quoting from something written by Glenn Johnson. I'd have to see the statement in its full content, but I don't disagree with that statement. 04:04:23

Q (By Mr. Page) Okay. Would you also agree that you would like to derive source patterns directly from analysis of ambient data?

MS. COLLINS: Object to form.

Q (By Mr. Page) In the context of principal 04:05:01
components analysis?

A Well, again, Glenn's chapter is about more than principal component analysis, it's also about polytopic vector analysis and other methods where you can identify sources directly from the data. 04:05:09
Principal component analysis, you can't.

Q You can identify groups of samples that appear to be related to the same source; correct, principal component analysis?

A You can identify groups of samples that behave 04:05:17
as if they were -- or analytes that behave as if they were coming from the same source.

Q And that would be a piece of evidence to determine source identification and evaluation, would it not? 04:05:23

A It could be a piece of evidence, yes.

Q Let me hand you what's been marked as Murphy Exhibit 8, and I can tell you, Dr. Murphy, that these are pages from Dr. Engel's expert report in this case. Have you testified you have reviewed Dr. 04:06:17

Engel's report?
A I testified that I had not.
Q I thought it was listed in your considered materials in this case; was I mistaken?
A I think I received it, but I didn't -- I don't recall reviewing it. 04:06:24
MS. COLLINS: I don't think so.
Q (By Mr. Page) You don't recall reviewing it, sir?
A I do not. 04:07:05
Q Let me ask you this, sir. Would you turn to the third page, which is a pie chart. Could you identify what Dr. Engel has identified as mass balance as the leading sources of phosphorus in the IRW? 04:07:15
A He identifies the leading source as poultry.
Q By review of this -- would this type of information in this pie chart help you determine which sources you should evaluate through a PCA?
A I think before I did that, I'd want to look at the information and see if it's correct. 04:07:27
Q Okay. Let's assume it's correct.
A If we assume it's correct, then I would say that poultry would be a reasonable thing to look at. You should look at other sources, too, but that 04:08:05

would one that shouldn't be overlooked.
Q Based on this information in Exhibit 8, are there any other sources that you would feel important to look at in an evaluation of PCA?
MS. COLLINS: You're limiting his answer 04:08:12
to sources reflected in this document?
MR. PAGE: Yes.
A Okay. So I won't mention native soils, then, since it's not reflected here. Commercial fertilizer shows up in his pie chart, dairy cattle 04:08:18
show up, human, which I imagine is wastewater treatment plants but I don't really know, or maybe septic tanks, those seem to be the other major sources in his pie chart. Whether they are in reality or not, I don't know. 04:08:32
Q (By Mr. Page) If those sources are in fact significant contributors, would you expect to find a pattern in a PCA analysis of ambient waters in the watershed?
MS. COLLINS: Object to form. 04:09:08
A You're always going to find a pattern in a PCA analysis.
Q (By Mr. Page) Would they be identified as a significant PC if they were significant sources of contamination? 04:09:14

A Not if you're -- well, if you're just looking at ambient waters, it's hard for me to see how PC analysis can identify sources. You're going to have to look at sources, too.

Q Wouldn't the ambient waters, if you did a PCA analysis of ambient waters, wouldn't it be able to determine, based on principal components it identified, separate groups of samples that were contaminated by a similar source? 04:09:32

A It would show you which sources are related -- which samples are related to which other samples. It would tell you which chemicals behave as if they had a common source, but it wouldn't tell you what that source is. 04:10:10

Q Okay. And would you expect that if there was a source in the IRW that was a very small contributor to contaminants, would you expect that to have an influence that you could see in a PCA analysis? 04:10:17

MS. COLLINS: Object to form. 04:10:28

A Well, it could be a small contributor for phosphorus, which is only one analyte, and your PC analysis typically has 20, 30 analytes, so it could be a major contributor for those other analytes. You can't do a PC analysis on one analyte. 04:11:04

Q I didn't suggest that.
A Okay.
Q What I'm suggesting is is that if a particular source in the -- a source of contamination in the IRW contributes very few contaminants, would you 04:11:11
expect to see that source -- a PC identify with that source in your PCA?
MS. COLLINS: Object to form.
A I would not find a PC identified with any source because to me, principal components do not 04:11:19
represent sources. They are totally mathematical constructs. They don't represent sources.
Q (By Mr. Page) Would you expect to see a PC associated with a source that had very few contaminants contributed? 04:11:26
MS. COLLINS: Object to form.
A I'm not sure I know what associated with means either. PC can tell you what samples are related to what other samples, that is, have the same signature, and it can tell you what analytes behave 04:12:07
as if they had a common source, but it doesn't identify sources.
Q (By Mr. Page) Would you expect to find a signature, a PC signature, a term you just used, for a contaminant source that contributes very minimal 04:12:13

contaminants to the ambient waters?
MS. COLLINS: Object to form.
A It's possible because PC is about variability, not about total concentration.
Q (By Mr. Page) Can total concentration affect variability? 04:12:21
A It can.
Q Did you have any mass balance information available to you for your evaluation, sir?
MS. COLLINS: Object to form. 04:13:09
A I don't recall. I certainly didn't use any mass balance information. I don't recall seeing any.
Q (By Mr. Page) Did you have any modeling information available to you, sir, that is a runoff model? 04:13:18
A I suppose it was available to me in the sense that I had access to Dr. Engel's report, but it wasn't germane to what I was doing.
Q Is that because you're simply focusing on PCA? 04:13:26
A And the specific measurements that were taken at the Cargill growers, focusing on two things.
Q Would the mass balance information that's available in Exhibit 8 help you to do an evaluation of potential sources in the IRW? 04:14:05

MS. COLLINS: Object to form.
A It could if it's correct, but I have no idea if it's correct or not.
Q (By Mr. Page) Could it help you interpret PCA results for the IRW? 04:14:11
MS. COLLINS: Object to form.
A It's conceivable. I don't know what the report looks like. And in the absence of any information, I can't reject it out of hand.
Q (By Mr. Page) Let me hand you what's been 04:14:24 marked as Exhibit 9. Can you identify that, sir?
A It's selected pages from a book that I edited called Introduction to Environmental Forensics, Second Edition.
Q And Chapter 7 is entitled what, sir? 04:16:05
A Principal components analysis and receptor models in environmental forensics.
Q Okay. I selected a page from that report, sir, it's Page 234, it's the next page following that chapter heading. 04:16:15
A Right.
Q Would you read the first two sentences -- excuse me, three sentences of the second full paragraph on page 234?
A In assumption of the conceptual mixing 04:16:20

models --

Q I'm sorry, the next paragraph.

A After the choice of K, see section 724, the receptor model then resolves the chemical composition of sources F, and the contribution of 04:16:26 the sources in each of the samples A. Recall, however, that in environmental forensics investigations, we rarely have a priori knowledge of all sources. If possible, we would like to derive source patterns directly from the analysis of 04:17:02 ambient data.

Q Could you stop there? Do you know what the author means by if possible, we would like derive source patterns directly from analysis of ambient data? 04:17:09

A This is in his section on self-training receptor modeling methods. It's not about PCA. PCA is described in earlier pages, 214 through 232, so this is in the context of things like polytopic vector analysis. What he's saying, within the 04:17:17 context of the measurements themselves, you can determine how many sources there are, what the composition of the sources is, and how much each source is contributing to each measurement, and you do that by relaxing some of the constraints on PCA. 04:17:25

Q Can you derive source patterns in PCA?
A I don't believe so.
Q You don't believe you can?
A Not really, it's not set up to do that.
It's constrained by having the PCs be orthogonal to 04:18:02
each other, and because of that constraint, the PCs
don't generally correspond to sources.
Q Okay. Can you -- do you agree that if
possible, you would like to derive source patterns
directly from analysis of ambient data, do you agree 04:18:10
with that statement?
A Yes.
Q With the PCA analysis, do you agree that that
statement is applicable also to PCA analysis?
A Source patterns, but not determining sources. 04:18:18
That's why it's in this section of his chapter and
not in the earlier PCA section.
Q So for PCA analysis, is it important to have a
sample collection from all sources in order to do a
PCA analysis? 04:19:03
MS. COLLINS: Object to form.
A I think that's generally the case, yes.
Q (By Mr. Page) So you think it's necessary to
have a sample from all sources in order to do a PCA
analysis? 04:19:11

A I would say it's useful. If your -- if your PC analysis is dominated by transport phenomena rather than by sources, it won't matter whether you have all sources or not because it will be simply how chemicals partition different ways in different 04:19:18 media.

Q Are you aware of investigators that have published peer review reports where they did not have samples for all the sources they were investigating? 04:19:25

A For a PCA analysis?

Q Yes.

A I'm not surprised, but I wouldn't think they could draw conclusions about the sources they hadn't investigated. 04:20:04

Q Could they not identify which components for a PC loaded the highest and then compare those loadings with what they knew about the constituents in a potential source?

A Again, loadings don't have to do with 04:20:16 concentrations, they have to do with what's contributing to variability.

Q Have you seen investigators in published reports on PCA, principal component analysis, evaluating loadings to determine sources? 04:20:25

A I've seen cases where they identify a particular sample as being an archetype, that is, it's highly loaded on one PC and is zero on the other, so its composition then in particular for that sample does reflect that PC. 04:21:05

Q Okay. Have you seen circumstances where you'll have one particular example as far as the PC from that source, but they look at the loadings for a particular PC, and then compare it to an analysis of the source material that's not used in the PC in 04:21:13 order to determine whether that particular PC is related to that particular source?

MS. COLLINS: Object to form.

A I don't recall such publications as I sit here. I suspect we'll be looking at them. 04:21:21

Q (By Mr. Page) Yes, sir. Does Olsen use the results of ambient samples to derive source patterns in his PCA?

A I would say he claims to.

Q Would this approach identify all major 04:22:10 sources, patterns?

A Well, see, I don't believe it's identifying sources. I believe it's identifying different -- differing transporting phenomena and different media. 04:22:17

Q I'm talking about major source patterns.
A Would you repeat the question?
Q Would this approach identify all major source patterns?
A Olsen's approach? 04:22:24
Q Yes.
A No.
Q Why not?
A Because the results of his approach are dominated not by sources but by different 04:22:28 partitioning in different media.
Q Could you be more specific in that regard, sir?
A Well, in the -- in the edge of field samples, for example, you see muddy water. In the stream 04:23:05 samples, as --
Q Would you stop right there?
A Yeah.
Q Where in your evaluation did you determine muddy waters? 04:23:10
A Well, I know what happens when you mix mud and soil -- I mean, when you mix water and soil.
Q Let me ask you something. You did not look at any concentrations of any edge of fields; is that your testimony or not? 04:23:15

A Not the concentrations.
Q Okay. So how would you know whether or not a particular edge of field sample is muddy or not unless you looked at the concentrations of the constituents that are running off? 04:23:23
A Well, I know it's in soil. I know the compounds that are in soil that are in Dr. Olsen's list of analytes, and those are the concentrations that are varying on the loadings, as if they had a common source, as well as the organic carbon is 04:23:29 varying with those metals, suggesting to me that they do have a common source, and since all of those things are found in soil, it appears to me that soil is the likely source.
Q Okay. How would you define muddy water? 04:24:06
A It's what happens when you mix soil and water.
Q And how much soil is necessary to make it muddy?
A It's a hard question to answer. It depends on your definition of muddiness, whether it's visible 04:24:17 muddiness, measurable muddiness.
Q What's your definition? You used the term. I'm asking you for your definition.
A My definition would be muddy enough to show those analytes appearing in your PC analysis for 04:24:24

edge of field.
Q So what concentration would that be?
A I haven't looked at concentrations, I've only looked at the results of variates.
Q So how would you know what the sufficient amount is to be able to see it in your PC? 04:24:32
A By the end result, that it shows up in the PC analysis and the loadings.
Q For all nondetects, would that show any kind of a variable pattern? 04:25:08
A I'm not sure I understand the question.
Q If there weren't sufficient concentrations running off, would you be able to discern a pattern for that runoff in a PCA analysis?
A If there weren't sufficient concentrations of any analyte to be detectable. 04:25:25
Q No, I'd say it was detectable.
A Then you should be able to use it in your PC analysis.
Q You've been given the dilution effects once the runoff reaches the streams and rivers? 04:26:03
A It's possible that some analytes might show up in the edge of field samples and not show up in the surface water samples because of dilution effects.
Q So don't you have to have sufficient 04:26:11

concentration of a contaminant source in order to be able to detect it in your PCA to determine whether it's presenting itself as an identifiable pattern in your PCA?

A You do have to have a detectable concentration in order to use it in your PCA analysis. 04:26:17

Q Do you have to have more than a detectable concentration?

A No, I think you can use it in your PC analysis if you can detect a concentration. 04:26:25

Q And you believe that will show a pattern in the rivers and streams of the IRW as long as it's detectable as it rolled off the edge of the field?

MS. COLLINS: Object to the form.

A Because it's about relationships between different analytes and between different samples. It's not about concentrations, it's about all of the concentrations or analytes. 04:26:32

Q (By Mr. Page) With sufficient dilution, would you still be able to discern those relationships? 04:27:06

MS. COLLINS: Object to form.

A If the analytes in question behaved the same, you would. You could have iron and aluminum at a thousand parts per million, it goes into the stream, it's down to one part per million. If the 04:27:13

relation -- if the fate and transport is the same, the relationship stays the same.

Q (By Mr. Page) Let's turn to Page 16 of your report.

MR. ELROD: Sugar and refined flour, man, there's nothing better. 04:28:24

Q (By Mr. Page) Okay. I'm sorry, it's Page 15. In the bottom paragraph, the second sentence where it begins, these analytes, would you read that, please, sir, for the record? 04:29:15

A On page 15?

Q Yeah, the bottom of Page 15, the bottom paragraph, the second sentence, where it begins, these analytes. The bottom of Page 15.

A Actually -- 04:29:24

MS. COLLINS: The pagination is a little different for some reason between --

A Is it the one that says, the analytes chosen by Dr. Olsen?

Q (By Mr. Page) Yes, that's the paragraph, and then the sentence I want you to read is the one following that. 04:29:29

A Okay. These analytes also include much double counting. For example, E.coli and enterococci and fecal coliform all measure fecal coliforms, yet all 04:30:04

three are included in the PCA.
Q Let's stop there. Is it double counting when you use E.coli, enterococci and fecal coliform?
A This is the error I referred to earlier. Enterococci should be a total coliform. 04:30:13
Q Okay. So it's not a fecal coliform?
A No, it is a fecal coliform. E.coli -- total coliform and fecal coliform all measure fecal coliforms.
Q Is it your testimony, sir -- well, I'm trying 04:30:24 to understand what your correction is. You say E.coli, enterococci and fecal coliforms are all measures of coliforms. Is that your testimony or not?
A No, it's not. I want to substitute the word 04:30:32 total coliform or the words total coliform for enterococci.
Q Oh, I see. Total coliforms. So is it your testimony, sir, that total coliforms are measures of fecal coliforms? 04:31:11
A It would contain fecal coliform in them, yes, so it would be an example of triple counting.
Q Okay. And when you performed your PC analysis, did you take this into account?
A As I indicated earlier, I performed my 04:31:17

analysis to simulate Dr. Olsen's analysis, and so no, I did not try to weed out the duplicates.

Q Do you know whether or not Dr. Olsen performed any sensitivity analysis on these bacteria to determine whether or not this double counting that you allege actually had an effect on the PCA? 04:31:25

A I -- he may have, I do not recall.

Q If his sensitivity analysis showed that it had no effect, then would you then change your opinion to say that it would not have a problem for double counting with regard to these bacteria? 04:32:11

A No, I would say whatever problem exists is subsumed under the larger problem of having the analysis dominated by media and not by -- and not by sources, so it may not show up in his sensitivity analysis. That doesn't mean that it wouldn't have an effect in a more rigorous or appropriate analysis. 04:32:28

Q Are you suggesting, sir, that you would stand by your statement concerning double counting of bacteria if Dr. Olsen's sensitivity analysis showed it had no definable, measurable impact on his PCA results? 04:33:05

MS. COLLINS: Object to form.

A I would have to look at what -- what he wrote. 04:33:12

Q (By Mr. Page) And at this point in time, you did not look at that as part of your review?
A I believe I did look at it, but I don't recall the specifics.
Q Okay. Would you read the next part of the 04:33:17
sentence then that starts, both?
A Both total, and I'm not even going to try to pronounce that, K-J-E-L-D-A-H-L nitrogen and nitrite plus nitrate are included in three measures of phosphorus. 04:33:24
Q Would you stop there, sir?
A Yeah.
Q What's the problem with Kjeldahl nitrogen and nitrate -- nitrite and nitrate being included, how is that double counting? 04:33:28
A Well, if you add them together, you get total nitrogen, and so what you're really -- if one is low, the other is going to be high, so they are -- they are already correlated.
Q Is there any double counting involved by using 04:34:08
those two?
A It's not exactly double counting. Well, it is double counting. When you use variables that are already correlated, it undercuts your variance analysis. 04:34:14

Q What's your basis for suggesting that Kjeldahl nitrogen and nitrate -- nitrite plus nitrate are correlated?
A That they measure different nitrogen compounds, so if one is high, the other tends to be 04:34:20 low.
Q How do you know they are correlated?
A I don't have an explanation beyond what I've told you.
Q Don't Kjeldahl nitrogen and nitrate plus 04:34:28 nitrate measure different substances?
A Yes, they do.
Q So how can one be high and the other be low in a correlation factor?
A If you add them together and get total 04:35:03 nitrogen, and total nitrogen is a constant, you can have one high and the other low and they will be very correlated.
Q You do agree that they are different species; correct? 04:35:11
A Yes.
Q So it's not like we're double counting nitrogen, are we?
A Not twice, no. But again, the issue is trying to avoid variables that are correlated in some way 04:35:15

with each other.
Q And I have yet to hear an explanation how you're suggesting that things that are totally different analytes are correlated any more than nitrate and nitrite might be correlated with copper. 04:35:21
MS. COLLINS: Object to the form.
Q (By Mr. Page) A priori.
MS. COLLINS: Object to form.
A I don't have anything to add beyond what I've told you. 04:35:27
Q (By Mr. Page) You have no explanation?
A Beyond what I've told you, no.
Q Would your explanation apply to the relationships between Kjeldahl nitrogen and copper, that there would be a correlation with those two? 04:36:06
A Not a priori, as you used the term.
Q And so it's your statement, sir, that in all circumstances where Kjeldahl nitrogen goes up, nitrate and nitrite in that sample will go down?
MS. COLLINS: Object to form. 04:36:17
A I'm not. I'm simply saying they're correlated, and when you're doing an analysis that is looking at correlations, you want to avoid things that are correlated in the beginning.
Q (By Mr. Page) Would you continue, sir, after 04:36:24

the next semicolon?
A Three measures of phosphorus are used.
Q Okay. Did you -- what's your complaint about the different phosphoruses?
A It suggests correlation. 04:36:32
Q Okay. Did you look at the sensitivity analysis that was performed by Dr. Olsen to see whether or not by him using three different measures of phosphorus had an impact on the PCA?
A As I stated, I believe I did look at it, but I 04:37:08 have not -- I do not recall the details.
Q Could the form of nitrogen, whether it be Kjeldahl nitrogen or nitrate plus nitrite help you determine a source of those contaminants?
A Outside the context of PCA analysis, yes. 04:37:19
Q But not within PCA analysis, in your opinion?
A Well, I think you have to use a great deal of care using variables that are likely correlated.
Q Can you use them in PCA analysis?
A You can use them and you'll get a pattern, but 04:37:28 I think your results are more reliable if you don't use correlated variables.
Q Would you read the next sentence, sir, through the first sub A?
A The net effect is to A, potentially let native 04:38:08

soils dominate the PCA.
Q Would you stop there, sir. Did you do any additional evaluation to demonstrate that native soils did dominate Olsen's PC analysis?
A No, and he's done no -- has no indication that they don't. 04:38:16
Q Okay. Would you read the next, sir?
A And B, overweight the analytes that are multiply counted.
Q Did you do any evaluation to determine whether or not there is an overweight of the analysis that you claim are multiply counted? 04:38:22
A I did not do any sensitivity analysis of that.
Q You claim here that Dr. Olsen did not use compounds such as sterols in the analysis, but at this point in time, you don't know whether that would have helped the PCA analysis or not; is that correct? 04:39:04
MS. COLLINS: Object to form.
A No, but I would suggest the word such as, that I'm not suggesting that sterols are the be all and end all. 04:39:09
Q (By Mr. Page) You haven't mentioned any more in your report or your deposition today, have you?
A No, but I've told you in the deposition today 04:39:13

how I'd go about identifying those compounds, by trying to isolate things that aren't in native soils.

Q Will you turn back to Page 8 of your report, sir? I think we talked earlier when you mentioned 04:40:16
we talked about he did not use all the data in his analysis, right, that's what you claim?

A Yes.

Q Okay. I want to look first at Page 19 then. I think you followed up on that comment. You see 04:41:01
the third paragraph from the top, the second full paragraph, the sentence -- second sentence there where it says, the only two. Would you read that for the record?

A The only two groundwater samples associated 04:41:11
with Schwabe's farm were excluded because they had too few analytes detected to meet Olsen's inclusion criteria.

Q Would you stop there? What's the basis for that statement, sir? 04:41:18

A I looked at SW3 and SW17, which are the two runs that are mentioned in it -- that his report relies on that are water runs, and I did not see those groundwater samples in those runs.

Q Are you positive? 04:41:25

A Well, I could be proven wrong, but that's my belief.

Q Okay. So it's your testimony, sir, that Dr. Olsen did not use the two Murphy groundwater samples in his PCA analysis; is that correct? 04:42:17

A The two what groundwater samples?

Q What did I say?

A Murphy.

Q Well, they probably didn't use Murphy groundwater. Let me try to restate the question. 04:42:22 Is it your testimony, sir, that Dr. Olsen did not use the groundwater samples from Schwabe in his PCA analysis?

A In SW3 and SW17, he only used the geoprobe sample. That was the only groundwater sample. 04:42:32

Q And SW3 is what run, sir?

A It's the surface water three run, that and SW17 are the two runs that form the basis of his report.

Q So surface water is SW3 by itself, and isn't it true, sir, that groundwater was included as surface water, so SW17 was a groundwater and surface water run? 04:43:06

A That's my recollection, yes.

Q So you wouldn't use a Schwabe groundwater -- 04:43:13

A No, SW17.
Q Okay. Do you recall the sample designations for SW17?
A LAL-16-GW-1 and LAL-16-GW-2.
Q And where did you get that information, sir? 04:43:32
A I got that information from a --
Q Is it in your report somewhere?
A Well, the source is -- is not. The information I'm quoting is on Page 18, first -- second paragraph. I can't recall if I got that 04:44:13 information from going through Dr. Olsen's materials or whether I got it from the database that was prepared for me for the Schwabe and Masters' locations. I think it may be the latter.
Q So it's your testimony, sir, that -- okay. 04:44:23 I'll strike that. Let me go back to Page 19. When you stated then that Dr. Olsen improperly did not use the groundwater analysis in SW3 on the second line of the third paragraph report on Page 19, you were mistaken in that term; is that correct, sir? 04:45:05
A That isn't exactly what I said, but, no, you're right, the SW3 is a surface water.
Q So it shouldn't be included with this sentence; correct?
A That's right. 04:45:10

Q Okay.
A Except it supplies to the spring water samples, which I think are in the SW3.
Q Are you sure about that, sir?
A I believe he took out one of the spring samples as being contaminated by cattle, LAL-16-SB-2. 04:45:26
Q Is it your testimony, sir, that spring samples, any of them, are intended to be part of the SW3 evaluation by Olsen? 04:46:05
A I don't recall. I would have thought they would have been in the surface water category, but they may be in the groundwater category.
Q So let's see which samples are identified with Schwabe. Let me hand you what's marked as Exhibit 10. I'll represent to you, sir, this is a table taken from Dr. Olsen's report, which shows the groundwater sample locations. Can you identify the sample ID for Robert Schwabe? 04:46:17
A GW9 and GW10. 04:47:06
Q And how did you identify that, sir?
A It's the first -- by looking at the first column and the fourth column together.
Q Would you circle those on this exhibit, sir, that is, the name of the property owner and then the 04:47:16

sample ID? So looking back on Page 18, have you misidentified the Schwabe groundwater samples in your designations here on the second paragraph of Page 18?

A No. GW10 and GW9 are used interchangeably with LAL-16-GW-1 and LAL-16-GW-2. 04:47:28

Q Okay. Is it your testimony, sir, that you tried to reproduce Dr. Olsen's results, so you would have used the same groundwater samples in your analysis as Dr. Olsen did? 04:48:18

A In the multimedia analysis?

Q Yes.

A I used the same samples if they had had measurements for all of the analytes.

Q And do you recall whether or not the Schwabe groundwater samples had measurements for all the analytes? 04:48:24

A I'd have to look in my report. Well, it looks like at least one did. Looking at Page 42, and I see one light blue groundwater cross surrounded by a -- probably by a red square, although I can't tell if it applies to that light blue cross or to something else in that patch. 04:49:13

Q Okay. So it's your testimony, sir, that both -- based on what you reviewed in your report, 04:49:23

both of the Schwabe samples were not used because they both did not have all the analytes analyzed?

A That's my recollection.

Q Okay. Let's see if we can refresh your recollection here some, sir. I'm going to hand you 04:50:02
two exhibits, that's always difficult for me because sometimes I mark them off. Let me hand you No. 11 first, and then I'll hand you -- that's 11, and let me hand you now what's been marked as No. 12, and, sir, these are from the considered materials from 04:50:21
Dr. Olsen, which you received through your counsel, and I'm sorry, I'll represent that these are screen shots from the PCA analysis for SW17. Can you see whether or not on Exhibit 11 the Schwabe groundwater sample was in fact used as groundwater No. 9 sample, 04:51:03
was in fact used in the SW17 analysis by Dr. Olsen?

MS. COLLINS: Object to form.

A It does appear in this list. I can't tell which analytes, if any, are missing, however.

Q (By Mr. Page) But it does shows that Dr. 04:51:13
Olsen used the Schwabe groundwater 9 sample in his PCA analysis; correct?

MS. COLLINS: Object to form.

A He may have at some point, but the SW17 that appears in his report, my recollection is not -- 04:51:20

does not use that groundwater sample.
Q And what's your basis for that, sir?
A Looking at the lists of samples that occur in the -- in that run.
Q Okay. This is -- sir, I'm going to represent 04:51:28
to you this is a list of the samples that are in the run. It shows the screen shot.
MS. COLLINS: Object to form.
A If it is the case that all the analytes
continuing off to the right, and we only see half a 04:52:05
dozen out of what, 28 or something, if it is the case that all the analytes off to the right are also detects -- well, some of these are nondetects. I mean, I can see that total arsenic is .0005 for a
number of samples, and so that's a default of either 04:52:17
the detection level or half of the detection level, and I can see that total aluminum is .05 for a number, which tells me it's also either nondetect or detection level.
Q (By Mr. Page) Did Dr. Olsen exclude any 04:52:24
samples based on the amount of nondetects?
A I don't believe he did.
Q Okay, sir.
A Well, no, I recall in some cases I believe he
did. 04:53:03

Q You're under oath, you know.
A Yes.
Q Is that your sworn testimony today, that Dr. Olsen did not use some samples based on the amount of nondetects? 04:53:08
A That is my recollection. I would need to check to verify it, but that is my recollection as I sit here today.
Q Doesn't Exhibit 11 indicate to you, regardless of the amount of nondetects, Dr. Olsen used GW9 in 04:53:14 his SW17 analysis?
A It suggests that I might want to look at that statement again; however, I would point out that we're not shown all the analytes here, there are analytes occurring off to the right of the page, and 04:53:29 we also are seeing a very large number of nondetects, apparently, for GW9. So if you were to exclude any samples because of prevalence of nondetects, this would likely be one of them.
Q But you do see this is a screen shot for his 04:54:06 SW17 PCA run; correct?
MS. COLLINS: Object to the form.
A That's what it appears to be.
Q (By Mr. Page) And it does include GW9 or the Schwabe samples, does it not? 04:54:13

A Yes, it does.
Q Okay. Let's look at Exhibit No. 12. This is also a screen shot from SW17. Does it show groundwater -- Schwabe groundwater sample number 10 on here? 04:54:20
A Yes, it does.
Q Does it show that Dr. Olsen included the other Schwabe groundwater sample?
A It does appear in this screen shot.
Q So if all of these screen shots are correct, 04:54:25 is your statement in paragraph three on Page 19 that Dr. Olsen did not use the only two groundwater samples associated with Schwabe's farm has excluded; is that incorrect?
A Not -- it may be, but I would need to look at 04:55:02 the input data from his run SW17, which was furnished to me in hard copy, in order to verify that that is correct.
MR. PAGE: Let's take a break now.
VIDEOGRAPHER: We're off the record at 04:55:11 4:54 p.m.
(Following a short recess at 4:55 p.m., proceedings continued on the record at 5:10 p.m.)
VIDEOGRAPHER: We are back on the record, 5:09 p.m. 05:10:02

MS. COLLINS: Before you start, can I ask for clarification of the record on this Exhibit 11 and Exhibit 12?

MR. PAGE: Uh-huh.

MS. COLLINS: Do you have a Bates number that we can correlate this to from Dr. Olsen's considered materials? 05:10:06

MR. PAGE: I can give that to you, but it was on part of the program we provided you, the database for the PCA. 05:10:12

MS. COLLINS: Okay. And so this particular screen shot is related to Dr. Olsen's original report in this case as opposed to something that was corrected later?

MR. PAGE: Yes. 05:10:16

MS. COLLINS: I would appreciate that reference later.

MR. PAGE: And if you looked at the top of Page 12 and Exhibit 12 and 11, you see the file name, it says, cross tab, underscore water, underscore 0429, underscore SW17XLS? 05:10:22

MS. COLLINS: Uh-huh.

MR. PAGE: That's how you identify the file --

MS. COLLINS: Okay. 05:10:27

MR. PAGE: -- in the considered materials for Dr. Olsen's.

MS. COLLINS: Okay. Thank you.

MR. PAGE: And these were both screen shots of the same file, it just so happened that 05:10:32 groundwater 10 and 9 weren't on the same screen, so we had to do two screen shots.

MS. COLLINS: Okay. Thank you.

Q (By Mr. Page) Dr. Murphy, isn't it true that Dr. Olsen did not eliminate samples based on 05:11:07 nondetect percentages, but based on percentages of analytes not analyzed in a particular sample?

A I think that is correct.

Q Let me hand you now what's marked as Exhibit 13, and then also Exhibit 14. If you could take a 05:11:20 look at these two exhibits, 13 and 14, and tell me if you recognize them, sir?

A Well, again, they are screen shots which I haven't seen before, but they appear to be similar to if not identical to copies of his input files 05:12:13 that we have seen.

Q If you look at the top where -- on the screen shot for Exhibit 13 and 14 as it shows the file number, does that indicate that this was a screen shot of your file or your PCA analysis using Dr. 05:12:23

Olsen's data?
A That is how it is labeled.
Q Do you recognize that to be your file name?
A I do not, but it's certainly possible.
Q Did you perform the PC analysis in Section 5 05:13:08
of your report?
A That was performed by Melanie Edwards at my
direction.
Q So she did the actual work?
A She did the actual computer work. 05:13:14
Q How much direction did you give her? Just
tell her how -- give her the general overview of the
parameters and she could work herself?
A We discussed how we were going to choose
samples for inclusion, what method we were going to 05:13:20
do to -- use to apportion samples, that is, the
fractional method. We discussed how we were going
to simulate what Dr. Olsen would have seen if he'd
done a multimedia analysis by using half the
detection level. We discussed basically all of the 05:14:01
important variables and how the method was going to
be conducted.
Q And she actually selected the data and then
put it into the Systat program and ran the program?
A Right, we selected the criterion for including 05:14:08

data together, and then she selected and put it in, yes.

Q Did you do any validation of her work?

A I have not done any detailed evaluation. I certainly have evaluated from the standpoint of do the end results look similar to what I expected them to based on previous PC calculations. 05:14:17

Q Did anyone else, to your knowledge, do any validation, other than what you just described yourself, of her work? 05:14:25

A I would have to check if that's the case or not.

Q You're not aware of it today?

A I'm not aware whether or not there was any validation. 05:14:32

Q You did not request it?

A I don't recall requesting it.

Q On Exhibits 13 or 14, does it indicate that both of Schwabe's groundwater samples were used in your PCA analysis? 05:15:08

MS. COLLINS: Object to the form.

Q (By Mr. Page) Let me just represent to you, sir, these are screen shots from your considered materials.

A Well, I see both GW9 and GW10 appearing in 05:15:14

these screen shots.
Q Does that reflect your recollection as to whether or not -- excuse me, does that refresh your recollection as to whether or not you used both GW9 and GW10 in your analysis? 05:15:22
A Not really. I'd really need to look at the documents that I reviewed when I drew the conclusion that GW9 and GW10 were not included. These screen shots are different documents.
Q If it turns out that you did use both, and, in fact, that Dr. Olsen did use both of these samples for his analysis, would you be making a correction to your report in this case? 05:16:01
A If it turns out that what you say is correct, I would certainly acknowledge that to be the case. Whether or not I make any formal changes in the report is really up to my client. 05:16:08
Q You say at the bottom of the paragraph of Page 19, just above Table 3-1, and this is on your report, sir. 05:16:24
A Uh-huh.
Q You say, thus, the Cargill contract growers are inadequately characterized or not characterized at all, and a second critical link to Dr. Olsen's transport theory is missing; is that correct? Did I 05:16:32

read that correctly?
A Yes.
Q Okay. What's your basis for saying the Cargill contract growers are inadequately characterized? 05:17:05
A Well, because we have samples for only two growers, and there are many more than two, the number, I believe to be 35, but there are many more than two.
Q Do you have any basis to assume that the 05:17:09 samples that we do have from the Cargill contract growers are not representative of the other contract growers?
MS. COLLINS: Object to form.
A I have no basis to decide whether they are 05:17:15 representative or not representative. We really only have environmental samples from one contract grower. Whether that's representative of others, I do not know.
Q (By Mr. Page) Okay. If they were 05:17:22 representative, if the samples that we do have are representative of groundwater found at other Cargill growers, would your statement be mistaken that you didn't have sufficient information to characterize all Cargill growers? 05:17:28

A I understand your question to relate strictly to groundwater?
Q Yes, sir.
A And I don't know how we can reach a determination that the one sample -- the one grower 05:18:07
sample we have is representative of other growers without actually doing sampling at other growers. But if it is -- if it were true, if, you know, there were some way of determining that, then yes, it would be a totalogy and it would be representative. 05:18:15
Q Do you know whether or not the litter samples from the Cargill facilities are any different than the litter samples from the other poultry facilities taken in this case?
A There are some similarities and some 05:18:26
differences. The Cargill -- the two Cargill litter samples show up in the same part of the principal component space as the -- some of the chicken growers.
Q Well, I think they're really all in the same 05:19:06
group, correct, on the PCA?
A For the analytes that Dr. Olsen selected, they're in the same group.
Q Did you compare the analytes from the analysis of the Cargill growers' litter with the analytes 05:19:13

from the other poultry growers to see if they are similar?

A That was the -- that comparison was the basis for seeing the estradiol appeared to be different.

Q Other than that, did you identify any other differences? 05:19:20

A Not within the analytes selected by Dr. Olsen.

Q And what about -- did you do the same evaluation for land application area soils, did you evaluate whether there was any difference between the Cargill soils and the other land application soils from other poultry -- 05:19:26

MS. COLLINS: Object to form.

Q (By Mr. Page) -- operators?

A I did not. 05:20:02

Q If, in fact, your PCA analysis did include both the Schwabe groundwater samples, then would your Figure 5 that only shows one groundwater sample from Cargill facilities be mistaken?

MS. COLLINS: Can you read back that question? 05:20:21

(Whereupon, the court reporter read back the previous question.)

A I'd really have to look at the computer output to see if there's one Cargill groundwater sample or 05:21:02

two Cargill groundwater samples. That red square may be including -- enclosing two groundwater samples. I can't tell. The points are too dense in that location.

Q (By Mr. Page) You're looking at Figure 5, sir? 05:21:09

A 5-2, yes.

Q You'll agree with me that Figure 5-1 and 5-2 appears to only show one Cargill sample; correct?

A That is what it appears to show. And if it is only one, I would think it would be a GP, the geoprobe sample. 05:21:16

Q And not the groundwater samples?

A That is -- that is correct. That would make the figure consistent with the text. 05:21:25

Q So why --

VIDEOGRAPHER: May I stop you for just a moment? I think I figured out why his microphone is not coming through. Can we take a break?

MR. PAGE: Sure. 05:22:03

VIDEOGRAPHER: Thank you. We're off the record at 5:21 p.m.

(Whereupon, a discussion was held off the record.)

VIDEOGRAPHER: Back on the record, 5:22 05:22:19

p.m.

Q (By Mr. Page) Dr. Murphy, you just referred to a figure, I guess Figure 1 or Figure 5-1 or 2, and you said that your interpretation of those figures shows that you only identified Cargill 05:22:28 geoprobe samples and not groundwater samples?

A Well, I said it shows one -- at most one Cargill groundwater sample.

Q And which figure are you looking at, 5-1 or 5-2? 05:23:07

A In both 5-1 and 5-2, I see at most one Cargill groundwater sample.

Q Is that -- do you see anywhere in the 5-1 and 5-2 of the groundwater references you have like in your key there for the different types of samples, 05:23:16 where it distinguishes between groundwater well samples and groundwater geoprobe samples?

A No, there's no distinction made.

Q So how did you -- what was the basis for your statement a couple of minutes ago that it would have 05:23:23 been a geoprobe sample that's reflected on either 5-1 or 5-2?

A The basis is that it makes it consistent with the text in that the one sample that we identified as groundwater at Schwabe was a geoprobe sample. If 05:23:29

I saw two or three groundwater samples, then I would say we're obviously including more than just that one geoprobe, but I see at most one.

Q Okay. So either your text is correct or your text is also mistaken on that regard also? 05:24:08

A Either -- the text and the figure appear to be consistent with each other, and the only way I can determine if they are correct or incorrect is to go back and look at the actual Olsen input data that I actually used. 05:24:16

Q If you look back on Exhibit No. 12, sir, which are the Dr. Olsen PCA screen shots.

A Yes.

Q Do you see both the geoprobe sample as part of his analysis on this screen shot, as well as the 05:25:10 groundwater tab analysis?

A I see GP-GW10, which is the one that I identified as a Schwabe geoprobe sample.

Q So based on the screen shots, does it appear that Dr. Olsen used not only both of the wells, but 05:25:20 also the geoprobe sample in his SW17?

A That's what the screen shot seems to indicate, but I would need to look at the documents in my possession on which I based my statement to see if, in fact, that those documents are consistent with 05:25:29

the screen shots.
Q If you looked at the analytes that were detected in concentrations in a groundwater sample from the Schwabe farms, could you determine one way or the other whether that groundwater was contaminated? 05:26:13
A I could compare the concentrations in those analytes with standard benchmarks, such as MCLs, and determine whether or not they met either state or federal definition of contamination. 05:26:25
Q Okay. Did you do that in this case?
A I did not.
Q Could you tell by looking at those analysis whether or not the groundwater samples from the Schwabe farms are contaminated by land applied poultry waste? 05:27:03
A Not just with that information, no.
Q Let me hand you what's been marked as Exhibit 15 -- excuse me, sir, Exhibit 15 to your deposition, and I'll represent to you that these are two pages taken from Mr. Olsen's considered materials that show the analytical results for the geoprobe sample taken from Schwabe's farm shown as GP-GW10. Can you tell from looking at these geoprobe samples whether or not the groundwater appears to have been 05:28:11

contaminated?

MS. COLLINS: Object to form.

A No, as I say, I would need to have a table of reference concentrations to compare it with. I don't have those things memorized. 05:28:16

Q (By Mr. Page) Is it your understanding that groundwater, if it was not contaminated, would have E. coli in it?

MS. COLLINS: Object to form.

A E.coli is a mark of contamination, but whether 05:28:21 the results shown of 14MPN per hundred milliliters meets a definition of contamination, I would need to look at some reference values.

Q (By Mr. Page) And does it show on this exhibit for the Schwabe geoprobe sample that there 05:29:08 is E.coli present in the sample?

A That's what the test result indicates, yes.

Q Is enterococcus group also an indicator of contamination of groundwater?

MS. COLLINS: Object to form. When you 05:29:15 use the word contamination, are you using it in a broad sense or specifically for one source?

MR. PAGE: I'm using it as contamination.

MS. COLLINS: Just in the broad sense, regardless of source? 05:29:20

MR. PAGE: Yes, it's been affected by something.

MS. COLLINS: Okay.

A Well, in the spirit of contamination being something that's present at an unacceptable level, I would say I'd have to look at that table of reference concentrations to determine whether this would be considered contaminated or not. 05:29:24

Q (By Mr. Page) Do you know whether or not groundwater would have naturally occurring bacteria in it? 05:29:32

A I believe it could.

Q And what's your basis for that statement, sir?

A I think I've read articles that indicate that.

Q Did groundwater have naturally occurring enter -- is it your understanding, sir, that groundwater would have naturally occurring bacteria from digestive systems of warm blooded animals? 05:30:05

A I don't recall the species of bacteria that were present in groundwater in the articles that I read. 05:30:16

Q Is E.coli a representative of a species of bacteria that comes from the guts of warm blooded animals?

A I believe it is. 05:30:21

Q So would you expect to find it naturally occurring in groundwater?
A In the absence of warm blooded animals over a substantial period of time, I wouldn't expect to find it in groundwater. 05:31:01
Q What about entercoccus group, sir, is that also a species of bacteria that comes from warm blooded animals?
A That I'm less certain of.
Q What about fecal coliform, sir, is that a 05:31:07
species or a group of bacteria that come from the feces of warm blooded animals?
A That's my understanding.
Q Would you expect to find that naturally occurring in groundwater? 05:31:13
A Well, in the absence of warm blooded animals, including wildlife and other species, in the absence of septic systems, in the absence of all those kinds of activities over a long enough period of time, I wouldn't expect to find it in groundwater. 05:31:21
Q Did you evaluate the levels of bacteria that were found in poultry waste samples that were evaluated in this case?
A Only to the extent of the PCA analysis.
Q Did you actually look at the concentrations? 05:31:28

A No.
Q Do you know whether or not the concentrations of fecal bacteria in poultry waste are pulled into raw sewage?
A Since I haven't looked at the concentrations, 05:32:08
I don't know.
Q Did you evaluate the concentrations of bacteria from edge of field samples taken in this case?
A Only through the PCA analysis. 05:32:16
Q Do you know whether or not the concentrations of fecal bacteria of edge of field samples are equivalent to raw sewage?
MR. ELROD: Object to form.
A Since I didn't look at the concentration data, 05:32:21
per se, I don't have any idea.
Q (By Mr. Page) Would you turn to the second page of Exhibit 15, sir? Do you see the entry for -- from this groundwater nitrite and nitrate?
A Yes. 05:33:09
Q What's the level, sir?
A 18.8 milligrams per liter.
Q Is that above the MCL for that constituent in groundwater?
A Well, the MCLs are really drinking water 05:33:15

standards, and my recollection is that nitrate is related to drinking water -- what drinking water containing nitrogen can do to babies, so whether or not it applies here, I don't know.

Q Do you recall what the standard is, sir? 05:33:26

A Not off the top of my head.

Q Do you recall whether it's 10?

A It may be 10.

Q Does that level of nitrate and nitrite indicate to you that this groundwater sample has been contaminated by nitrogen? 05:34:02

MS. COLLINS: Object to form.

A Assuming everything you say is true, it indicates that it would not be suitable for drinking water. 05:34:08

Q (By Mr. Page) Are you aware of naturally occurring groundwater with nitrate and nitrite levels as high 18.8 milligrams per liter?

A I haven't done any survey of naturally occurring nitrogen in groundwater. I do know I've seen other places where chemical species have caused nitrate to be high. 05:34:16

Q Were those levels approaching 18.8 milligrams per liter?

A I don't recall. They were above 10, though. 05:34:24

Q Does this particular sample show any contamination by brevibacteria, 16SR and aging?

MS. COLLINS: Object to the form.

A It shows that when they were -- the sample was subject to PCR, that the number of copies made per 05:35:08 liter were 4,000, so there's some sort of multiplication effect which isn't described here that doesn't tell me what the original concentration was.

Q (By Mr. Page) Does that indicate that the 05:35:16 biomarker -- is that the biomarker that has been developed in this case by the State's experts, do you know?

MS. COLLINS: Object to the form.

A I don't know. I have not read that expert's 05:35:21 report.

Q (By Mr. Page) Do you see the level of dissolved phosphorus in this particular report, total dissolved phosphorus?

A I see two indicators of total dissolved 05:36:01 phosphorus.

Q Okay. Do you see the one that says, total dissolved phosphorus method 4,500?

A Yes.

Q Okay. What's the amount? 05:36:05

A .5 milligrams per liter
Q Do you have any basis to evaluate whether that would be indicative of contamination of the groundwater, that level?
A Not off the top of my head. I'd have to consult some of my reference works for that. 05:36:11
Q What about the total phosphorus level by method 6020, do you see that, sir?
A Yes.
Q And what is the amount there? 05:36:17
A It wasn't detected at a level of .01 milligrams per liter.
Q I was looking at total phosphorus con --
A I'm sorry.
Q I might have misspoke. I was looking at 6020, total phosphorus? 05:36:21
A The level is 137 milligrams per liter.
Q In your experience, sir, would that indicate that the groundwater is contaminated?
A Again, I don't have a basis for saying yes or no without consulting some other references. 05:36:32
Q Can you turn to Page 9 to your report, sir? The top bullet, the very first paragraph, you reference you -- you make a statement that the data from the Schwabe farm do not support an allegation 05:38:03

of chemical and bacterial concentrations in the environment due to turkey litter, do you not?

A That is correct.

Q And you mention that your opinion is based on, number one there below that, consistency of soil samples with background reference samples? 05:38:11

A Yes.

Q Could you explain that statement for us, please?

A In the PC analysis, the background soil reference samples show up in the same part of the PC space as the Schwabe farm samples. 05:38:15

Q Were all the samples from the Schwabe farm located in the PC analysis with the reference samples? You're looking at 3-1, sir, Figure 3-1 to your report? 05:38:26

A I am, but I'm looking for -- yeah, in the PC1 and PC2 plot, the red squares are the -- sorry. The green squares are the reference samples, and the locations with the red box around them are the Cargill soil samples. 05:39:22

Q If we expanded this view, would these samples overlap? You've got it kind of clustered here. If we expanded the view of them, would you find that the samples would overlap? 05:40:01

A If you expand the view enough, any two points on this plot will pull apart.

Q Would you show a significant separation for the red, sir?

A Not significant as measured by distance along the PC axes. 05:40:07

Q Is this PCA evaluation that you're looking at, Figure 3-1, tell you anything about the level of contamination in those samples, those Schwabe samples? 05:40:15

A I don't believe it does.

Q Did you do any evaluation of the level of contamination in those Schwabe soil samples compared to reference samples to see if there were differences? 05:40:22

A I did not. Strictly looking at the patterns through PC analysis.

Q Let me hand you what's marked as Exhibit 16 and hand you what's marked as Exhibit 17. Sir, Exhibit 16 is from Dr. Olsen's considered materials. 05:42:06 It shows the results from the three of the Schwabe soil samples where all the analytes were analyzed, LAL-16-B, 16-C and 16-D, and then Exhibit 17 is from Dr. Olsen's -- from Appendix D of Dr. Olsen's report showing the reference samples from soils within the 05:42:24

IRW, and these samples are both referenced within the zero to two inch horizon, as well as the Cargill soil samples. Sir, I'd like you to take a moment to review the reference concentrations for fecal coliform, and in Exhibit 17, could you tell me what 05:43:04
the average dry weight concentration is for fecal coliform in the reference?

A 37.2627 MPN per gram.

Q Would you now look at Exhibit 16, the first page, on LAL-16-B. What is the concentration of 05:43:17
fecal coliform in this Schwabe soil sample?

A It appears to be 123,076.9 in the same units.

Q Okay. So is that concentration in this soil sample higher or lower than the reference sample?

A It appears to be higher. 05:44:03

Q Much higher; correct, sir?

A Over two orders of magnitude.

Q Would you turn to the third page of Exhibit 16 and look at the fecal coliform results for Schwabe soil sample LAL-16-C. And how does that compare to 05:44:12
the reference for the soil samples as shown in Exhibit 17?

A The dry weight result is 27,522.

Q Is that more than an order of magnitude greater reference? 05:44:22

A Yes, it is.
Q Let's look at the third sample from Schwabe, sir, LAL-16-B. What is the fecal coliform result there, sir?
A 17,223.9. 05:44:29
Q And is that again more than the order of magnitude higher than the Schwabe results -- excuse me, than the reference results?
A Yes, it is.
Q Okay. Let's look at some other bacteria. 05:45:09
Let's look at E.coli, sir, and the reference samples, what was the level of E. coli determined by dry weight average?
A Dry weight average is 37.2442.
Q Let's compare that to the LAL-16-B E.coli. Is 05:45:17
that lower or higher?
A The dry weight LAL-16-B is higher than the average, but it's only a factor or two different than the maximum in the reference samples.
Q And the average is about 10 times higher? 05:45:29
A It would be about 10 times higher for -- comparing average, yes.
Q And let's look at 16-C. How does the E.coli results in the Schwabe sample 16-C compare to the reference numbers? 05:46:11

A The -- the dry weight result is 244.6, which is almost identical to the dry weight maximum, but it is larger than the dry weight average for the reference samples.

Q It's much larger than the minimum also; correct, sir? 05:46:19

A It is much larger than the minimum, yes.

Q Okay. Let's look at the third sample, E.coli and Schwabe, how does that compare to reference the samples? 05:46:27

A 16-D is 11.1, which is less than the average in the reference sample.

Q Okay, sir. So two of the three Schwabe samples were higher for E.coli?

A Higher than the average reference sample. 05:47:05

Q Yes. Okay. Let's look now at the entercoccus group. What's the average for the entercoccus group, sir, in the reference?

A It's 1.3.

Q And what's the maximum? 05:47:11

A It's 4.6.

Q And then the minimum is less than 1; is that correct, sir?

A That's correct.

Q But the 1.3 is the maximum probable number of 05:47:16

colony count?
A Well, remember, there aren't too many reference samples, so the average in maximum and so on here doesn't have a lot of statistical meaning.
Q Okay. 05:47:23
A We could have used more reference samples.
Q How many reference samples were there for soils?
A Oh, just a couple, as I recall.
Q Two? 05:47:27
A Let me look at my report and figure it out.
Q Maybe it would be easier for you to look at the end on the exhibit, might save us both a little time.
A And the number is N6, yeah. 05:48:05
Q So there were 6 reference samples of soil?
A In -- for those analytes we've been discussing, yes.
Q Okay. And for entercoccus group on the LAL-16-B sample, how does that compare in the 05:48:12 Schwabe sample to the reference sample?
A LAL-16-D?
Q Yes, sir. Oh, I'm sorry I said B. Excuse me. We can use the same order.
A For LAL-16-B, the entercoccus group is 1,435. 05:48:20

Q Compared to 1.32?
A Compared with 1.32.
Q Okay. And let's look at the next sample from Schwabe. What's the level of entercoccus group from the Schwabe property, on the second Schwabe property 05:49:01
sample 16-C?
A 16-C is dry weight is 9,582.
Q And that compares with 1.3 in the reference samples?
A For the average, yes. 05:49:09
Q And let's look at the third Schwabe sample and compare the entercoccus group back to the reference. How does that compare, sir?
A 16-D is dry weight of 821.
Q And how does that compare to the reference? 05:49:21
A The reference sample has an average of 1.3.
Q So it's several hundred times larger; correct, sir?
A Yes.
Q Okay. Let's look at chloride, water soluble 05:49:29
chloride, what's the level in the reference samples?
A Water soluble chloride appears to have an average of 10.1.
Q Okay, sir. And how does that compare to the water soluble chloride -- 05:50:12

A Oh, but the percent detected is zero, so we really don't know.
Q Okay. Let's skip that one then. Let's go to total copper, sir. What is the dry weight average for total copper from the reference samples? 05:50:22
A 5.6.
Q Would you expect that level of copper in native soils to leach and run off during rainfall events?
A I would expect there would be some leaching, 05:51:02 but how much I can't say.
Q Okay. Let's compare that to total copper amount of 5.6 or 5.5 is the average to total copper in the Schwabe sample LAL-B, 16-B.
A It's 8.2, which is less than the maximum, but 05:51:14 more than the average in the reference samples.
Q Okay. Sir, let's look at the next sample from Schwabe. What is the total copper amount in the soils on Schwabe property 16-C?
A 25.6. 05:51:26
Q And how does that compare to the reference samples?
A It's about twice the maximum of the reference samples.
Q And around four to five times the average? 05:52:03

A Yes.
Q Let's look at the next sample, sir, total copper for Schwabe LAL-16-D, how does that compare?
A Schwabe LAL-16-D is 11, which is about the same as the maximum of the reference samples, but 05:52:18
about two times the average.
Q Okay. Let's now look at the potassium, sir. What is the potassium amount in the average in the reference samples?
A Total potassium is an average of 526. 05:52:32
Q And how does that compare to LAL-16-B?
A LAL-16-B is 880, which its somewhat higher than the average, but less than the maximum in the reference samples.
Q Okay. And let's go to the next sample from 05:53:17
Schwabe and compare potassium, if you would, sir, 16-C sample.
A 16-C is 1,346, which is slightly higher than the maximum in the reference samples.
Q And several times higher than the average? 05:53:27
A It's about two times higher.
Q Did you consider about a 350 milligram per liter difference between the maximum reference and the dry weight from this particular sample from Schwabe to be a slight difference? 05:54:09

A It's really difficult to say with only six reference samples. You really need more to analyze it statistically. You know, what you're really looking for is that 1,346 a ninety-fifth percentile value or a ninety-ninth percentile or seventy-fifth 05:54:22 or what is it? So you really can't do statistics on these number of samples -- reference samples.

Q Do you know how many acres within the IRW are unimpacted by poultry waste?

A I haven't looked into that. 05:54:28

Q Let's look at the last sample for potassium, sir, 16-B. How does that compare to the reference?

A The 16-B is 1,013, which is about -- which is close to the maximum, but about twice the average of the reference samples. 05:55:14

Q Okay. Let's do the same drill for zinc, sir. How does the 16-B sample from the Schwabe property compare to the reference samples for zinc?

A LAL-16-B is 29.4, and the average dry weight of the reference samples is 23, so it's very close. 05:55:27 It's in between the average and the maximum.

Q Okay. And let's look at the next sample presented from the Schwabe property. What is the level there?

A 45.1. 05:56:06

Q How does that compare to the reference values for zinc?
A It's not too different than the maximum, but it's about twice the average.
Q And the last sample, sir, 16-B? 05:56:11
A It's 27.9, which again is close to the average, but really between the average and the maximum value of the reference samples.
Q Okay. Would you look now at total nitrogen and compare the Schwabe sample for total nitrogen to 05:56:24 the reference total nitrogen numbers, Schwabe No. 16-B?
A 16-B for total nitrogen is 3,610, and the reference samples are an average of 2,329, and a maximum of 2,983, so it's slightly higher than what 05:57:08 the average and the maximum, which are pretty close together.
Q And would you look at the next one, sir, the next sample and compare total nitrogen on the 16-C sample to the reference samples? 05:57:16
A 16-C is 4,618, and in the reference samples, it's about half that for the average and three-quarters that for the maximum.
Q And finally the last sample for nitrogen, sir, could you compare that, please? 05:57:28

A 16-D is 3,698, and the reference sample is 2,329 for the average and a little less than 3,000 for the maximum, so it's slightly higher than both the average and the maximum.

Q And finally, let's look at total phosphorus for Schwabe sample 16-B. How does that compare to the reference sample -- 1620, sir. 05:58:10

A Okay. For 16-B, total phosphorus is 594, and in the reference samples, it's 310 for the average and 523 for the maximum. 05:58:26

Q Okay. And so it's -- this particular sample is higher than both the average reference and the total --

A Slightly higher -- slightly higher than both.

Q Okay. Let's look at the next samples. 16-C, how does the total phosphorus by 6020 compare? 05:59:02

A 16-C, the total phosphorus is 1,468, and the reference samples, it's -- the average is 310, and the maximum is about 523, so it's several times higher. 05:59:16

Q Would that indicate to you, sir, that for this particular sample of 16-C, that there had been some addition of phosphorus to the natural soils on this field?

A It's possible. I would need to look at the 05:59:21

basis of the reference sample, you know, whether they really form a true reference dataset with statistical validity.

Q Let's look at the last sample, sir, 16-D. What is the phosphorus result -- total phosphorus 06:00:01 result by 6020 on that?

A 900 parts per million, and the reference sample is 310 for the average, and 523 for the maximum, so it's two to three times higher than those. 06:00:11

Q Assuming these are appropriate references, does that indicate that these soils have been impacted by phosphorus?

A If these are truly representative of reference soils that haven't been impacted, then that would 06:00:19 indicate that total phosphorus has been added.

Q Does LALC show any presence of the brevibacteria biomarker?

A According to this table it does.

Q Do you know how the samples, the soil samples 06:02:02 were collected on the Schwabe farm and the other Cargill facil -- just the Schwabe farms?

MS. COLLINS: I'm sorry, can you repeat that question?

Q (By Mr. Page) Do you know the sampling 06:02:16

methodology for collecting the land applied field areas on the Schwabe farms?

MS. COLLINS: Object to form.

A I really haven't looked into that. I have -- I certainly am familiar with what's typically done 06:02:24 to collect soil and groundwater samples, but I haven't reviewed a methodology statement for collection of these samples.

Q (By Mr. Page) Do you know whether or not there were composite samples which followed a 06:03:01 protocol that would get a representative sample for a complete field?

A The work on positive samples, I would agree with that. Whether they get a representative sample for a complete field or not, I don't know. 06:03:10

Q You didn't do an evaluation of that --

A Well, there's very few samples and very large fields, so --

Q How many samples were taken from what size of fields? 06:03:16

A It's in my report, I believe. Well, Schwabe's whole farm is a square mile, and we've got areas A, B, C, and D, so each composite is trying to represent a quarter of a mile -- well, a quarter of a mile by a quarter of a mile. 06:04:02

Q Is that how the methodology was set up, the composite was set up for a quarter of a mile representation?

A I'd have to look at it in more detail, but my recollection is that it's nearly a square mile 06:04:10 Schwabe farm, and there's four sampling areas.

Q Isn't it true, sir, that the sampling for the soils on the Schwabe property were only done in pastures where there had been documented land application of poultry litter? 06:04:19

MS. COLLINS: Object to form.

A I don't -- I don't know that to be the case.

Q (By Mr. Page) If that was the case, would that change your analysis of the number of samples for the whole farm? 06:04:24

A Well, I have to say it's different than what I was told by Randy O'Boyle, that he couldn't tell me where the poultry litter had been applied on the Schwabe farm. But if that were the case, depending on how recent the application was, that could be 06:05:02 significant.

Q Do you know whether or not 60 or 70 samples were taken in each specific field that was documented for planned application, and then those samples were composited for the samples you're 06:05:10

reviewing here as LAL-A through D?
A I think that 60 or 70 refers to at different depth, and the samples below the surface weren't used in the PC analysis.
Q How many sample locations were there taken at each field that were composted from the zero to two? 06:05:17
MR. GRAVES: Did you mean composted or composited?
MR. PAGE: I meant composited.
MR. GRAVE: Okay, you said composted. 06:05:28
MR. PAGE: Make that correction, please.
A I'd have to look at the input data file. My recollection is it was a handful of samples.
Q (By Mr. Page) Do you recall whether or not there were at least 20 locations at each field that were sampled for the zero to two inch horizon and then composited? 06:06:02
A I don't recall that.
Q Did you review that?
A I did it one time, yes. 06:06:09
Q And what information did you review that's a sampling of land applied fields?
A I reviewed samples locations, the A, B, C and D locations for Schwabe's farm and where the samples were collected on maps that Randy O'Boyle furnished 06:06:20

me.
Q And where did he get those maps?
A I'm not sure.
Q Do you recall reading anything in Dr. Olsen's report about the sampling? 06:06:25
A Not as I sit here today.
Q Do you recall seeing anything in Dr. Olsen's considered materials concerning the sampling of Schwabe's or a Schwabe's farm?
A Not as I sit here today. 06:07:03
Q Reviewing these soil samples from Schwabe's farm and comparing them to the reference samples, do you have an opinion as to whether or not they are contaminated?
A Well, again, I have some questions about what the reference samples represent, whether they have statistical validity, but the numbers on the Schwabe farm for the analytes that we've looked at are higher, generally, for the analytes we've looked at, and to me, it shows, among other things, the value of having some analytes that are related to living things as opposed to just minerals in the soil. 06:07:12 06:07:26
Q So it's a biomarker, the brevibacteria biomarker?
A Well, that I can't speak to because I don't 06:08:03

know what was done there.

MR. PAGE: Let's break now for the evening.

MS. COLLINS: Okay.

MR. PAGE: I'll see you at 8:45. 06:08:10

MS. COLLINS: 8:45 it is.

MR. PAGE: Yeah, I don't know how long it's going to take tomorrow. We'll see. I think it will be less than today.

VIDEOGRAPHER: We are off the record, 6:07 p.m. 06:08:14

(Whereupon, the deposition was recessed at 6:08 p.m., to be resumed on 3-26-09.)

I, Brian Murphy, Ph.D., do hereby certify that the foregoing deposition was presented to me by Karla E. Barrow as a true and correct transcript of the proceedings in the above styled and numbered cause, and I now sign the same as true and correct. 06:08:17

WITNESS my hand this _____ day of _____, 2009.

_____ 06:08:17

BRIAN MURPHY, Ph.D.

SUBSCRIBED AND SWORN TO before me this _____ day of _____, 2009. 06:08:17

_____

Notary Public

06:08:17

My Commission Expires:

_____

C E R T I F I C A T E

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

I, Karla E. Barrow, Certified Shorthand 06:08:17
Reporter within and for Tulsa County, State of
Oklahoma, do hereby certify that the above named
witness was by me first duly sworn to testify to the
truth, the whole truth and nothing but the truth in
the case aforesaid, and that I reported in 06:08:17
stenograph his deposition; that my stenograph notes
were thereafter transcribed and reduced to
typewritten form under my supervision, as the same
appears herein.

I further certify that the foregoing 285 06:08:17
pages contain a full, true and correct transcript of
the deposition taken at such time and place.

I further certify that I am not attorney
for or relative to either of said parties, or
otherwise interested in the event of said action. 06:08:17

WITNESS MY HAND this day of April,
2009.

KARLA E. BARROW, CSR
CSR No. 00113

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BRIAN MURPHY, Ph.D.

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IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)	
Plaintiff,	)	
vs.	)	4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)	
Defendants.	)	

- -

VOLUME II OF THE VIDEOTAPED DEPOSITION OF BRIAN MURPHY, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 26th day of March, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

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(Whereupon, the deposition began at 8:51 a.m.)

VIDEOGRAPHER: We are back on the Record for Volume II deposition of Dr. Brian Murphy. Today is March 26th, 2009. The time is 8:51 a.m. 08:51AM

Counsel, please identify yourselves for the Record.

MR. PAGE: David Page for the State of Oklahoma, and with me here is Dr. Olsen.

MS. COLLINS: Melissa Collins of Faegre & Benson for the Cargill defendants. 08:51AM

MR. GRAVES: James Graves for the George's and George's Farms.

VIDEOGRAPHER: Thank you.

BRIAN MURPHY, PhD

having first been duly sworn to testify the truth, the whole truth and nothing but the truth, testified as follows:

DIRECT EXAMINATION

BY MR. PAGE:

Q Good morning, Mr. Murphy. 08:51AM

A Good morning.

Q I want to just remind you, you are still under oath today.

A Yes.

Q I want to follow up with a little bit with how 08:51AM

we ended yesterday. We were looking at the samples that were collected from Schwabe's farm, and I want to hand you what's been marked as Exhibit 18, and let me tell you that Exhibit 18, it was prepared for your cross examination. It wasn't part of any -- 08:52AM
I'm not sure if it's part of the errata, but basically it's the same concept, that it was one of the plots that Olsen originally did and it was corrected, the figure was corrected using the change for the log transform, and what we've added here is 08:52AM
we've taken a circle in red and identified the Cargill LAL 16B, C and D samples on it. So that's what this exhibit is, and I wanted to ask you a couple of questions concerning it.

MS. COLLINS: Okay, and I object to the 08:52AM
extent that you're asking him questions about a document that relates to a disclosure filed February 10th, 2009 after the deadline for filing discovery -- I'm sorry, plaintiff experts' reports, and also to the extent that this document has never 08:53AM
been produced before, nor has the underlying analysis, and having said that and not waiving any of those objections, we request that you provide all considered materials underlying the February 10th, 2009 disclosure, including all summary or corrected 08:53AM

scores, plots, figures and any analysis that underlies any of that as soon as possible.

MR. PAGE: Okay. Well, I think we've produced the considered materials, but I'll check that for the February 9th or 10th errata. This is a cross examination piece, and so we're not -- we believe there's no obligation to produce any considered materials if that even relates to something created for cross examination. 08:53AM

MS. COLLINS: Well, and on that point, your February 10th, 2009 disclosure includes, I think, two or three corrected figures, and several times you've made representations, not only in this deposition but in prior depositions, that each of these corrected figures are a result of the analysis that took place underlying the February 10, 2009 disclosure, which was served on defendants as some sort of errata in order to correct mathematical errors, and now you're presenting documents that purport to also reflect these corrected errors without having given the defendants the time to analyze this or the witnesses time to be able to understand what underlies these charts. 08:54AM 08:54AM

MR. PAGE: Okay. We note your comments.

MS. COLLINS: Okay. 08:54AM

Q Dr. Murphy, would you do me a favor and tell us, where do the Cargill samples, as we've identified in here, lie in relationship to the other land-applied surface soils?

MS. COLLINS: Object to form. There's been no evidence that these particular circles you have drawn are the actual Cargill sample corresponding points. 08:55AM

MR. PAGE: If you want to object to form, please do, but don't speak to the witness and coach him when you make your objection. 08:55AM

MS. COLLINS: It's for the Record.

A The three circled red squares are in the middle of the cluster of surface soil squares. Whether they are land-applied surface soils or not, I do not know. 08:55AM

Q Okay, and where are the reference soils in relationship to those three Cargill identified locations?

MS. COLLINS: I'll make the same objection, if you'll give me a standing objection. 08:55AM

A They are -- oh, they have somewhat smaller values of PC1, and they're on average somewhat smaller in PC2.

Q The references are? 08:56AM

A Yes.
Q Okay. Do any of the referenced soil plots overlay the Cargill identified locations?
A They don't appear to overlay them, no.
Q Could we turn to Page 18 of your report, sir? 08:56AM
Do you have a criticism, that I believe is stated on Page 18, that not all of the Cargill soil samples were used in Olsen's PCA; is that correct?
A That's correct.
Q Okay. Did you use them all when you did your 08:57AM
PCA?
A I don't believe I did because I was trying to emulate what Olsen did.
Q Do you know whether or not -- and the soil samples that were left out were the ones that were 08:57AM
in the two to four or the below the two-inch depth horizon; correct?
A There was also soil samples from LAL 16A that were surface that were left out.
Q Okay. Was there a similarity between those 08:57AM
two groups, that is, LAL 16A and the deeper soil samples, that caused them to be eliminated from Olsen's PCA analysis? And I guess in more particular, I'll just get to the point, isn't it true that those samples did not have all the 08:57AM

parameters analyzed?
A It is true that as you went down in depth, fewer parameters were analyzed.
Q Okay, and so was that part -- was the lack of having all the parameters analyzed one of the criteria for Olsen selecting his PCA samples for running? 08:58AM
A For the deeper soil samples, that appears to be correct. I'd need to look at LAL 16A to see why that was disqualified. 08:58AM
Q Okay. How is waste land applied?
A My understanding is that -- it's a surface application.
Q Okay, and so it would be -- after it's applied, it would generally be along the top of the surface of the soils? 08:58AM
A That would generally be correct.
Q Based on your experience, would you then expect the upper profile of soils zero to two to have the largest impact from a land application? 08:58AM
A I think that would generally be the case.
Q And would it also be generally the case that these upper two inches of soils would have the largest impact, that the soils and anything applied to them would have the largest impact on any runoff? 08:59AM

A On runoff, yes.
Q What about leaching?
A Well, of course, over time the leachate is going to spread the contamination downwards, and so after a long enough time it may very well be that 08:59AM
the two to four is more significant than the zero to two because the soluble components have been transported downward.
Q So you'd want to take some look at the soluble components of interest and see if they've been 08:59AM
transported, but generally, at least for current land application, the zero to two-inch layer would have the most impact on leaching?
A For fresher applications, yes.
Q So it -- wouldn't the zero to two-inch soils 08:59AM
be the most applicable to determine effects on the environment from land application soils?
MS. COLLINS: Object to form.
A That would generally be the case, not in the context of PCA analysis necessarily, but as a 09:00AM
general matter, yes.
Q Can we turn to Table 3-3 of your report, sir? I think it's on Page 22, sir. Would you explain Table 3-3 for the Record?
A Table 3-3 is based on information I received 09:01AM

from Randy O'Boyle, and it shows sample locations downstream or downgradient of the various Cargill contract growers.

Q Okay, and how were these sample locations selected? 09:01AM

A They were selected by Randy O'Boyle.

Q And what were the criteria?

A That they be downstream or downgradient of Cargill growers.

Q Was there any other criteria? 09:01AM

A Not that I'm aware of. I think the instructions were to be generous in deciding what was downstream or downgradient.

Q What do you mean by generous?

A Oh, if there was an issue as to whether 09:01AM something was downgradient. For example, if it was a little bit off the direction of groundwater flow, to still consider it downgradient, that a plume that was spreading could possibly impact that location.

Q What about for surface samples; what were the 09:02AM criteria?

A Again, just to be generous in deciding which surface samples were downstream or downgradient, downstream.

Q So you would look -- when you say generous, 09:02AM

does that mean you would go farther distances away?
A No. These are -- these are nearby surface water, surface soil samples and -- or surface water or spring or sediment samples.
Q How do you -- I'm sorry. Finish, please. 09:02AM
A Exactly how far downstream they are, I'd have to ask Randy O'Boyle, but what we were trying to do is identify any place that could possibly have a Cargill impact and see if those stood out from other samples. 09:03AM
Q Stood out in what respect?
A Had a different PC signature.
Q Did you do any comparison with respect to concentrations of, for example, phosphorus, any of the water and the sediment? 09:03AM
A My analysis has been totally in the context of principal component analysis.
Q So the answer is no?
A That's correct.
Q What was -- what was your instructions to Mr. O'Boyle concerning trying to be near to the down -- I think the sampling location nearby? 09:03AM
A I don't recall I gave him instructions in terms of how near was near, you know, in terms of how many miles. 09:03AM

Q Would eleven miles be nearby?
A I'm not sure if it would or wouldn't.
Q Did he select the closest sampling location?
A I believe he tried to, yes.
Q Were these all -- were these all of the 09:04AM
Cargill growing operations?
A That was the intention, yes.
Q So this represents all 35, Table 3-3?
A That was the intention.
Q Doesn't appear that there's 35 operations on 09:04AM
this table, does it?
A No.
Q So can you tell us what's missing?
A I don't know which ones are missing. I think
if you compare the list of Cargill contract growers 09:04AM
here with the total list, you'd be able to see which
ones are missing because the third column gives you
the names of the growers.
Q Did you do that analysis?
A I did not. 09:04AM
Q Did your analysis consider whether Cargill
poultry litter had been applied upgradient from any
of these locations?
A Since I don't know the locations, and I don't
believe Randy O'Boyle does either, where the actual 09:05AM

application was, they're -- they're downgradient or downstream of the houses.

Q So the answer is no?

A That's correct.

Q And did the analysis that you performed consider whether there was any other poultry litter from any of the other of the defendants upgradient from these locations? 09:05AM

A I don't believe it did.

Q Did it consider any of the timing of poultry litter application around or near these locations? 09:05AM

A I don't believe it did. It's strictly a spatial analysis.

Q We took a look at a couple of these to evaluate your criteria, Dr. Murphy. Let me hand you what's marked as Exhibit 19, and I can tell you that this is a map of the IRW. Do you recognize that, sir? 09:06AM

A Yes.

Q And do you recognize the Lester location here? 09:07AM

A I see it on the map, yes.

Q From your work, do you recognize that as being the location of the Lester grower for Cargill?

A I wouldn't be able to say yes or no.

Q Okay. Well, I'll represent to you that we 09:07AM

identified that, and best of my knowledge it's been properly identified. Is Lester one of the people that you've looked at as part of your analysis on Page 22, Table 3-3?

A Lester appears on Table 3-3. 09:08AM

Q Okay, and what is the spring ID that you looked at?

A The spring is Anderson spring.

Q Okay. Where does the Anderson spring ID show up on this map at Exhibit 19? 09:08AM

A Well, again, I can't vouch for the accuracy of the map, but it certainly is not the closest location.

Q In fact, there was another one called Spring 04 that would be closer; correct, sir? 09:08AM

MS. COLLINS: Objection.

A Yes. It's -- the sample ID is also Anderson, however. So it's unclear to me which location is being used. They're both Anderson.

Q Okay. If in fact, you used sample ID Spring Anderson, which is shown on the Oklahoma portion, you'll admit to me, sir, if that's accurately shown, that you did not select the closest spring to the Lester facility as part of your analysis? 09:08AM

MS. COLLINS: Object to form. 09:09AM

A Assuming everything you say is true, that would be correct.

Q What are the differences in phosphorus between the two sample locations?

MS. COLLINS: Object to form. 09:09AM

A The Spring 04 Anderson non-filtered has a phosphorus level of .69 milligrams per liter; whereas, the Spring Anderson has a phosphorus level of .014 milligrams per liter.

Q How far away from the Lester facility is the 09:09AM Spring Anderson, the location that's identified on Table 3-3 of your exhibit?

MS. COLLINS: Object to form.

A It looks like, based on the key from this map, and, again, assuming everything is accurate, perhaps 09:10AM 25 miles.

Q On Table 3-3 where you've got a notation for location, is that your -- is that your sample ID reference?

A It's the sample ID that I -- reference that I 09:10AM received from Randy O'Boyle and used to circle the various locations as being downstream or downgradient.

Q Did you check any of his work?

A I have not. 09:10AM

Q Just let me look at one other example. Let me hand you what's marked as Exhibit 20, sir. Sir, this is a GIS picture of -- within the IRW showing the Edwards facility, and then sample locations that would be downgradient from the facility, along with 09:11AM their sample IDs, and also the results from samples taken from those locations.

MS. COLLINS: Object to form. Object to the use of this exhibit without providing the information that generated it. 09:11AM

MR. PAGE: I'll just represent to you this is information that was taken from information provided to the defendants during the course of the discovery of this case.

Q Can you identify on this map, sir, the sample 09:12AM location that you used for the Edwards facility?

A Well, assuming that it's what's given in Table 3-3, it would be SD 062.

Q Would you circle that on the exhibit, sir, please, in red? 09:12AM

A (Witness complied).

Q Okay. Is it the only sample location that's downgradient from Edwards?

A The map that you've provided, Exhibit 20, shows two other locations. 09:12AM

Q Okay, and what locations are those?
A SD 063 and BS 062A.
Q Okay, sir. Which location is the closest?
A SD 063.
Q Okay. Assuming this information is correct, 09:13AM
your chart did not select the closest sampling
location for sediment evaluation, did it?
MS. COLLINS: Object to the form.
A Assuming that the chart is correct or assuming
that the figure you provided is correct, that would 09:13AM
be correct.
Q And you did not check Mr. O'Dell's (sic) work
on determining whether or not he selected the
closest location for Table 3-3?
A I did not check Mr. O'Boyle's work, no. 09:13AM
Q Is the closer -- how far is, by the way, the
SD 062 location from the Edwards facility?
A Oh, it appears that it might be ten miles.
Q Would you consider that a nearby location?
A It's not the location I would use if I had a 09:13AM
closer location.
Q But you would -- if it was the only location,
you would believe that would be nearby for Edwards,
about ten miles?
MS. COLLINS: Object to form. 09:14AM

A Well, again, I did not provide Randy O'Boyle a definition of nearby in miles. I'd have to check with him as to what he used.

Q Okay. Well, based on your experience and opinion, would you think a ten-mile sediment sample taken from a creek ten miles downgradient from a farm would be representative? 09:14AM

A Well, the spirit of this is to try to find samples that could be, not are, but could be impacted by Cargill growers, and if that was the closest that I had, that's the one I would use. 09:14AM

Q Do you know how sediments transport in the IRW?

A I know how sediments transport generally.

Q But in this facility, is it true that sediments rarely build up within the streams and rivers of the IRW, that they're regularly flushed down into Lake Tenkiller? 09:14AM

MS. COLLINS: Object to form.

A I haven't looked into that. 09:15AM

Q You don't know. Well, if that was the case, if that was the process going on in the IRW, would stream and river sediments be a good indicator of activities transporting off the rivers and creeks?

MS. COLLINS: Object to form. 09:15AM

A Again, it really depends on where in the stream you take your sediment measurement. When you have -- on the inner part of a curve is where the sediments are going to tend to build up, and the outer part is where they're going to tend to be 09:15AM scoured. So the inner part of the curve is going to contain sediments, depending on the depth you go, that are representative of longer periods.

Q But if all the sediments had been scoured in streams traditionally in the IRW, would you expect 09:15AM to have much of a sediment history, much of a history of runoff of sediments in these creeks and streams?

A Well, if what you say is true, if all sediments are scoured, there shouldn't be any 09:15AM sediments.

Q Fine-grained sediments?

A All right.

Q Would you still say the opinion, same opinion if all fine-grained sediments had been scoured? 09:16AM

MS. COLLINS: Object to form.

A If that were the case, then these sediment measurements would represent measurements in coarse-grained sediments.

Q How would -- what size would you identify as 09:16AM

coarse-grained sediment?
A I haven't looked into it. It depends on -- you know, what is going to be scoured is going to depend on stream velocity and depth and things like that that I haven't looked into. 09:16AM
Q Do you recall our discussions yesterday concerning reference information for edge of field samples?
A You'll have to refresh me as to what part of that discussion. 09:17AM
Q Well, do you recall your testimony to the effect that edge of field reference samples would be important to determine whether or not poultry litter runoff looked any different than runoff from unimpacted or unapplied fields? 09:17AM
A Yes, but unimpacted I included cattle manure as well.
Q Okay. Did you do any literature searches to determine whether or not there was any studies made concerning the difference, if any, between fields 09:17AM that had poultry and cattle on them versus fields that had no such applications?
A Only in the context of the principal component analysis.
Q Did you identify any studies? 09:18AM

A I didn't look at studies, no.
Q So would studies that evaluated whether or not there was a difference between poultry-applied fields and non-applied fields be probative to whether or not the signature that is identified in 09:18AM
Olsen's PCA was in fact poultry versus just runoff from natural fields?
A Those studies could be important as would studies that would show the opposite.
Q Okay. Let's look at some of those studies. 09:18AM
Let me hand you what's marked as Exhibit 21. Would you read for the Record the name of that -- title of that paper, sir?
A Poultry Litter and Grazing Animal Waste Effects on Water Runoff Quality. 09:19AM
Q Have you ever seen this paper, sir?
A I have not.
Q Have you done any search as part of your work in this case to determine if any such research and evaluation was available? 09:20AM
A As I indicated earlier, no.
Q Okay. Can you tell me where this paper was published?
A The Journal of Environmental Quality.
Q Are you aware of that journal, sir? 09:20AM

A Yes, I am.
Q Does it have a good reputation?
A I don't know of anything bad to say of it.
Q Okay. Who are the authors?
A T. J. Sauer, T. C. Daniel, P. A. Moore, K. P. 09:20AM
Coffey, D. J. Nichols and C. P. West.
Q Okay. Where were they located at the time
they did this investigation?
A Various institutes associated -- well, in
Arkansas, University of Arkansas. They all appear 09:20AM
to be University of Arkansas.
Q In Fayetteville?
A In Fayetteville.
Q Is the University of Arkansas in Fayetteville
within the IRW? 09:21AM
A I do not know.
Q Would you read the first five sentences of the
abstract for the Record, please, sir?
A In complex landscapes of multiple land uses,
it is often difficult to identify the source of 09:21AM
contaminant loadings. The objective of this study
was to compare nutrient runoff as affected by
grazing animal depositions versus poultry litter
application. Simulated rainfall was applied twice
to 1.5 by 6.0 meter runoff plots of tall fescue 09:21AM

with treatments of no waste, CT, dairy calf feces and urine, DFU, poultry litter, PL and dairy calf feces and urine with poultry litter, DFU plus PL. Chemical properties of the runoff samples, including pH, electrical conductivity, carbon, soluble 09:21AM reactive phosphorus, total nitrogen, potassium, magnesium, sulfur, B -- I don't know if that's barium.

Q Is it boron perhaps?

A Could be. Yeah, it's probably boron perhaps. 09:22AM Copper, iron, manganese, molybdenum, sodium and zinc were determined.

Q Read one more sentence, sir.

A Plots receiving poultry litter had significantly greater losses of most nutrient 09:22AM parameters for both rainfall simulations.

Q Okay. I just wanted to give a little background of the paper there, sir. Now let's look at some of the results. Would you please -- so let me ask this: Do they have control samples in this 09:22AM study, sir, represented by CT?

MS. COLLINS: Why don't you give him a minute to look through the document so he's comfortable with it?

Q Take your time. 09:22AM

A CT are the no waste samples.
MS. COLLINS: Take a minute or whatever to --
Q So what was sampled in this study, sir?
MS. COLLINS: Give him -- take whatever 09:23AM
time you need to familiarize yourself with that deposition -- or I mean the exhibit before you answer.
A Would you repeat the question?
Q What was sampled? 09:24AM
A Various compounds, metals, nitrogen, soluble reactive phosphorus.
Q Okay. Those are the analytes. What was the media sampled in this case; wasn't it runoff samples in this case? 09:25AM
A Simulated runoff, yes.
Q Okay. So let's turn -- so would the CT samples be representative of natural or native soils?
A In the context of this study, which is in the 09:25AM
Ozark, set in the Ozark Highlands, yes.
Q Okay. Is the IRW part of the Ozark Highlands?
A I do not know.
Q It uses fescue in the study; correct?
A Yes. 09:25AM

Q Are fescue grasses a dominant pasture grass in the IRW?
A I do not know.
Q Okay. Let's look at Table 3, sir, and let's compare the control to both cattle-amended soils and poultry-amended soils. All right, sir? 09:25AM
A Which table?
Q Table 3 on Page 862. Are you with me, sir, at the bottom of Page 862?
A Yes. 09:26AM
Q Okay. What I want to do is look at the -- this study had two rainfall events, one close -- near to the original application of the soils studied and then another about two weeks later; is that correct? 09:26AM
A They were simulated rainfall events.
Q But were there two simulations, sir?
A It appears that's the case.
Q Okay. So let's look at the first simulation. What were the results for total nitrogen from the native or control soils field? 09:26AM
A Appears to be .40 for NO3. That's nitrogen.
Q Okay. What about total nitrogen? Let's start there on the left-hand side.
A Oh, total nitrogen, yes, TN, it's 2.06. 09:27AM

Q Okay, and how does that compare to cattle-amended field?
A Cattle amended is 7.7.
Q And poultry?
A Poultry is 64.9. 09:27AM
Q So poultry is some 30 times greater runoff in this study than for total nitrogen than the control fields?
A That's correct.
MS. COLLINS: Object to form. 09:27AM
Q Okay. What's the next column, sir; what does that represent?
A NH4 is nitrogen.
Q Okay. Is that a subcomponent of -- of total nitrogen? 09:27AM
A I believe so.
Q Okay. What -- how does the control field compare to both the cattle and the poultry fields?
A The control field is quite a bit lower.
Q Quite a bit. How many times lower than 09:28AM poultry?
A Oh, over a hundred.
Q Okay, and what's the next column, sir, analyte?
A NO3 is nitrogen. 09:28AM

Q Okay, and is that a subcomponent of total nitrogen?
A I believe it is.
Q All right, and how is that nitrogen analyte different in the control versus the dairy and the poultry fields? 09:28AM
A The control is three times lower than the dairy and about five or six times lower than the poultry.
Q Do you have an understanding as to why the investigators thought it was important to investigate different species of nitrogen? 09:28AM
A Not without reading the study.
Q Fair enough. You do notice, though, they do investigate three different species of nitrogen in the runoff; correct? 09:29AM
A Three different nitrogen parameters, yes.
Q Thank you, sir. Let's continue on to the next column. SRP, do you understand what that stands for? 09:29AM
A That was soluble reactive phosphorus.
Q Okay, and how does the control field relate to the cattle and the poultry fields?
A It's about three times lower than the cattle field and, oh, maybe fifty times lower than the 09:29AM

poultry field.
Q And how does just the cattle versus the poultry field relate; can you compare the differences between the reactive phosphorus runoff between cattle-amended fields and poultry? 09:29AM
A Poultry is about, oh, twenty times higher than cattle.
Q What's the next element that was evaluated, sir?
A Potassium. 09:29AM
Q Okay, and how -- would you do the same comparison for us, please?
A In that case the control field is about three times lower than the cattle-amended and about, oh, twenty times lower than the poultry. 09:30AM
Q Again, is there a difference between the cattle and poultry field runoff for potassium also, sir?
A Yes. The cattle is about seven times smaller.
Q Okay. What about -- what's the next element that's investigated in this study? 09:30AM
A Well, that's what I'm looking for.
Q MG is --
A I don't remember if it's -- magnesium, yes, not manganese but magnesium. 09:30AM

Q I make the same mistake. How do those values compare?
A In this case magnesium is about, oh, 50 percent -- well, the cattle-amended is very close to the -- it's identical, in fact, to the control 09:31AM
field, and the poultry litter is about maybe 50 percent higher than the control field.
Q Okay, sir, and then what's the last element?
A I believe that's sulfur.
Q Okay. 09:31AM
A The cattle and the control field are very similar. The poultry litter field is two and a half to three times higher.
Q Okay. Except for sulfur, were these elements used in Olsen's PCA investigation? 09:31AM
A They were. They form a subset of the total parameters that he used.
Q Okay. Let's continue on to Table 4, sir. I want to do the same evaluation with the substances that were evaluated in Olsen's PCA. I think the 09:32AM
first one, boron, was not. So let's go on Table 4 on 863 to the copper. Do you see those results, sir?
A Yes.
Q What were the differences between the native 09:32AM

control field and the cattle and poultry runoff fields?

A The cattle and the poultry -- and the poultry field?

Q Well, I want to look at the same thing we did before, the control, the cattle and the poultry, and look at the comparison from the first runoff event. 09:32AM

A All right. The -- there's an indicator there that the control and the cattle are not significantly different. 09:33AM

Q Okay.

A The control and the poultry are significantly different, with the poultry being, oh, maybe 200 times higher.

Q Okay. What about iron, sir; could you do the same comparison for me there, sir? 09:33AM

A Yes. In this case, the cattle, it's about twice the size of the poultry in milligrams per liter, and the poultry is about ten times higher.

Q Than the control fields? 09:33AM

A Yes.

Q All right, sir, and the next one is manganese?

A Manganese, yes, sir.

Q Could you do that evaluation, please, sir?

A In this case the cattle is about twice as high 09:33AM

as the control field, and the poultry litter is about, oh, six times as high as the control field.

Q Okay. Let's skip over then to sodium then, sir. What's the analysis there indicate?

A The control field and the cattle are not statistically different. The control field is about ten times lower concentration than the poultry litter. 09:34AM

Q Okay, and finally the zinc comparison; can you do that evaluation for me, sir? 09:34AM

A In this case the cattle is not statistically different than the control field, and the poultry litter is not statistically different than the cattle.

Q Okay, sir. Is there a difference -- but there is a difference in the actual results, is there not? 09:35AM

A There's a difference in the numbers reported here.

Q Okay. Does this information indicate to you that there may be a difference between native control field runoff and poultry-amended field runoff? 09:35AM

A For some analytes but not for the total set of analytes used in Dr. Olsen's PC analysis.

Q But for the analytes that are represented in 09:35AM

this study that were also used in Olsen's study, it does indicate a difference, does it not?

A If the conditions were the same, there would be a difference. Whether or not the conditions are the same, I haven't investigated. 09:35AM

Q Okay, and does it also indicate that there's a difference between runoff between beef-amended fields versus poultry-amended fields?

A It does for the level of amendment that was used in these simulations. 09:36AM

Q Let's look at another study. Let me hand you Murphy Exhibit 22, and you might want to take a minute, like your counsel wisely advised you, to take a moment to take a look at this document before we begin discussing it. 09:36AM

A All right.

Q Okay, sir. Could you read for the Record the title of this article?

A Decreasing Metal Runoff From Poultry Litter With Aluminum Sulfate. 09:39AM

Q Okay. Have you ever reviewed Murphy Exhibit 22?

A I have not.

Q Okay. Would you read for the Record -- oh, can you tell me where this article was published? 09:39AM

A It was published in the Journal of Environmental Quality.
Q And who were the investigators?
A P. A. Moore, Jr., T. C. Daniel, J. T. Gilmour, B. R. Shreve, D. R. Edwards and B. H. Wood. 09:39AM
Q Okay, and where are those -- where were those gentleman located at the time they published this report?
A University of Arkansas, University of Kentucky and Auburn University. 09:40AM
Q Do you know whether or not the states of Kentucky and Alabama have substantial poultry operations?
A I do not.
Q Do you know how Arkansas ranks among other states as far as the concentration of poultry operations? 09:40AM
A I have not investigated that.
Q All right. Sir, would you read the first two sentences in the abstract? 09:40AM
A Aluminum sulfate applications to poultry litter can greatly reduce phosphorus concentration in runoff from fields fertilized with poultry litter, as well as decrease NH3 volatilization. The objective of this study was to evaluate metal runoff 09:40AM

from plots fertilized with varying rates of alum treated and untreated, bracket, normal, bracket, poultry litter.

Q All right, sir. Now, let's turn to the next page, please, and go to the section on Page 93 of 09:41AM this exhibit, and see where it says materials and methods?

A Yes.

Q Just for background for the court, could you just read the first three or four sentences, about 09:41AM halfway down in that column under materials and methods?

A This study was conducted using 52 small plots, 1.52 by 3.05 meters, with 5 percent slope, located at the main agricultural experiment station of the 09:41AM University of Arkansas on a Captina silt loam soil, fine silty, siliceous, mesic Typic -- oh, I'm going to spell the next word -- Typic F-R-A-G-I-U-D-U-L-T, all in brackets, which had been in continuous fescue for two years. 09:41AM

Q Continue, sir.

A The plots have runoff collection troughs at the down slope, and that enables the collection of runoff water. There were a total of thirteen treatments, four rates of alum-treated poultry 09:42AM

litter, four rates of untreated poultry litter, four rates of ammonium nitrate and one of unfertilized control.

Q Okay, sir. Now, I want to now go to the next page, and see where it says results and discussion 09:42AM and then trace metal runoff --

A Yes.

Q -- on Page 94? Would you read about half the way down that column under copper runoff?

A Soluble copper concentrations in the runoff 09:42AM water of the unfertilized control plots average .01 milligrams of copper per liter for the first runoff event and .014 milligrams copper per liter for the second event seven days later.

Q Is that referring then to Figure 1? 09:42AM

A Yes, it does.

Q Okay. Would you continue on?

A These values are near the average, .015 milligrams copper liter, of that for natural waters in the USA. 09:43AM

Q So is that your control, unfertilized or unamended fields results?

A I believe that's correct, yes.

Q Okay. Would you continue, sir?

A The amount of soluble copper in the runoff 09:43AM

water increases linearly with litter application rate regardless of litter type but was significantly higher from normal litter than alum-treated litter, Figure 1, Tables 2 and 3.

Q Okay. One more sentence, sir. 09:43AM

A At the highest litter application rate, the average soluble copper concentrations in the runoff water from untreated litter was 93 times higher than the control, bracket, .93 milligrams copper per liter. While the -- 09:43AM

Q Okay. That's -- well, you can continue, but I think that's as far as we need to go.

A All right.

Q Does that indicate to you -- that finding indicate to you that there's a difference in copper runoff from a native soil field versus a poultry litter-amended soil field? 09:44AM

A For the soils that were used in this experiment, yes.

Q Okay. Let's look at Figure No. 1. Does that table indicate that dissolved copper runoff from poultry-amended fields is substantially different than unamended fields? 09:44AM

A Figure 1 is a comparison between alum-treated fields and fertilized but non-alum treated fields. 09:45AM

Q Okay. If you look at the top part of Figure 1, can you tell me where the -- what dot is the control field before application for runoff?

A Well, the litter application rate is at zero zero of the coordinate system. 09:45AM

Q So -- so -- so the no applications would represent the point at zero zero; correct?

A As near as can be told on this figure.

Q And if we just focus on the unamended, unalum-amended portion of the evaluation, which would be the top line; correct? 09:45AM

A Correct.

Q Does it show that an unamended field has a substantially different copper, dissolved copper runoff than an amended -- poultry-amended field? 09:46AM

A For the conditions of experiment, yes.

Q Does it also indicate, sir, that with increasing litter applications on the field, the copper runoff concentration also increases?

A Yes, it does for the untreated litter as well as for the alum-treated litter. 09:46AM

MR. PAGE: Let's take our morning break here.

VIDEOGRAPHER: We now off the Record at 9:47 a.m. 09:46AM

(Following a short recess at 9:47 a.m., proceedings continued on the Record at 10:08 a.m.)

VIDEOGRAPHER: We're back on the Record. The time is 10:08 a.m.

Q Dr. Murphy, let's continue on with this paper by Mr. Moore as lead author, Exhibit 22 to your deposition. Let's now -- we looked at copper. Let's look at zinc. I believe the discussion begins on Page 95. Would you read beginning under zinc runoff to the sentence that ends on the next page? Read through that, please. 10:08AM 10:08AM

A Soluble zinc concentrations in the runoff water from control plots were .047 and .043 milligrams zinc per liter for the first and second runoff event, Figure 4A and B. These values are slightly below the average, .064 milligrams zinc per liter, of that for natural waters in the USA, Manahan 1991. 10:09AM

Q Could I ask you to stop and ask a quick question there, sir? Does it appear that the investigators are comparing natural waters with runoff from unaffected fields to see -- to make a comparison of those two types of waters? 10:09AM

A It's an average of some sort for the USA for natural waters. 10:09AM

Q Okay. You don't know whether those are stream?
A I have not looked at the Manahan dot paper.
Q Okay. Thank you, sir. Would you continue?
A As with copper, the zinc concentrations of the runoff water increased with litter application rate for both types of litter on the first runoff event, Table 2. 10:09AM
Q Okay. Now, let's look at Table 2 -- excuse me, Figure 4. Does Figure 4 right below where we stopped provide a chart similar to the copper chart showing a comparison between untreated fields and then poultry-treated fields for zinc runoff? 10:10AM
A For soluble zinc concentrations, yes.
Q Okay, sir, and if we look at the upper part of Figure 4, focus on that, what does it show the control field runoff amount to be approximately? 10:10AM
A It looks like it's about .04 milligrams zinc per liter.
Q Okay, and does the runoff from this field increase as poultry litter applications are increased? 10:10AM
A The soluble zinc concentration increases as poultry litter application is increased.
Q Thank you, sir, and so does this indicate, 10:11AM

this experiment, that native soils would have less zinc runoff than poultry-amended fields?

A If the conditions are the same as in this simulation, yes.

Q Okay. These authors, along with the other authors, a lot of them are from Arkansas, University of Arkansas; correct? 10:11AM

A Several are, yes.

Q Would you expect these authors to try to simulate local soil and runoff conditions in their experiments? 10:11AM

MS. COLLINS: Object to form.

A I haven't addressed it.

Q Okay. Let's go to arsenic, sir. Let's just turn to the Figure 5, which is soluble arsenic, and, again, looking at that figure on Page 97, does it indicate that arsenic, soluble arsenic concentrations are increased at poultry-applied fields as opposed to control or native fields? 10:12AM

MS. COLLINS: Object to form. 10:12AM

A In this experiment, that's what it shows.

Q And does it show that the arsenic runoff from poultry-amended fields increases based on the number of applications?

A It does immediately, as with the zinc that we 10:12AM

just looked at. Seven days later the amount applied is much less important. In fact, you even see some decreases.

Q So that would be after -- is that for arsenic on Figure 5 or were you looking at aluminum, sir? 10:12AM

A My comment goes to both Figure 4 and Figure 5, the lower portion of each figure. Seven days later you don't see that same increase with the amount applied, particularly in Figure 4.

Q You don't see -- you talking about figure -- 10:13AM let's go back to Figure 4. You don't see as much of an increase over time in Figure 4?

A In Figure 4 it doesn't look like there's any increase with application after seven days.

Q After the first rainfall event, for the second 10:13AM rainfall event; correct?

A For the second simulated rainfall, yes.

Q Okay, and for arsenic, for the first rainfall event, there's an increase based on litter application rates; correct? 10:13AM

A For the first simulated rainfall, yes.

Q And what about for the second?

A For the second, there's overall a slight increase.

Q So most of the arsenic appears to be running 10:14AM

off after the first runoff event; is that correct?
A That is correct.
Q Okay. Let's -- I don't believe they plotted iron, but let's go on to look at iron. Could you read the first sentence under iron on Page 97 of the exhibit? 10:14AM
A Soluble iron increased linearly with litter application rate for both the alum-treated and untreated litter.
Q So does that indicate to you, sir, that iron also increased -- iron runoff was increased at litter-applied fields as opposed to control fields? 10:14AM
A That's what it indicates.
Q Okay. Would you look at the Figure 6 for aluminum? Does it appear that for aluminum the control fields have less runoff than the litter-applied fields? 10:14AM
A For the first rainfall event, yes. For the second rainfall event, the uncertainty or error of ours is such that you could draw a horizontal line through it rather than one that's increasing with application. 10:15AM
Q Okay. So for aluminum, there's not as much evidence of increased runoff from applied fields; is that correct, sir? 10:15AM

A I'd say that's correct, yes.
Q But over -- if you get up to about ten applications, does it appear that there's a difference between the control fields and -- and the litter-applied fields? 10:15AM
A Well, it's not ten applications. It's the amount applied, which I think is -- looks like it's megagrams per hectare.
Q Yes, sir.
A Yeah. 10:15AM
Q Thank you for that correction, but does it based on the amount of applied, that there would be an increase over control fields?
A For the first rainfall event, yes, for the first simulated rainfall event. 10:16AM
Q Let's turn now to the next page, Figure 7, for calcium. Does it appear that the control fields have much less calcium runoff than litter-applied fields?
A For the untreated litter, but for the 10:16AM alum-treated litter, there's no difference --
Q Right.
A -- for the first rainfall, and for neither is there any difference after -- for the second simulated rainfall. 10:16AM

Q Okay. We're talking about untreated litter. Do you know whether or not the IRW litter is treated?
A I do not.
Q Okay. So let's go with untreated litter. Is there a difference in calcium runoff for untreated litter? 10:16AM
A For untreated litter after the first rainfall, there is an increase with the amount applied.
Q Let's go to the next page, sir. Do you see where it says on Page 99, potassium and sodium runoff? 10:17AM
A Yes.
Q Would you read the first two sentences there?
A Concentrations of potassium and sodium in runoff water followed similar trends, Tables 2 and 3. The concentrations of both these metals increased linearly with litter application rate for the first runoff event and tended to be higher from plots fertilized with alum-treated litter. Data not shown. 10:17AM 10:17AM
Q What does it indicate the potassium concentrations were?
A Potassium concentrations were in excess of 200 and 250 milligrams potassium per liter in runoff 10:17AM

from the highest rate of untreated and alum-treated litter during the first event.

Q So do the authors conclude -- did the authors demonstrate here in this experiment that there's a difference in most constituents that they measured between the runoff in an untreated field versus a poultry-treated field? 10:18AM

A For the metals that we've looked at, that is correct.

Q Okay. Would you read the first two sentences under the conclusions? 10:18AM

A Trace metal, arsenic, copper, iron and zinc concentrations in the runoff water from plots fertilized with poultry litter were increased as litter application rates increased and were higher from untreated litter compared to alum-treated litter. 10:18AM

Q Do you agree that that conclusion is representative of the data you've reviewed?

A I do. 10:18AM

Q Would you continue on, sir?

A The metal of greatest concern in poultry litter is copper, which was found in extremely high concentrations in the runoff of untreated litter, one milligram copper per liter. 10:18AM

Q Okay. Thank you, sir. So does this paper and the experiments performed by the investigators indicate that there's a difference between native soil runoff and poultry litter-applied soil runoff?

A For some compounds, but it doesn't indicate that my conclusion regarding Dr. Olsen's PC analysis is incorrect. 10:19AM

Q I'm confident you would say that, sir. I'll move to strike the last portion of the statement as non-responsive. 10:19AM

Does it also -- does the investigation also indicate that with poultry application increases, runoff for these constituents, these metals, also increase?

A In these simulations, yes. 10:19AM

Q In these two papers how many of the parameters in Olsen's PCA analysis were investigated?

A Well, I haven't been keeping count, but we've looked at something like six or eight.

Q Would you agree with me if I said 14 of the 26 parameters in the PCA were investigated in these two papers? 10:20AM

A I'd need to go back and count.

Q Okay. Do you have a recollection as to whether or not the constituents that are 10:20AM

investigated in these two papers also tended to be the highly loaded constituents in Olsen's PCA evaluation?

MS. COLLINS: Object to form.

A By highly loaded, do you mean highly loaded on PC1? 10:20AM

Q Yes, sir.

A Okay. Well, I don't think that tells you the whole story because you need to look at multiple PCs. 10:20AM

Q Would you answer the question?

MS. COLLINS: Object to form.

A I don't recall.

Q Well, the -- there have been runoff samples collected in this case; correct, sir? 10:21AM

A They are the edge of field samples.

Q Okay, and I'd like to take a moment to look at some of the results of the edge of field samples. Let me hand you what's marked as Exhibit 23. Can you identify that for the Record, please, sir? 10:21AM

A It's the summary -- it's titled Summary of Edge of Field Poultry Samples. I don't know who it's -- it was prepared by.

Q I'll represent to you this is Appendix C of Olsen's report in this case. You received a copy of 10:22AM

Dr. Olsen's report, did you not?
A Yes.
Q Okay. Did you review this data?
A Well, I reviewed it in the context of the principal component analysis. 10:22AM
Q You didn't actually look at this Appendix C that I'm showing you right now?
A I don't recall doing so.
Q What's the name of this document, sir?
A Table 1, Summary of Edge of Field Poultry Samples. 10:22AM
Q Okay. Do you know how the edge of field samples were collected?
A They are runoff samples generally collected from the edge of field, although there's a couple of cases in which that's not true. 10:22AM
Q And was it the investigators' purpose to try to find runoff from fields where there had been poultry application?
MS. COLLINS: Object to form. 10:23AM
A I would think that would be the case, although how they did that or thought they were doing that, I do not know.
Q You didn't investigate that as part of your work? 10:23AM

A No, since I don't know where the poultry application was.

Q Do you know whether or not the -- for the edge of field samples, the experts for the State had information that related to whether or not these fields had poultry application associated with them? 10:23AM

MS. COLLINS: Object to form.

A I do not.

Q Okay. Let's look at Exhibit 23 and focus on the bacteria. What is the average bacterial concentration for E. coli? 10:23AM

A For E. coli the average is 89,669.

Q And Enterococcus?

A Enterococcus, it's 1,600,000 -- I'm sorry. That's the maximum. The average is 125,603 -- 623. 10:24AM

Q And for fecal coliform?

A Fecal coliform it's 89,894.

Q Okay, sir. Would you expect to see these levels of bacteria run off from native soils?

MS. COLLINS: Object to form. 10:24AM

Q What I mean by native, I mean non-poultry litter applied soils.

A Well, it would depend on the presence of cattle manure, wildlife, septic tanks and so on. If none of those things were present and no poultry 10:24AM

litter was present, I would think that the bacterial levels could be quite a bit lower.

Q Let's look at arsenic. Dissolved arsenic was one of the constituents that was evaluated in this paper, was it not, his review? 10:25AM

A Yes.

Q Okay. What are the average arsenic levels, dissolved arsenic levels?

A The average is .8156.

Q Is that higher than the investigators' -- the papers we just evaluated for non-poultry litter applied fields? 10:25AM

MS. COLLINS: Object to form.

Q Look at the bottom of Page 96, second column from the Moore paper, Exhibit 22. 10:26AM

A I think the story is told in Figure 5.

Q Well, does it --

A Table 4 is the application rates.

Q Okay. Does it provide the soluble arsenic concentrations at the bottom of Page 96 under arsenic runoff for easy comparison to the numbers we have here on Exhibit 23? 10:27AM

A I believe that's on Page 97.

Q Well, I guess I'm reading from at the bottom of Page 96. Let me read it and see if you agree. 10:27AM

A Okay. Now I see where you are reading.
Q Would you please read that, sir?
A Soluble arsenic concentrations in the runoff water from the unfertilized control plots were .028 and .031 milligrams arsenic per liter. 10:27AM
Q Okay, and how does that compare to the edge of field samples collected in this case on Exhibit 23?
A The average edge of field sample is higher by a factor of maybe 30.
Q So would you expect the numbers that are shown on Exhibit 23 to be reflective of runoff from unimpacted fields or native fields without any litter application? 10:27AM
A I can't -- I can't tell just looking at that single parameter. 10:28AM
Q There's a substantially greater amount of arsenic, though, running off from these edge of field samples than there is in the control plots shown in Moore's investigation; correct?
A In their simulation, yes. 10:28AM
Q Okay. Let's look at dissolved copper. What are the average dissolved copper numbers here on the edge of field, Exhibit 23?
A .1244 milligrams per liter.
Q Okay, and how does that compare to Moore's 10:28AM

investigation, and I'll direct your attention to Exhibit 22, Page 94 under trace metal runoff, copper runoff.

A It's about ten times higher.

Q And would you compare, sir, the same evaluation of -- in the paper done by Sauer, Exhibit 21, would you compare the dissolved copper control with that and the copper numbers found on edge of field on Exhibit 22? 10:29AM

A The edge of field copper sample is quite a bit higher. It's about, oh, 60 times higher than the copper level in the untreated simulation. 10:29AM

Q Is it also higher than the fields that are treated with cattle manure?

MS. COLLINS: Object to form. 10:30AM

A In the simulation, yes.

Q About 60 times?

A 60 to a hundred, yes.

Q Okay. Looking at these numbers on Exhibit 23 for dissolved copper runoff, would you expect these numbers to be reflective of runoff from native or natural soils? 10:31AM

MS. COLLINS: Object to form.

A I really can't tell without having a native soil sample to compare it or samples really. You 10:31AM

need something statistically significant.
Q What about the information provided in the Sauer and Moore papers; isn't that a method by which you could do that comparison?
MS. COLLINS: Object to form. 10:31AM
A Well, I think it's -- It's an issue in two ways. One is it's a simulation rather than the actual runoff sampling from native soils during actual rainfall events. Secondly, it's only for selected parameters and not for the full list of 10:32AM parameters.
Q Okay. I was asking you about copper. My question was addressed to copper. Would you, based on the information you have, would you expect that runoff of dissolved copper rate shown in Exhibit 23 10:32AM to be reflective of runoff from native soils?
MS. COLLINS: Object to form.
A Well, some of the 90 samples may be from native soils and others may be from poultry litter. So you really can't sort it out. There were 90 10:32AM samples that went into making up that average, and we're comparing it with one sample here. So statistically I don't know what it means.
Q Would you believe that their average concentrations are not reflective of what you would 10:32AM

expect to see for average concentrations from native soils? Let me just point out to you, sir, that Table 4 on the Sauer paper is showing mean concentrations for copper and all the constituents there. 10:33AM

MS. COLLINS: Object to form.

Q Do you agree that the Sauer paper is showing you --

A It is showing mean concentration, you are correct. 10:33AM

Q So when you compare those mean concentrations for copper to the mean concentrations of edge of field, does that indicate to you that the edge of field samples collected here would not be reflective of copper runoff of native soils? 10:33AM

MS. COLLINS: Object to form.

A It's suggestive, but, you know, as I say, the only way to really do it is to collect some edge of field samples from untreated soils and look at all the parameters. 10:34AM

Q Are simulated tests for -- I guess sometimes you call them maybe bench tests used in environmental investigations?

A They very often are.

Q Are they considered probative for evaluations 10:34AM

of environmental forensics?
MS. COLLINS: Object to form.
A I would say that they're always wrong and sometimes useful.
Q If you do not have an actual -- a natural case which you can draw from, are simulations the next best evidence? 10:34AM
MS. COLLINS: Object to form.
A They can be.
Q Let's look at the second page of Exhibit 23. What are the average TKN concentrations in runoff from these edge of field samples? 10:34AM
A 24.3989.
Q Do those levels of runoff appear to you to be reflect -- would that level of runoff -- let me strike that. Would that level of runoff be reflective of a native unimpacted soil? 10:35AM
MS. COLLINS: Object to form.
A I can't tell without having a sample from a -- or samples, multiple samples from native unimpacted soils. 10:35AM
Q Do you recall the nitrogen analysis that was done in Sauer's paper?
A Yes.
Q Okay. Those are also mean concentrations 10:36AM

there also?
A Of different nitrogen measures than in the edge of field samples that we've been looking at.
Q Okay. So Kjeldahl would be a subset of total nitrogen, would it not? 10:36AM
A I believe that's correct.
Q Okay. Let's just compare Kjeldahl nitrogen average to the mean concentration of total nitrogen in Mr. Sauer's paper. How do they compare, the control field there of total nitrogen to just the 10:36AM subset of nitrogen on the runoff samples shown on Exhibit 23?
MS. COLLINS: Object to form.
A Well, I have to assume that the TKN nitrogen is being measured as nitrogen, which it doesn't say, 10:37AM but if I make that assumption, the edge of field sample is about ten times higher than the total nitrogen shown in the Sauer paper for an unapplied field.
Q So does that indicate to you that these -- 10:37AM these samples or this level of nitrogen that is identified here in the edge of field samples would not be reflective of what you would see from an untreated or unapplied field?
MS. COLLINS: Object to form. 10:37AM

A First of all, as I said, I don't know that the TKN nitrogen is being measured as nitrogen.
Q Okay. Let's make that assumption.
A All right. Having made that assumption, my answer is the same as with the other things we've 10:38AM
looked at, that I really can't say without having some samples from native soils.
Q You wouldn't use evidence, such as provided in published articles by Mr. Moore, et al, and Mr. Sauer, et al, as to what would be indicative of 10:38AM
runoff of native soils?
MS. COLLINS: Object to form.
A I think those articles could be useful, particularly at the start of planning a sampling program to determine what you were going to sample 10:38AM
and what you were going to include in your principal component analysis.
Q Okay. Let's look at one other element here. Let's look at soluble reactive phosphorus, 4,500. What was the average concentration in the edge of 10:39AM
field samples collected in this case?
A 3.7517.
Q And how does that compare to the control analysis found in the Sauer paper, Exhibit 21?
A It's about 12 or 15 times higher. 10:39AM

Q Does this indicate to you that poultry-applied fields would have different runoff of soluble phosphorus than native fields?

MS. COLLINS: Object to form.

A Again, my answer is that I would like to see some actual runoff from native soils. 10:39AM

Q Would you concede that it is some evidence that there's a difference between poultry-amended soils and native soils?

MS. COLLINS: Object to form. 10:40AM

A I would say that it's worthy of consideration, that these papers could be very useful at the start of a program in planning what kinds of samples to take.

Q Would you identify the level of Brevibacteria 16S rRNA gene runoff on the edge of field samples? 10:40AM

MS. COLLINS: Object to the form. David, that's not even included in Olsen's analysis. So why do we keep talking about Brevibacteria?

MR. PAGE: You know, I don't have to answer your questions, and you shouldn't be making speaking objections. If you have an objection, just say object to the form and we'll continue on with the deposition. 10:40AM

MS. COLLINS: Well, yes, but you've 10:40AM

continued -- I've been very, very patient with the line of questioning that you started yesterday asking Dr. Murphy questions that are irrelevant, completely foundation and often call for legal conclusions. If that's how you want to spend your time, go ahead. Go ahead. 10:41AM

MR. PAGE: Your characterization of my questions are your characterization.

MS. COLLINS: That is true.

Q So, Dr. Murphy, would you please continue? 10:41AM

A After PCR has multiplied the level, the number of copies was 8,502,780 for the average. It was only detected in 55 percent of the samples, and the others I'm not sure how half the detection limit was used. 10:41AM

Q Is a Brevibacteria gene of a constituent of a native unimpacted soil?

MS. COLLINS: Object to form.

A I do not know. It's a constituent of -- it may be -- it's probably associated with living creatures. Whether you'd find it in native unimpacted soil or not, I do not know. Whether it would be present for wildlife, I do not. 10:41AM

Q And the bacteria that's analyzed in Dr. Olsen's PCA is also from a living creature, also, 10:42AM

are they not, that is, the fecal bacteria?
A That would be correct.
Q So he did, in fact, use some constituents in his PCA that were from living creatures; is that not correct? 10:42AM
A That would be correct.
Q Yesterday did you testify that your understanding was that the soils in the IRW are cherty soils?
A That is what I've read. 10:42AM
Q Okay. What are cherts?
A My understanding is that they're soils with a high silica or quartz content.
Q Do you know whether or not they have a high phosphorus content? 10:43AM
A I have not looked into that.
Q Copper content?
A I've not looked into that.
Q Arsenic content?
A Same answer. 10:43AM
Q Zinc content?
A I have not looked into that.
Q Do you know whether or not phosphorus is very soluble?
A I believe it is. 10:43AM

Q What about copper?
A I'm not able to give you a precise figure, but I don't think it would be terribly soluble.
Q If that's the case, do you have any explanation as to why there would be high dissolved copper running off from the simulated poultry applied fields in the papers 679? 10:43AM
MS. COLLINS: Object to the form.
A Well, in the paper the increasing soluble copper concentration is related to the increasing litter application. 10:44AM
Q Okay. So does that suggest there's some component in poultry litter that makes copper soluble?
A It suggests that you can get soluble copper from poultry litter. 10:44AM
Q Would you look at Page 94 of Exhibit 22, sir, and you see it says under trace metal runoff, copper? The second column lower right-hand paragraph of that Page 94, would you read the conclusions of the investigator beginning where it says soluble copper? 10:45AM
A Soluble copper concentration in the runoff were highly correlated with soluble organic carbon, SOC, levels, which supports the finding of del 10:45AM

Castilho, et al, who show that copper concentrations in soil solutions were more affected by soluble organic carbon than any other soil parameters.

Q Okay. Does poultry litter have soluble organic carbon in it? 10:45AM

A I would think that it would, although I haven't looked into it.

Q So does that indicate that there's a relationship between dissolved copper runoff and poultry litter from poultry-applied fields? 10:45AM

A In these experiments, yes.

Q Would you expect that that same phenomena to occur in the natural environment?

A I think the chemistry would be the same.

Q Are arsenics soluble, sir? 10:46AM

A Organic arsenic is.

Q Is the form of arsenic that's put into poultry litter organic or inorganic?

A I have not looked into that.

Q If they were organic arsenics, would that explain how they could be soluble and then run off into poultry-litter applied -- to land-applied fields? 10:46AM

A That would be -- assuming that's the case or that they become methylated in the poultry, that 10:47AM

would be the part of the whole chemistry of what's happening, yes.

Q What about zinc; is it typically a soluble constituent?

A Looking at the plots, it appears that zinc is about as soluble as arsenic perhaps. The curves in the paper have about the same axes, so it's comparable to the others we've discussed. 10:47AM

Q Thank you. Would cherts -- in your experience would cherts provide much partitioning capacity? 10:48AM

A I really haven't investigated the properties of the soils here.

Q Based on your knowledge of cherts in general, would you expect them to have much partitioning capacity? 10:48AM

A I don't know what the organic carbon content is of these soils.

Q Okay. Are you aware, sir, that Dr. Olsen performed geochemical modeling to evaluate the interactions of litter leachate with soils? 10:48AM

A I've only focused on Dr. Olsen's principal component analysis.

Q Did you understand that was part of his report?

A I do recollect that, yes. 10:48AM

Q And you received his report?
A Yes.
Q And I think yesterday in your testimony you were saying that these partitioning or chemical properties would have a major impact of what you see in PCA. Did I understand your testimony correctly? 10:49AM
A The difference in partitioning between soils and water, yes.
Q But you didn't do the -- you didn't review Olsen's investigation of that? 10:49AM
A No. I only looked at the principal component analysis.
Q And just to make sure I understand, so you didn't perform any such modeling as part of your work in this case? 10:49AM
A I have not.
Q Without either reviewing Dr. Olsen's work or doing your own investigation, how do you know that partitioning is important?
A From the principal component analysis because the scores plots show that there -- whatever you consider the signature to be is very different in the solid phases than in the liquid phases. 10:49AM
Q And does that indicate that a principal component analysis, such as you performed in Section 10:50AM

5 of your report, would not be a very effective tool to see if there is -- I think you used the word handoff between the solid litter to the constituents or potential contaminants in the water samples?

A It shows that there is no signature that goes from source to receptor, both my analysis and Dr. Olsen's analysis, and, therefore, if you believe there should be such a signature, principal component analysis, at least the way it's been done here with the analytes that have been used, is not a particularly useful technique, or it means that there is no signature. 10:50AM 10:50AM

Q Well, or does it not indicate, sir, just like you found in that case in I believe it was the work you did in the Maine bay, that it wasn't effective to show cross media or multimedia analysis because of a chemical -- that a multimedia analysis would not be effective to show a relationship between the solids and liquids because of the chemical interactions that are occurring in the environment? 10:50AM 10:51AM

MS. COLLINS: Could you read that back, please?

(Whereupon, the court reporter read back the previous question.)

A Well, first of all -- 10:51AM

MS. COLLINS: Object to form.
A -- in that Maine case, I didn't attempt a multimedia analysis, so I don't know if it would have been effective or not, but I think what you're saying is another way of saying -- I mean, there are 10:52AM
two possible conclusions. There is no signature as you go from medium to medium that is preserved or principal component analysis is not a useful tool here.
Q If the edge of field are your representative 10:52AM
media for determining what is your source, because that's where the release is occurring, wouldn't that be an effective tool to compare edge of field samples if that was your source with the ambient water quality samples? 10:52AM
A It would be more effective to compare SPLP poultry litter samples with the ambient water samples.
Q So you would go to the bench test then in that circumstance? 10:52AM
A In that particular case, yes.
Q Rather than use what the actual -- you actually see in the environment for runoff?
A Because when you are looking at edge of field, you are also looking at native soils. So I'm 10:53AM

choosing the lesser of two evils within the context of the program that's already been implemented.

Q Does SPLP represent any soil interactions that may occur?

A I'm not sure I understand the question. 10:53AM

Q Well, if you look at SPLP, you're totally ignoring any interactions that would occur in the soil once the poultry litter has been applied when the rain has fallen from the sky; isn't that correct? 10:54AM

A That's right, but if we want to look for a poultry litter signature, you should start with the poultry litter; otherwise, you're going to get a mixed signature at best.

Q The edge of field samples do, though, show the reactions that occur with poultry litter after it's applied to the fields; correct? 10:54AM

MS. COLLINS: Object to form.

A Well, assuming that the edge of field samples represent where -- locations where poultry litter was applied, which I don't know if they do or not, but assuming that they do, they would have some poultry litter content. Whether it's recognizable above the native soil content, I don't know. 10:54AM

Q But that would be -- they would be reflective 10:54AM

of the contaminants that are entering the surface and groundwaters, at least the surface waters of the IRW, would they not?

A From poultry litter and from other sources.

Q Would you turn to Page 23 of your report, sir? 10:55AM

You quote, I believe, at the upper part of Page 23 of your report a portion of Dr. Olsen's report; is that correct?

A That is correct.

Q And then you conclude by saying, thus, Dr. 10:56AM

Olsen uses loadings plots to identify sources; is that correct?

A That's correct.

Q Okay. Are you aware of other investigators that use loadings plots to help identify sources? 10:56AM

A I can see how loadings plots could help you identify sources because they indicate analytes that co-vary, and then if you've got a particular source with those analytes present, you might say, well, that suggests that this is the source. 10:56AM

Q Is that part --

A But the loadings plot itself doesn't represent sources.

Q I understand that, sir, but isn't that the process that Dr. Olsen employed in this case, at 10:56AM

least one of the processes?
A I would say no. He jumps immediately to the conclusion that PC1 represents poultry litter.
Q Are you suggesting that the only analysis Dr. Olsen did to identify PC1 with a source, that is, 10:57AM
poultry litter, was just looking at the loadings plots?
A No. I'm aware he also did a spatial analysis.
Q Did he also do a temporal analysis?
A I don't recall that. 10:57AM
Q Did he do an analysis of samples based on high and low flow?
A I believe that's correct.
Q Would that be a part of a temporal analysis?
A I suppose you could characterize it that way. 10:57AM
Q Did he also look at concentration trends with time, for example, on lake sediments?
A I don't recall that, although I do know that lake sediments were age dated.
Q If he did do that, would that also be a 10:58AM
temporal analysis?
A Yes, it would.
Q Okay. So Olsen did those things, both the spatial and temporal analysis. He wasn't relying solely on the loadings plot to identify PC1 as a 10:58AM

poultry source, was he?

MS. COLLINS: Object to form.

A I guess that's right. In his mind he was using those three lines of inquiry.

Q How could a spatial analysis be helpful in identifying sources when you're working with a PCA analysis? 10:58AM

A Well, when you're immediately downstream, say, of a known source and you get a different principal -- if you collect all the locations that are downstream of known sources and you compare those with locations that are not believed to be affected by known sources and the principal component signature is different, that helps you identify that principal component signature. The difference is being related to the known source. 10:59AM 10:59AM

Q Did Dr. Olsen employ that type of analysis in his work in this case?

A He did something similar. He looked at the magnitude of PC1 and compared that magnitude after he had adjusted it by adding -- making all the scores greater than one. He looked at that magnitude, compared to -- at different locations in the IRW. I know there's some issues, having read Dr. Johnson's report -- deposition, as to whether 10:59AM 11:00AM

his red dots and green dots are really red and green as they should be, but in Olsen's mind I think that's what he was doing.

Q Did Dr. Olsen also look at PC scores on reference samples? 11:00AM

MS. COLLINS: Object to form.

A I believe he did.

Q As part of his spatial analysis?

A I don't specifically recall that, but I do remember that there were reference samples in his analysis. 11:00AM

Q All right, sir. Let's -- let me hand you what's marked as Exhibit 24. Take a moment to look at that, and would you identify it for the Record, sir? Dr. Murphy, I see that we're almost time to change the tape. Why don't we take our break and if you'd like to look at the paper somewhat over the break, you can do so, and then after the break we can begin our evaluation of the paper. 11:01AM

A All right. 11:04AM

Q Thank you.

VIDEOGRAPHER: We're off the Record at 11:05 a.m.

(Following a short recess at 11:05 a.m., proceedings continued on the Record at 11:22

a.m.)

VIDEOGRAPHER: We are back on the Record at 11:22 a.m.

Q Dr. Murphy, just before the break, I handed you a paper by lead author Simeonov. It's Exhibit 24. Are you familiar with this paper, sir? 11:22AM

A I don't believe I've seen it before.

Q Okay. Do you know there was cited as -- do you know whether or not it was cited in Dr. Olsen's report in support of his PCA analysis? 11:22AM

A I don't recall.

Q Can we look at page -- was this a -- was the investigator performing a PCA analysis?

A That's one of the analyses that he performed.

Q Okay, and would you look at the analytes that are on Page 4121 of this paper? It's about the third page of the exhibit in Table 1. Are you with me there, sir? 11:23AM

A Yes.

Q Are those similar to the analytes that Dr. Olsen investigated in his PCA? 11:23AM

A Many of them are in common.

Q Was this paper by -- investigation by Simeonov, was this a basin-wide study, such as a watershed-wide study? 11:23AM

A Well, I think it may be more than basin-wide. It appears to be all the major river systems, as well as streams, tributaries and ditches.

Q Okay. So it was a large land area being investigated? 11:24AM

A It appears to be.

Q Okay. Did the investigator -- I'll turn your attention to Page 4122. Did the investigator perform a Z-transformation such as that was used by -- also used by Dr. Olsen in his PCA evaluation? 11:24AM

A Well, at least in the context of cluster analysis they did.

Q Okay, sir. Can we turn to the next page, sir? What's the title of the section on the top of the left-hand corner of Page 4123? 11:24AM

A Data structure determination and source identification.

Q Okay. Would you -- we'll skip the introductory paragraph. Would you go down to the second paragraph there where it says six principal components? Would you read that, please? 11:24AM

A Six principal components were obtained with Eigenvalues greater than one, summing almost 90 percent of the total variance of the water dataset, Table 2. The first PC, accounting for 22.1 percent 11:25AM

of the total variance was correlated with chemical oxygen demand, biological oxygen demand, total organic nitrogen I believe that is, total phosphorus and another phosphorus compound. This organic factor may be interpreted as representing influences 11:25AM
from point sources, such as municipal and industrial effluents.

Q Would you stop there, sir? Did the investigator in this case use the loadings information in order to identify -- help identify a 11:25AM
source of the contamination in the waters?

MS. COLLINS: Object to form.

A They did, but there appears to be an additional step because if you look at Table 2 where the loadings are laid out, there are -- there's a 11:25AM
significance test that was applied to determine which loadings factors were significant.

Q Okay. It did use the loadings to identify the PC sources; correct?

MS. COLLINS: Object to form. 11:26AM

A Yes. I don't know if the significant -- what the significance test was, except it may be the source apportionment that's discussed in a later portion of the paper.

Q Okay, sir, and did the investigator here use 11:26AM

PCA to identify sources?
A Well, to identify a source category.
Q Okay, and how is that different than to identify the source?
A Well, the source category is very broad. I mean, the source categories used here are organic, nutrient, weathering, soil leaching, so on. 11:26AM
Q And what were the sources that he used to identify that with? I mean, using those constituents in his PCA analysis, did he indicate a source for PC1? 11:26AM
A He did, but I believe it's after conducting the source contribution analysis.
Q Okay, and what was the source that he identified? 11:27AM
A He identified it as an organic factor.
Q Okay. Did he identify it as point sources, such as industrial and municipal effluents?
A Such as municipal and industrial effluents.
Q Okay. So he identified -- with his PCA analysis, he identified point sources as his PC1; correct? 11:27AM
A Well, again, I don't think it's just the PCA analysis. I think it's also the source apportionment using a method of Spangler and 11:27AM

Thurston that leads him to this conclusion.
Q Okay. Well, he hasn't begun discussing his source apportionment analysis at this point in the paper; correct?
A But I believe the footnote to Table 2 reflects 11:27AM that source apportionment analysis. I believe that's how he figured out what was significant.
Q Okay. Let's continue on under Section 3.2. Does he identify any other sources with this PCA analysis? 11:28AM
A The second PC accounting for 19.8 percent of the total variance was correlated primarily with water soluble nitrogen species, and then he lists three species, and, secondarily, with phosphate species or total phosphate. 11:28AM
Q Okay. Let me ask you, does he use unloadings to identify a source?
MS. COLLINS: Object to form.
A Well, a source category.
Q A source category, okay, and what source 11:28AM category does he identify as PC2?
A Nutrient.
Q And does he say this represents influences from non-point sources, such as agricultural runoff and atmospheric deposition? 11:28AM

A That's what he says.
Q Let me hand you what's marked as Exhibit 25, and I'll just note for the Record there's initials DPP at the top and I put that on the exhibit. Dr. Murphy, can you identify Exhibit 25 to your 11:29AM
deposition?
A It is a paper titled Chemometric Application and Classification and Assessment of Monitoring Locations of Urban River System.
Q And the lead author is who, last name? 11:30AM
A Kannel, K-A-N-N-E-L.
Q Okay, sir. Are you familiar with this paper?
A I don't believe I've seen it before.
Q Do you know whether or not it was cited by Dr. Olsen in support of his PCA analysis? 11:30AM
A I don't recall.
Q Would you turn to the third page, sir, where it says Section 2.3 data treatment and chemometric methods? Are the investigators in this case employing a Z-transformation to standardize their 11:30AM
data?
MS. COLLINS: Can you give him a moment to familiarize himself with the full exhibit?
MR. PAGE: Absolute. I didn't tell him he had to answer in five seconds. 11:30AM

MS. COLLINS: I know.
MR. GRAVES: It was clearly implied.
MR. PAGE: He's wise enough to look at it.
MS. COLLINS: Probably.
A It appears he used a Z-transformation. 11:32AM
Q And does that identify the formula for the Z-transformation identified an Page 392?
A Yes.
Q Could you circle that in red, please, sir?
A (Witness complied). 11:32AM
Q Is that the same formula that -- or essentially the same formula that you provided on a blank piece of paper yesterday?
A Yes.
Q Okay, sir, and which are the -- which of 11:32AM the units are constants in this formula?
A Well, for a particular analyte, X prime is the average value, and Sigma is the standard deviation. So within an analyte -- within the set of samples, they do not -- they are constants. 11:32AM
Q And then for this formula then, X would represent the concentration of that analyte in that particular sample?
A Yes, or the original value of the parameter.
Q Okay. Thank you, sir, and so does this 11:33AM

transformation allow you to still evaluate the concentration effect on your PC score?

A A PC score under some circumstances could be affected by concentration.

Q Okay, and did this investigator also log transform their data prior to performing the PCA analysis? I just think it's above in the page -- I think where I was referring, Dr. Murphy, is on the page above where we were just looking. 11:33AM

A For some variables they did. 11:34AM

Q Okay, and so is it true that this investigator employed the same transformations as Dr. Olsen did --

MS. COLLINS: Object to form.

Q -- in his PCA analysis, at least with regard to the log and the Z that we've looked at? 11:34AM

A Yeah, not with regard to the pairwise deletion but with regard to the others, yes.

Q Are you saying that this investigator did or did not use pairwise deletion? 11:35AM

A I don't see any reference to pairwise deletion here.

Q Okay. Will you turn with me to Page 397, sir? First column under Table 5, sir, would you read beginning with the first full paragraph in that 11:35AM

column?
A With the Eigenvalue criteria, Eigenvalue greater than one, the factor analysis with Varimax rotation with mean data resulted in three varifactors comprised of 91.4 percent total 11:35AM
variance. Factor 1, with the highest grouping power, is highly correlated to parameters: EC, DO, calcium, magnesium, Talk, chlorine, phosphate compound, total phosphate and several nitrogen compounds, as well as BOD and COD. It, thus, 11:36AM
describes the chemical factor of pollution.
Q Continue, sir.
A Dissolved oxygen is negatively correlated as BOD, COD, NO3 and NH4N are oxidized in expense of dissolved oxygen. 11:36AM
Q Okay. Continue.
A The main sources of NH4N, PO4P, TP and CO are domestics and municipal wastewaters.
Q Okay. Does the investigator in this case use loadings in order to help identify sources of the 11:36AM
contaminants?
A Well, with broad categories of contaminants, yes.
Q Okay, sir. Would you look down to the bottom paragraph of that same column where it says the 11:37AM

pollution sources; would you read that first sentence, sir?

A The pollution sources in the river system are identified by the representation of the factor scores versus monitoring locations. 11:37AM

Q Okay. Did the investigator in this paper then use spatial analysis with the factor scores to identify sources of contaminants?

A Looks to me like he's plotting factor scores versus location along a stream or river and saying 11:38AM the high scores correspond to the high influence of the factor on the sampling sites.

Q Okay. Is that similar to the process employed by Olsen?

MS. COLLINS: Object to form. 11:38AM

A I'd say it's similar. There's more factors being looked at here.

Q Was this a basin-wide study, sir?

A Yes.

Q And the parameters that are investigated in 11:38AM this study, are they similar to the parameters investigated by Olsen?

A There's some overlap. It's a short list of parameters.

Q In this particular study? 11:39AM

A In this particular study.
Q A shorter list than Olsen's?
A Yes, which can be a good thing.
Q Or it could be a bad thing?
A I think in general it's probably a good thing 11:39AM
until it gets too short.
Q And what's too short?
A Oh, I don't have a quantitative description as
to whether it's three, four, five, six analytes, but
carefully chosen analytes to investigate the problem 11:39AM
at hand rather than simply a long list of analytes.
Q How many analytes were investigated,
parameters investigated in this case?
A Looks like 16.
Q And how many analytes were investigated by Dr. 11:39AM
Olsen?
A As I recall, it's 26 or 28.
Q And does this investigator analyze multiple
nitrogen components?
A Yes. 11:40AM
Q And multiple phosphorus components?
A Yes.
Q I hand you what's been marked as Exhibit 26,
Dr. Murphy. Take a moment to look at that, sir.
Sir, could you read for the Record this document -- 11:42AM

what this document is?
A Spatial Distribution of Heavy Metals in Hong Kong's Marine Sediments and Their Human Impacts, A GIS Space Chemometric Approach.
Q Okay, and have you ever reviewed Exhibit 26 before? 11:43AM
A I don't believe I have.
Q Do you know whether or not it's cited by Dr. Olsen in support of his analysis for PCA?
A I don't recall. 11:43AM
Q Would you turn to Page 1375 of this paper? Do you see under where it says data pretreatment; do you see that portion? Page 1375, sir, do you see where it says data pretreatment on that page, sir?
A Yes. 11:43AM
Q Okay. Can you tell us whether or not the data pretreatment by the investigator in this PCA analysis is similar to what Olsen performed in his PCA analysis?
MS. COLLINS: Object to form. 11:44AM
A It looks like log transformation was applied to some of the variables.
Q And what about Z-transformation?
A It appears to me that the Z-transformation was used. 11:44AM

Q Okay. Is this a similar process that was employed by Dr. Olsen?
A Those two steps, yes, not the pairwise deletion.
Q Okay, and let's go to Page 1178, sir. Would you look at the section that says 3.4. Would you read the heading for this section, sir? 11:44AM
A Human Impacts of Heavy Metals in Hong Kong's Marine Sediments.
Q Okay. Would you read the second paragraph, sir? 11:45AM
A According to the results of PCA for all sites, three latent pollution choices were discovered.
Q So was the author in this case using PCA to identify sources of contamination? 11:45AM
A That's one of the methods he used, yes.
Q Would you continue on?
A Or that they used. Which shape the pollution patterns of heavy metals on a global scale. VF1, which I take to be Factor 1, or Principal Component 1, 39.38 percent of the total variates had strong positive loadings or zinc, lead, copper, cadmium and mercury, representing human sources according to Figure 5A. 11:45AM
Q So did the investigator in this case use 11:46AM

loadings to identify sources of contamination?
A Combined that with other information to do that, yes, the other information being the enrichment factors for heavy metals.
Q He did use loadings as one of his lines of 11:46AM
evidence to determine sources; is that not correct?
A To determine a source category, yes.
Q Okay. You made a comment about the number of analytes. Can we look back on the Simeonov paper, sir, which is Exhibit 24, and would you look at the 11:46AM
parameters investigated by that author on Table 1 and tell us how they compare to the parameters investigated by Olsen, that is, the number of parameters.
A I see 26 parameters. 11:47AM
Q And how does that compare to number of parameters --
A It's essentially the same.
Q And does the investigator in this particular paper, Simeonov, et al, investigate multiple 11:47AM
phosphorus parameters?
A Yes.
Q And multiple nitrogen parameters?
A Yes.
Q And did Olsen also investigate multiple 11:47AM

phosphorus and nitrogen parameters in his analysis?
A Yes.
Q I hand you what's been marked as Exhibit 27, Dr. Murphy. Can you tell me if you're familiar with that document? 11:48AM
A I am.
Q And what is it for the Record, sir?
A It's a paper, Multivariate Statistical Methods in Environmental Forensics by Stephen Mudge.
Q And is this a paper you relied on as part of your analysis? 11:48AM
A I did.
Q And who is it authored by?
A Stephen Mudge.
Q And was he involved in this project? 11:48AM
A He was the peer reviewer for my report.
Q Okay. Under principal components analysis, would you -- do you see that on the first page here?
A Yes.
Q Okay. The third sentence down, would you read that for the Record, please, starting with PCA? 11:49AM
A With PCA the data may be used as collected, e.g., the concentrations of each compound present, species numbers, or it may be transformed to proportions or percentages. 11:49AM

Q Is Dr. Mudge suggesting here that you can just use the data as collected using the concentrations without transformations?
A He says that that is a possible thing to do.
Q With PCA analysis; correct? 11:49AM
A Yes.
Q Would you look at the second page at 156? The first full paragraph, the last sentence that says if the compounds co-vary. Would you read that for the Record, sir? 11:50AM
A If compounds co-vary, bracket, behave the same as if they had the same source, bracket, in this type of analysis, they will have similar loadings factor on the model that describe the vector through the data matrix. 11:50AM
Q Is Dr. Mudge here suggesting if you have a similar loading factors, then those samples would appear to have the same or similar sources?
A He is saying that, but he's saying it in the context of multiple PCs, not PC1 alone or PC2 alone. 11:50AM
Q Okay. Would you read the second sentence in the next paragraph for the Record, sir?
A Each compound would have its own loading factor.
Q I'm sorry. The next paragraph, sir. It says 11:50AM

when compounds come from the same source.
A When compounds come from the same source, these loading factors are numerically similar for each compound, and if these loadings were plotted against each other, will group close together. 11:51AM
Q Isn't that a similar analysis as employed by Dr. Olsen in this case?
A Again, it's similar except that, which is a very important except, Mudge is talking about multiple PCs being examined simultaneously. 11:51AM
Q Didn't Dr. Olsen examine multiple PCs simultaneously?
A Not when he was doing his source allocation.
Q You mean source identification?
A Source identification, yes. 11:51AM
Q Okay. He didn't plot PC1 versus PC2?
A Yes, he did, in some cases.
Q Isn't that a multiple evaluation?
A Well, it's two, but I think Mudge is talking about more PCs than that. 11:51AM
Q Does he say that?
A Oh, I think in this paper he references how to determine the number of PCs that are required.
Q In the part of the paper where you just read, does he make any mention? 11:52AM

A No. I think it's later in the paper.
Q Okay. On Page 158, sir, turn to that with me, please. Would you read in the first column the second full paragraph the first sentence that starts in a? 11:52AM
A In an environmental forensics context, PCA may be used to demonstrate which chemicals are behaving similarly in a set of samples and are, therefore, from a similar source.
Q Do you agree with that statement, sir? 11:52AM
A Well, I think the conclusion he jumps to is a little bit -- and it should be and, therefore, are behaving as if they come from a similar source.
Q But he doesn't say that, does he?
A He doesn't, no. 11:52AM
Q So do you agree or disagree with Dr. Mudge's statement?
A I agree with his intent. I think his wording could have been better.
Q Do you know what Dr. Mudge's intent was when he wrote that statement? 11:53AM
A Well, I think elsewhere in this paper he talks about behaving as if they had the same source.
Q How is that different, what he says there, than what Dr. Olsen says as being associated with 11:53AM

the same source?
A Again, I think it's looking at loadings or multiple PCs simultaneously that leads to that conclusion.
Q So are you saying there's a difference between 11:53AM
what Dr. Mudge is saying there as being -- behaving similarly in a set of samples and are, therefore, from a similar source, do you think that's different than when Dr. Olsen is saying -- when he says in his
evaluation that the PC1, for example, is associated 11:53AM
with the same source?
A That's exactly right because in the next sentence Mudge says, this association needs to be demonstrated in all significant PCs.
Q Yes, sir, and you're saying that Dr. Olsen did 11:54AM
not demonstrate that?
A I believe that's correct.
Q And what's your basis for that statement?
A Well, I don't think he has a basis for
determining how many PCs are necessary or 11:54AM
significant for one thing.
Q Okay. Did you do that evaluation?
A No, because I was trying to emulate what Dr. Olsen did.
Q Let's look at Page 160. Does Dr. Mudge state 11:54AM

what the accepted method is for non-detects?
A He states that that's one of the accepted methods.
Q Okay, and what is one of the accepted methods?
A He says it's taking a value that is half the limit of detection. 11:55AM
Q And is that what Dr. -- the method that Dr. Olsen employed in his analysis?
A That is what Dr. Olsen did. There is an issue doing this that I have discussed with Mudge because if you have very small concentration values and you take half the detection limit and then you take the log, you get large negative numbers which can skew your PC analysis, and what Mudge says is change the units so that you don't get large negative numbers. 11:55AM 11:56AM
Q Okay, and do you know whether that issue was involved in Dr. Olsen's analysis?
A I haven't checked that it is. I know that's one of the criticisms that Cowan has.
Q You don't know whether it's in fact the case? 11:56AM
A I haven't looked into it.
Q Let me hand you what's been marked as Exhibit 28, Dr. Murphy, and I'll tell you that this is a page from Dr. Olsen's report and that the markings in here are reflected -- I put in there reflective 11:57AM

of his errata that he submitted in this case. What I'd like you to look here, sir, as the paragraph just above spatial analysis, would you read that for the Record, sir?

A Because of the chemical and bacterial comparison discussed above, PC1 has been identified as associated with poultry waste and PC2 has been identified as associated with wastewater treatment plant effluent. 11:58AM

Q Okay. Let me stop you there, sir. How is Dr. Olsen's statement about the PCs being identified as associated with different sources, the language he used there, any different than the language that is used in investigators that we just looked at where they identified sources? 11:58AM

MS. COLLINS: Object to form.

A Well, the identification methodology is different because we're not looking at loadings on multiple PCs simultaneously.

Q Is that your testimony what Simeonov did and Zhou did and Kannel did in their -- 11:58AM

A I was referring to the Mudge paper in particular.

Q Well, okay. Let's look at Kannel, Simeonov and Zhou, those investigators, where they identified 11:59AM

sources, how is that any different than how Dr. Olsen referred to his source identification?

MS. COLLINS: Object to form, asked and answered.

A Well, Simeonov has a test of some kind to determine what's a significant factor loading, and as I indicated before, I think it's his source apportionment using the method of Thurston and Spangler that leads him to be able to identify particular compounds with particular PCs, which is different. 11:59AM

Q Which is different?

A Yeah.

Q So you'd say it was fair for Simeonov to do that based on his analysis but not fair for Dr. Olsen? 12:00PM

A Well, I'd say the other factor here is that Simeonov is only looking at broad categories, and if Dr. Olsen looked at broad categories saying this could be poultry litter and cow manure and native soils, that's PC1 or whatever, that might make some sense, but to try to pick it apart based on this PC or that PC or this source or that source doesn't make sense to me. 12:00PM

Q But Dr. Olsen employed some evaluations that 12:00PM

were not employed by Simeonov, such as spatial and temporal analysis, did he not?

MS. COLLINS: Object to form.

A That would appear to be the case.

Q What about Kannel; how is what Kannel did, K-A-N-N-E-L, in Exhibit 25 any different than what Dr. Olsen did? 12:00PM

A Again, Kannel is looking at broad categories. His Factor 1 is the chemical factor of pollution.

Q Chemical factor of pollution from humans; correct? 12:01PM

A He says it's the main sources -- well, he says it's a combination of domestic and municipal wastewaters, as well as runoff from agricultural fields. 12:01PM

Q Okay. So his analysis and group of parameters allowed him to identify a different source of contaminant than Dr. Olsen but he didn't employ the exact same parameters, did he not?

MS. COLLINS: Object to the form. 12:02PM

A I don't know if they're exactly the same, but they're very similar.

Q And Dr. Olsen employed some additional analyses to identify source along with the PC loadings; correct? 12:02PM

MS. COLLINS: Object to form.
A I don't believe that Kannel did any temporal. He did spatial analysis but doesn't appear to have done temporal analysis.
Q Did he do evaluation of the scores? 12:02PM
MS. COLLINS: Object to form.
A Could you rephrase the last question?
Q Well, did he do an evaluation of the PC scores?
MS. COLLINS: Are you referring to the 12:02PM author of the article or Olsen?
MR. PAGE: Yes, Kannel. Thank you.
A Yes.
Q Okay, and did Dr. Olsen also employ that technique? 12:02PM
A To a very limited extent. There were very few score plots in Dr. Olsen's analysis.
Q Did Dr. Olsen also employ an evaluation of the -- did Dr. Olsen employ an evaluation of the magnitude of the score in order to identify sources? 12:03PM
A Yes, he did.
Q Did Kannel do that?
A Perhaps you could direct me to a portion of the paper. I'm not seeing it.
Q I don't think he did. That's the point of my 12:03PM

question.
A Yeah, okay. That's -- okay. Yeah, and I don't think you should.
Q Oh, you don't think that's ever proper to look at the magnitude of the scores to evaluate sources? 12:04PM
A I think the utility of the scores plot is to see where clusters of scores occur in a multiple PC space, and that the score, along an individual PC, I don't think is of much utility in identifying sources. 12:04PM
Q If you perform a Z-transformation rather than a fraction standardization, wouldn't the score be more probative in identifying sources than a fraction-wise methodology?
A Well, I don't know the answer to that in light of my last answer, that I don't think the magnitude of scores is a useful way of approaching the issue of sources. 12:04PM
Q Within a cluster, isn't the magnitude of the PC score important? 12:05PM
MS. COLLINS: Object to form.
A The magnitude of the score as a multidimensional space determines where a cluster forms.
Q So the score is important; correct? 12:05PM

A It's important in determining where there are clusters, yes.
Q Okay. So -- but within a cluster, within a cluster, isn't the magnitude of a PC score important? 12:05PM
A Within a cluster, the scores are going to be the same or very similar.
Q Doesn't the score itself actually indicate what samples will plot in that same location?
A Yes. 12:05PM
Q So the score is important?
A Yes.
Q Let's look on Page 9 of your report, sir. Under your section, Dr. Olsen's interpretation of his PC results, do you see that, sir? 12:06PM
A Yes.
Q The second bullet, would you read the first two sentences there, sir?
A Dr. Olsen adds an arbitrary number to all his PC scores so that they are all positive. He then 12:06PM focuses on high adjusted scores as evidence of poultry-litter related effects.
Q Okay, sir. Would you explain what your concern is as reflected there?
A Well, if you have large negative scores, those 12:06PM

are transformed into scores of one or near one, and
a large negative score can be as important as a
large positive score in telling you what's going on.
Q Okay. So what did Dr. Olsen do?
A He added an arbitrary number -- well, not 12:07PM
arbitrary but he added a number so his smallest
score whether it had originally been negative or
positive was equal to one.
Q But he added the same number to all the
scores; correct? 12:07PM
A To all the scores in each PC run, yes.
Q So they didn't change in their relationship
with respect to each other; correct?
A No. They didn't along an individual PC. In
multiple PCs they would have change. 12:07PM
Q Didn't the rescaling of the PC scores simply
shift them all by the same amount without changing
the relationships among the scores at all?
A For an individual PC, yes.
Q Well, isn't the relationship among the 12:08PM
points -- let me strike that. What important
information is overlooked by doing this?
A Information about things that are negatively
correlated.
Q Okay. What important information is 12:08PM

overlooked regarding the relationships between the samples?

A The -- before you add a value to make the smallest PC score one, you have a plot that -- where both the X and Y axes have negative and positive values. After you do the transformation, you've moved those axes a different amount horizontally than you have vertically because you had to add a different number to those scores for PC2 than you did for PC1. 12:09PM

Q So how did that affect the relationships between the samples?

A The dots plot in more or less the same pattern, although there is -- there is some shifting between the horizontal and the vertical because you've added different amounts horizontally and vertically, but relative to which dot is further to the right or which dot is further up, that doesn't change. 12:09PM

Q Would you really see any difference in the scores plots based on the transformation, the rescaling that Dr. Olsen performed? 12:09PM

A I think it would look different in multiple PCs when you get beyond two, if you go to three or more. 12:10PM

Q How do you know that?
A Because you're adding a different -- you're changing the axis, each axis by a different amount.
Q Did you test that theory of yours?
A I have not. 12:10PM
Q Well, let's look at least with two PCs and see if it shows any difference. I'm going to hand you Exhibit 29. Exhibit 29, Dr. Murphy, is the SW3 PC run, and the first page is before the scaling was done in the original PC plot, and the second is 12:11PM after the scaling. By comparing Pages 1 and 2, do you see any difference in the scores plots?
MS. COLLINS: Objection.
MR. PAGE: What's your objection?
MS. COLLINS: What is the -- is this -- for 12:11PM clarification, are these plots from his original report --
MR. PAGE: Yes, his original report.
MS. COLLINS: -- disclosure? So where it says original, means that these plots were with 12:11PM disclosed in his original report, and then if you continue, the last three documents in Exhibit 29 --
MR. PAGE: Last two --
MS. COLLINS: Last two that say corrected?
MR. PAGE: Yeah. That's after the log 12:12PM

transformation was corrected.

MS. COLLINS: Okay. So these are associated not with his original report but the February 10, 2009 reanalysis?

MR. PAGE: Yes. 12:12PM

MS. COLLINS: And the one just before that shows original expanded view?

MR. PAGE: Yes.

MS. COLLINS: Is this figure different in any way from the figure that was included with Dr. 12:12PM Olsen's different report?

MR. PAGE: No.

MS. COLLINS: So we can find the original expanded view in his original report?

MR. PAGE: Yeah, and what he did was -- 12:12PM this view has all the plots on it, and then you have these ones in the upper right-hand corner which tends to condense the ones on the left side. So if you take those off, that's what happened in the expanded view, so then you can see more separation 12:12PM among the plots on the lower left, and both were shown in Dr. Olsen's original report.

MS. COLLINS: Well, I make the same objection as I stated earlier with respect to the last two pages of Exhibit 29 and the untimely 12:13PM

disclosure and failure to produce any of the underlying analysis.

Q Now that we've clarified everything a little bit there, do you see any difference between Pages 1 and 2, that is, before the rescaling and after rescaling? 12:13PM

A Well, I've already indicated that I -- that the relatives of the positions of the dots in terms of where they are relative to each other horizontally and vertically is preserved by this transformation, but you have added a different number to the horizontal values and to the PC1 values than you did to the PC2 values. 12:13PM

Q But they maintained the same relative locations, did they not? 12:13PM

A The same relative locations, but I think there's some -- yes, they maintain the same relative locations.

Q And can you say the same thing with regard to Pages 3 and 4, sir, maintain -- just so we have an expanded view, it may be a little easier to compare. Do they maintain their same relative locations before and after? 12:13PM

MS. COLLINS: Objection to form.

Q Before and after rescaling? 12:14PM

A I would expect that they would.
Q Okay, and what about the ones Dr. Olsen made the correction of the log transformation?
A Well, I would expect they would, but if you actually hold the pages up to the lights, the dots 12:14PM
don't fall on each other. What's happened is there's been some stretching because different numbers have been added to PC1 and PC2. So it's as if the dots were on a piece of rubber and you stretched them in different -- differently. 12:14PM
Q They maintain their basic relationships with each other?
A They maintain their basic relationships, but the two plots don't line up one on top of the other.
Q So what important information regarding 12:14PM relationships has been lost by the rescaling?
A Well, at this point I'd have to say that the -- I do quote Mudge's opinion that this reduces the usefulness of PC1 as a signature source discriminator. That's on Page 24. I quote Mudge to 12:15PM that extent.
Q And you have Mudge's paper in front of you. Would you identify that portion of the paper that you rely upon?
MS. COLLINS: Could you repeat that

question?

(Whereupon, the court reporter read back the previous question.)

A It's Page 158, second column, middle of the page, paragraph starting if raw concentration data are used. 12:17PM

Q Okay. Is it referring to concentrations here, sir?

A It goes on to say a nominal number has been added to the scores to make all values positive and, therefore, able to be plotted on a log-log figure, referring to Figure 5B. 12:17PM

Q But he's talking about the use of raw concentration data in this example; correct?

A I think it's referring to adding a constant to the PC1 and PC2 and then the taking the log. 12:18PM

Q In this application, an example, was raw concentration data used for the principal component?

A In Figure 4A it is, yes.

Q He refers to Figure 5B; correct? 12:18PM

A Yes.

Q Is his example here the same application that Dr. Olsen used?

A Well, it's the same application adding a constant to each PC to make them positive. 12:19PM

Q But in Figure 5A and B it shows that the relationships changed on his example; correct?
A That's because the constant that's been added is much larger than the original scattering of the data. 12:19PM
Q When we evaluated what Dr. Olsen did, you didn't see that kind of change on Exhibit 29, did we?
A No, but we did see some shifting of the points. 12:19PM
Q But nothing is as exacerbated as Mudge's example; correct?
A No, though Mudge keeps the relative positions of the points, just as Dr. Olsen does.
Q Okay. It's time for our break. We'll take a break for lunch now of about an hour. 12:20PM
VIDEOGRAPHER: We're off the Record at 12:20 p.m.
(Following a lunch recess at 12:20 p.m., proceedings continued on the Record at 1:24 p.m.)
VIDEOGRAPHER: We are back on the Record. The time is 1:24 p.m.
Q Dr. Murphy, could we turn to Page 38 of your report, which is table -- or excuse me, Figure 4-1. 01:23PM

Would you describe Figure 4-1 for us, please?
A That is the loadings on PC1 and PC2 according to Olsen's SW3 calculation.
Q Okay, and so -- and this was on the surface water analysis, SW3? 01:24PM
A Yes.
Q Okay, and is this -- why did you perform this analysis on Figure 1?
A I believe in the text I'm making the point about how you have to look at loadings on several 01:24PM PCs at the same time.
Q And that's what you attempted to show here?
A Yes.
Q Okay. In this plot does it appear that the phosphorus and the potassium constituents plot near 01:24PM each other?
A On these two principal components they do.
Q Okay, and because of that, would you conclude that phosphorus and potassium have common sources?
A If that relationship was borne out in 01:25PM subsequent PCs, PC3, 4, et cetera, I would conclude that they behave as if they had a common source.
Q Okay. Do you know any IRW sources that have both phosphorus and potassium?
A I really haven't looked into that. 01:25PM

Q How do those phosphorus and potassium analytes compare with the bacteria?
A Well, if you only looked at PC1, it would look as if they were very similar. They have similar loading on PC1, but when you look at PC2 also, you 01:25PM see that the bacteria have a negative loading of about, oh, I don't know about minus .2, and the phosphorus and potassium have a positive loading of about .5. So on PC2 they clustered separate. They don't behave as if they have a common source. 01:26PM
Q And what about the metals, nickel, copper, zinc, arsenic?
A Those have a -- are near zero on PC2, which means that PC2 isn't contributing very much to them.
Q But PC1 is; is that correct? 01:26PM
A That's right, and we don't know about PC3 or 4, et cetera.
Q So looking at these two PCs, the figure that you provided for us, would it be reasonable to conclude that it appears that PC1 and PC2 are common 01:26PM sources for phosphorus and potassium?
A Well, this is Dr. Olsen's calculation. I've simply added the names of the different analytes.
Q Is that what that shows on your Figure 4-1?
A For those two PCs, just looking at these and 01:27PM

no further PCs, phosphorus and potassium are behaving as if they have a common source.

Q And would it indicate that phosphorus -- excuse me, that the PC2 would not have the metals or the bacteria associated; correct? 01:27PM

A Well, I would say that's correct for nickel and copper, but for bacteria it's got a negative loading, so it does have a correlation. It just happens to be a negative correlation.

Q Okay, but you wouldn't expect those bacteria to be found in PC2 constituents, correct, source constituents? 01:27PM

A No. I -- they're important in determining PC2.

Q And their absence is what's important, PC2; is that correct? 01:28PM

A No, I don't -- that's not how I interpret it. I think that's correct for zinc, copper and nickel because they're very near zero on PC2. There is some variation with the bacteria on PC2. 01:28PM

Q Okay. What about calcium and alkalinity?

A They are negative about .3 on PC1 and positive about .4 on PC2.

Q Okay. What about sodium and chloride?

A They're slightly negative on PC1 and about .8 01:28PM

or .9 on PC2.
Q Okay, sir. Do you know whether or not wastewater treatment plant effluent is a source of phosphorus?
A I haven't looked into it. 01:29PM
Q If that's the case, wouldn't that explain both PC1 and PC2 showing phosphorus loading as being part of the signature?
A I'd need to know all the sources of phosphorus in the IRW. 01:29PM
Q Okay. Based on the pie chart, would that kind of information help you do that evaluation if you had a mass balance similar to the pie chart we looked at yesterday?
A If I believed it to be correct, it might. 01:29PM
Q Okay. At this point in time do you believe it to be incorrect?
A I don't have any information one way or the other.
Q Okay. Is it true, sir, that wastewater treatment plant effluent is chlorinated if it's properly being administered? 01:29PM
MS. COLLINS: Object to form.
A I don't know that to be the case, but it could be true. 01:30PM

Q If that was the case, would that indicate, if it was properly being administered, that it would have a low bacterial count?

MS. COLLINS: Object to form.

A The intent is certainly to reduce the bacterial count, but to what level, I don't know. 01:30PM

Q Do you know whether or not the sodium, chloride, sulfate, calcium and alkalinity are -- let me ask you this: Would you agree that sodium, chloride, sulfate, calcium and alkalinity are mostly associated with whatever source is identified as PC2? 01:30PM

A No. I think that it's entirely likely that they're associated with their solubility properties, as well as whatever sources are present. 01:31PM

Q You do agree that the metals, zinc, arsenic, nickel, copper and also organic carbon, are mostly associated with PC1?

A Just looking at these two PCs -- well, yes, it does appear to be the case. 01:31PM

Q Let's look at the nitrogen species you have on Figure 4-1. Do you know whether or not TKN or total Kjeldahl nitrogen is ammonia plus organic nitrogen?

A I know it includes some organic nitrogen. I think that's right. 01:32PM

Q And it doesn't include nitrite and nitrate?
A No. That's separate.
Q Okay. So which of the two forms, nitrate and nitrite or Kjeldahl nitrogen, represent more oxidized -- an oxidized state of nitrogen? 01:32PM
A I don't know the answer to that.
Q If it's nitrite and -- well, let me see. Is one of the functions of a wastewater treatment plant to oxidize both organic nitrogen and ammonia?
A Yes. 01:32PM
Q So if nitrate and nitrite happen to be more oxidized forms of nitrogen, does it make sense they would be more closely associated with PC2 if that source -- if the source of PC2 is wastewater treatment plants? 01:33PM
A If the source of PC2 was wastewater treatment plants, yes.
Q And does the plot on 4-1 indicate that, that it is more closely associated with PC2?
A Yes, it does. 01:33PM
Q And how is it related to PC1, nitrate and nitrite?
A It's near zero on PC1, so it doesn't affect PC1 at all.
Q And the Kjeldahl nitrogen, how is that 01:33PM

associated with PC2 if at all?
A It's perhaps minus .1 on PC2, so there's a slight influence on PC2.
Q And is that consistent with what your knowledge of the effect is of wastewater treatment plant on nitrogen? 01:33PM
A If that were the source here, that would be the case.
Q Based on the -- your knowledge of poultry waste, would poultry be associated with TKN, poultry waste? 01:34PM
A I haven't looked into that.
Q The information you looked at today, based on the samples and analyses, do they indicate that poultry waste is associated with TKN? 01:34PM
A One of the papers did, yes.
Q I believe in your report, Dr. Murphy, you state that a high PC score does not mean a high concentration; is that correct?
A That's correct. 01:35PM
Q Given what we understand about Dr. Olsen's data preparation, would that also be true in Dr. Olsen's analysis?
A I believe so.
Q Isn't it true that the Z-transformation does 01:35PM

preserve the concentration of the individual analytes so that the PC score would be affected by the concentrations?

A It can be affected by the concentration, but when you divide by the standard deviation, you're 01:35PM basically dividing by the range over which the parameters varies, and so you're tending to normalize all the different analytes to about the same.

Q But isn't there still some influence of 01:35PM concentration after Dr. Olsen's transformations?

A There can be.

Q Did you do any tests to determine whether there was?

A No. 01:36PM

Q If there was some relationship to concentration remaining after Dr. Olsen's transformations, isn't it possible then for Dr. Olsen to be able to state that a higher PC1 score implies a greater degree of contamination? 01:36PM

A Well, when I say it may be, I'm referring to a specific analyte, which where the division by the standard deviation doesn't entirely reduce the normalized concentration to the same value as other analytes. I would be very surprised if it's true 01:36PM

for all analytes. There may be some where concentration is coming through but not all of them.

Q And where that's preserved, though, wouldn't that have an impact on the PC scores?

A Where it's preserved at what? 01:37PM

Q So the higher PC score in that circumstance would indicate a higher degree of contamination, would it not?

A It would indicate -- the higher PC score would be influenced by the higher concentration in that 01:37PM case for that specific analyte.

Q Dr. Murphy, have you seen pairwise deletion used with PCA?

A I know that it's an option in SysStat. I don't think I've ever seen it used. 01:38PM

Q Okay. Do you believe there is any flaw with an investigator analysis, PCA analysis if he uses pairwide deletion?

A Well, the problem with it is that it won't permit you to calculate scores. You can calculate 01:38PM correlations and loadings but not scores without making some additional assumption.

Q Okay, and did Dr. Olsen do that when he employed pairwise deletion?

A I believe he did, yes. He made an additional 01:38PM

assumption.
Q Have you ever seen pairwise deletion used in PCA analysis, any published reports?
A No, but as I say, I'm not surprised since it's an option in SysStat. 01:38PM
Q Let me hand you what's marked as Exhibit 30 and ask you if you could identify that for the Record.
A It's an article titled, Distribution of PCDDs and PCDFs in Soils Collected from the Denver Front Range. 01:39PM
Q Are you familiar with this?
A I don't believe I've seen it before.
Q Do you see down in the bottom right-hand corner it shows a Bates number from your considered materials? 01:39PM
A Yes, it does.
Q Does that refresh your recollection as to whether you've looked at this paper in the past?
A No. It may very well have been in my collection but doesn't refresh my memory. 01:39PM
Q And did the investigators in this case employ principal component analysis?
A Yes.
Q Would you look on Page 192, sir, and look at 01:40PM

about Page 1.5 -- not Page 1.5 but Section 1.5 and take a minute to review that, sir, and I have a couple of questions. Have you had a chance to look at that, sir?

A Yes. 01:40PM

Q Did the -- were the statistical methods employed by the investigators in this paper similar to those employed by Dr. Olsen?

A They were, and they note that the -- using the Z score is intended to minimize bias associated with 01:41PM order of magnitude differences in concentration, which is what I've been saying.

Q Okay. So they also did the log transform?

A Yes.

Q And then the Z-transformation? 01:41PM

A Yes.

Q And then also used pairwide deletion; is that correct?

A Yes.

Q And were they able to consider scores in this 01:41PM paper?

A They present scores plots.

Q Okay. So even using the pairwise deletion, the investigators of this paper were also able to evaluate scores; correct? 01:41PM

A They are. They had to make some additional assumption, but whether that was to replace some blanks with means or what it was, I do not know.
Q Okay. Where was this paper published?
A Environmental Science and Pollution Research. 01:42PM
Q Are you familiar with that journal?
A I guess I've seen it before, yes.
Q If you would turn to Page 10 of your report, sir, do you see the first bullet at the top of the page, sir? 01:43PM
A Yes.
Q Would you read that, please?
A Dr. Olsen made a fundamental mathematical error which renders all of his results invalid.
Q How did -- is this the failure to log 01:43PM transform the data after he ran through PCA?
A It involves the log transformation of data, yes.
Q Okay, and what was the problem?
A He calculated the correlation coefficients 01:44PM using log transformed data and then calculated PC scores on data that was not log transformed.
Q So the data out of SysStat should have been log transformed?
A Yeah. Either -- it should have been 01:44PM

consistent, either not all log transformed or all transformed.

Q How did this render all of his results invalid?

A Well, it really should say all his PC score results invalid. 01:44PM

Q Okay. Does it still allow him to plot scores; even without the second transformation, does it still -- is he still able to plot scores and evaluate score plots? 01:44PM

A He is, but their values on the PC1, PC2, et cetera, axes are not where they would be if they had been done correctly.

Q But is it your belief, sir, that the scores would still cluster similarly without the transformation? 01:45PM

A There would be at least a tendency to do that.

Q Let me hand you what's been marked as Exhibit 31, and does this document look familiar to you, sir? 01:46PM

A It's a figure from Dr. Olsen's report. I don't know if it's the corrected version or not.

Q I'll represent to you it's the non-corrected version.

A The non-corrected version, okay. 01:47PM

Q And this is for the surface waters; correct, sir?
A Yes.
Q So this is the scores plots for surface waters? 01:47PM
A Using just the first two PCs, yes.
Q Okay. Using the pen that we provided you, would you draw a circle around the edge of field samples from this plot, sir? I've got it here for you. 01:47PM
A I'm sorry, repeat it.
Q Would you draw a circle around the edge of field samples on this plot, sir?
MS. COLLINS: Object to form.
A (Witness complied). 01:47PM
Q Can I see that, sir? Okay. Thank you, and Dr. Olsen uses edge of field as representative for poultry waste releases; correct?
MS. COLLINS: Object to form.
A That is his interpretation, yes. 01:48PM
Q Now, would you draw a circle around the wastewater treatment plant samples on this figure, sir?
MS. COLLINS: Object to form.
A (Witness complied). 01:48PM

Q And would you please label the edge of field with an EOF and the wastewater treatment plant with WWTP?
A (Witness complied).
Q May I look at that, sir? All right, sir, and 01:49PM
now would you finally draw a circle around the reference samples shown in this SW3 plot?
MS. COLLINS: Object to form.
A (Witness complied).
Q Sir, on the plot, given these three different 01:49PM
types of samples, do they show separation?
A They do. It would be really interesting to see the SPLP poultry litter samples on here, too, to see how those break out.
Q And, Dr. Murphy, is it true that the plots 01:50PM
that are between the reference and the wastewater treatment plant and the edge of field would be mixtures of those potential sources?
MS. COLLINS: Object to form.
A Well, that would be part of it. The other 01:50PM
part is even though this is all surface waters, that other things such as, you know, stream flow and so on and fraction are going to make differences for what's total and what's dissolved. So there's some
fate and transport going on there as well as 01:51PM

sources.
Q Okay, sir. Let me hand you what's been marked as Exhibit 32 and, sir, this is the corrected scores plot now but it's not the expanded view, so that's why the figure is a little different label at the 01:51PM
bottom. It's 6.11-18D, and so this is after the log transformation has been corrected, and I want to ask you to do the same thing. Would you please draw a circle around the three different sources and label them? 01:51PM
MS. COLLINS: I repeat my standing objection from earlier as to the nature of this exhibit.
MR. PAGE: Save the speech and save the time. 01:51PM
MS. COLLINS: Also object to form.
Q Would you also label them, sir?
A (Witness complied).
Q And then the reference samples also?
A (Witness complied). 01:52PM
Q I don't believe you labeled the reference on Exhibit 31. Would you do that also for me?
A Yes.
Q Thank you, sir. Okay. Do the -- after you do the transformation, do you also find that there are 01:52PM

three separate groups for these three separate source categories?

MS. COLLINS: Object to form.

A Well, they're not really separate in that there's some other kinds of samples mixed in but 01:52PM they -- the figures I do -- I did draw do enclose or are in relative position to each other.

Q And so there's not an overlap between the different groups, is there?

A Not in either figure, no. 01:53PM

Q So is it fair to conclude that although unfortunate, the mathematical calculation did not affect Dr. Olsen's ability to interpret these scores plots?

MS. COLLINS: Object to form. 01:53PM

A This is the plot just for surface waters, and I'd need to see what the original and corrected versions looked like for the other runs, the SD 1 and so on.

Q But for the surface waters, would you -- 01:53PM

A For the surface water, the clustering is about the same.

Q So you could do the interpretation either way; correct?

MS. COLLINS: Object to form. 01:53PM

A Yeah. Whether he did it correctly either way is a different issue.

Q On Page 30 of your report, Dr. Murphy, you reference a couple of examples by citing papers of successful use of multimedia PCA analysis; correct? 01:55PM

A Yes.

Q Do you know whether in all circumstances multimedia analysis is appropriate for PCA?

A No. I would say it's not going to be very useful when the patterns between contaminants change 01:55PM from media to media because of fate and transport differences.

Q Okay.

A At least it's not going to be useful for determining sources. It may be useful for defining 01:55PM fate and transport differences.

Q Well, if you can connect the source to the place where the transformation occurred, then you could still make that linkage, could you not?

MS. COLLINS: Object to form. 01:56PM

A You mean along the part of the pathway where are there are no differences?

Q Yeah.

A You could do an analysis on that part of the pathway. 01:56PM

MR. PAGE: Can we go off the Record a minute?

VIDEOGRAPHER: We are now off the Record. The time is 1:57 p.m.

(Following a short recess at 1:57 p.m., 01:57PM
proceedings continued on the Record at 2:03 p.m.)

VIDEOGRAPHER: We are back on the Record. The time is 2:03 p.m.

Q Dr. Murphy, I located a copy of the report I wanted to ask you about. Let me hand you Exhibit 33 02:03PM and ask you to identify that for the Record.

A It's a paper called Patterns and Sources of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans Found in Soil and Sediment Samples in Southern Mississippi. 02:03PM

Q And was this paper one of the ones that you cited as representative of multimedia analysis?

A I believe it is, yes.

Q Okay. Take a moment to take a look at it and I want to ask you a few questions. 02:04PM

A All right.

Q What were the multiple medias evaluated in this particular work?

A They're shown in Table 1. There's pulp mill effluent, which I take to be a liquid. There's 02:05PM

sediments; there's soils; there's water from sewer inflow and outflow, sewage sludge, sediments, septic tank. It's a mixture of solids, sediments, liquids.

Q And was the effluent from the pulp mill known to contain dioxins? 02:05PM

A I would say it was probably suspected to contain dioxins. Bleached paper mills typically do produce dioxins.

Q Did they actually have some analysis that showed they contained dioxins? If you're doing a 02:05PM dioxin investigation and I guess you're doing a multimedia analysis and you're looking at effluent, aren't you going to have to analyze for dioxins in the effluent as well as in the other media you are evaluating to see if you can identify the source? 02:06PM

A That's right. You're trying to make a connection between the source and the receptor, and it appears that it did because I see that Sample No. 6 occurs on the PC1, PC2 plot.

Q So the investigator knows that the plant's 02:06PM effluent contains dioxins?

A Yes.

Q Does the investigator also know from his samples that these constituents are also in the sediments? 02:06PM

A I don't know if he knows it beforehand, but he certainly suspects it.
Q Okay. Did the study confirm or not that there's a contribution from the effluent to the sediments? I'll turn you to Page 425, if you'd like, sir. 02:06PM
A 425 is, oh, I see, results of the PCA?
Q Yes, sir.
A It says the pulp mill water emissions are clearly separated from the soil and sediment samples. 02:07PM
Q So in this analysis he was not able to identify the source?
A No. I would say he's concluding that the source is not the pulp and paper mill, the source of chlorinated dioxins in the sediment and soil. 02:07PM
Q And that's even though there is clearly a discharge of dioxins from the pulp and paper mill; is that correct?
A That is true. 02:08PM
Q Are you aware of any physical process whereby there would be a discharge of dioxins from a pulp and paper mill but they would not reside in the sediments downgradient from that discharge?
A Their presence could be masked by much larger 02:08PM

contribution of dioxins from background subsequent to dilution.

Q At the bottom of Page 425 -- or excuse me, 424, he's referring to Figure 1. Could you read that last paragraph on Page 424? It says from Figure 1. 02:08PM

A All right. This has to do with the hierarchical cluster analysis. From Figure 1, it can be seen that it is not possible to group the sediment samples into two groups, one above the pulp mill and one below the pull him mill. In other words, it is not possible to distinguish sediment below the mill from sediment above the mill. As a result from the dioxin analysis -- 02:09PM

Q Could you stop there, sir? 02:09PM

A Yeah.

Q Could you -- does that make any sense, given that there's a source of dioxins from the effluent coming from the mill?

A Same answer as before. It's likely being masked by the background dioxins. 02:09PM

Q Are you confident of that, sir?

A I think that's the most likely explanation.

Q Or is another explanation that the multimedia analysis just didn't work in this case? 02:09PM

A This is the hierarchical cluster analysis, not the PCA analysis, what we just read.
Q Okay. Let's go to the results of the PCA at 425. I apologize. Would you read the last sentence at the bottom of Page 425 at 4.1.2? 02:10PM
A This was also found with PLS discriminate analysis, another technique based on PC.
Q Okay, and the sentence before that, sir. I apologize.
A Within the groups of soil and sediment 02:10PM samples, there is no separate between samples collected upstream and downstream of the mill.
Q Okay. So again, sir, does that make any sense to you?
A Same answer. It's very likely that the effect 02:10PM of the mill is being masked by a larger background.
Q Does that indicate that the PC analysis wasn't effective for this multimedia evaluation?
A I'd would say it was effective. It showed that the mill was not a significant source. 02:10PM
Q If the source -- well, so you're suggesting, sir, that -- is another explanation of the failure to be able to find it upstream and downstream the fact that the PCA analysis simply does not work multimedia in this case? 02:11PM

A No, I don't think that's the case, particularly since there -- one of the comparisons being made is sediment to sediment and they're drawing the same conclusion.

Q Wouldn't you expect the discharge from a known source of dioxins to have higher concentration than the background? 02:11PM

A No, I wouldn't. There have been studies done around waste incinerators and other point sources, and they show that the background is the major contributor. 02:11PM

Q So that was the point of this study, to show that the dioxins in the sediments were not being contributed by the paper mill?

A I'd say it's the conclusion of the study. What they -- I think they were probably open minded when they set out in the study what they wanted to show. 02:12PM

Q If the effluent from the plant had some dioxins in it, which it shows it does based on the analysis, wouldn't you expect to have some difference if the PC was run properly between the unimpacted sediments and the ones that are impacted by the effluent -- 02:12PM

MS. COLLINS: Object to form.

Q -- that is, the upstream and downstream?
MS. COLLINS: Object to form.
A Not if the contribution from the paper mill is being masked by a much larger background concentration. 02:13PM
Q Is there any evidence in this paper that indicates that's the case?
A Yeah. It's in the discussion section saying the pulp mill has clearly discernible dioxin pattern from all of the samples. It does not reflect any 02:13PM similarity of sediment in the soil patterns from above and below the mill.
Q Would you expect there to be any chemical changes in the pulp mill dioxin samples after they're released into the river? 02:13PM
A Only over long periods of time.
Q Are you aware of any -- that dioxins do in fact, modify or change chemical composition after they are released into the environment?
A Yes. 02:13PM
Q Could that account for the failure to identify the sources in the sediment downgradient from the pulp mill?
A I don't believe that's the case. I believe the explanation I've given is the most likely one. 02:14PM

I would point out also that Mr. Rappe is probably the world's best known dioxin researcher, so he's aware of all of these possibilities.

Q Did he consider that in part of his analysis?

A Well, I'd say it's implicit in the analysis 02:14PM that the sediments below the mill are like the sediments above the mill, so those sediments haven't transformed over time, and why would the dioxins from the mill degrade more rapidly than the dioxins that are already in the river? 02:15PM

Q Did the investigators in this case look for this large background source?

MS. COLLINS: Object to form.

A I would say that they did not look for a specific background source because they know from 02:15PM other work, including Rappe's work, that background is pervasive from vehicles and heating and so on, that it exists on a continent-wide scale.

Q In large concentrations?

A Yes. 02:16PM

Q But that's not stated in the paper; is that correct?

A It's not, no. You would have to look at his other papers.

Q It's an assumption on your part? 02:16PM

A No. It's based on reading literature, including the EPA dioxin study which summarized background concentrations.

Q In your PCA multimedia run on Figure 5-1, are your water samples well separated? 02:16PM

MS. COLLINS: Object to form.

A Well, they are certainly well separated from the poultry litter samples.

Q Are the samples themselves within the samples well separated, different types of water samples? 02:17PM

A I would say the water samples are among the most tightly clustered type of samples. Very distinct from poultry litter, very distinct from soil samples.

Q And given chemical processes concerning the 02:17PM constituents in poultry litter after it's been exposed to water, does that make sense to you?

A It tells me that this isn't as much about sources as it is about transformations going from media to media, that there is no signature that goes 02:17PM from poultry litter to surface water.

Q Do you see how -- where are the solid samples in your analysis?

A Solid samples would be the red dots are cattle manure. The yellow dots are poultry litter. The 02:18PM

reference soil is black dots in with the green crosses, which are regular soil. The sediments are the red crosses.

Q So where are the poultry litter samples in this analysis? 02:18PM

A They're the yellow dots.

Q And are they separated from the other soil samples?

A They are separated from soil samples, yes, which are the green crosses. 02:18PM

Q Do the edge of field samples in your diagram connect the litter with the water samples?

A Some of the edge of field samples lie between the soil and the surface water, and some of the edge of field samples lie between the cattle manure and 02:19PM poultry litter and the surface water.

Q So there does appear to be a connection between some of the edge -- actually most of the edge of field samples between the ambient water samples and poultry litter; is that correct? 02:19PM

MS. COLLINS: Object to form.

A And/or cattle manure, but still very distinct from the surface water. There's just no carryover from poultry litter to surface water.

Q So your opinion is based on your analysis that 02:19PM

poultry litter that's disposed of in the amount of 350,000 tons a year in the IRW is having no impact on the IRW waters?

MS. COLLINS: Object to form.

A What I'm saying is that Dr. Olsen's analysis does not indicate any impact. 02:20PM

Q His PCA analysis?

A His PCA analysis, nor does my own analysis.

Q Do you agree, sir, that most of the poultry litter samples are separated by most of the edge of field samples to the ambient water samples? 02:20PM

MS. COLLINS: Object to form.

A Actually the cattle manure samples are more like the edge of field samples than are the poultry litter samples, and the SPLP from the poultry litter is quite distinct from edge of field samples, and there are other plots that show this in a little better expansion, for example, Olsen's SW18, I believe. 02:20PM

Q With your knowledge of SPLP, would you anticipate that edge of field samples would have a similar chemical pattern as SPLP samples of poultry litter? 02:21PM

A Well, it's not based on my knowledge of SPLP. It's based on the fact that those edge of field 02:21PM

samples are also going to have native soils in them, and it would be very interesting to see where SPLP on -- of native soils plots on this plot.

Q Let's talk about the methods you used to do your multimedia analysis. You talk about log transformations; correct? 02:21PM

A Yes.

Q Did you log transform the data before you did your multimedia analysis?

A Yes. I was trying to emulate Dr. Olsen, so I did. Oh, no, I'm sorry, I didn't. In this case, in my multimedia analysis, it's -- each chemical is represented as a fraction of that total chemical group. 02:22PM

Q Is most environmental data lognormally distributed? 02:22PM

A Yes, it is.

Q So given that case, would it make sense to log transform the data before you did your analysis?

A No, I don't think so, because, again, I'm trying to represent each chemical as a fraction of its group, and taking the log of each chemical and dividing by the sum of the logs of all the chemicals doesn't produce anything. 02:22PM

Q Doesn't Mudge in the paper we've looked at 02:23PM

actually suggest that it is important to do log transformation prior to PCA?

A He talks about that. He also talks about the -- using each chemical as a fraction of its group.

Q On Page 159 does he not state that -- well, the data for PCA do not have to be normally distributed. Improved separation can be seen when it is? 02:23PM

A Yes, if you're doing it in the method that Dr. Olsen used. You have to be careful, again, about detection level effects and low concentration effects, but log transformation of data is not unconventional. 02:23PM

Q So if you were trying to follow Dr. Olsen's methodology, why didn't you log transform the data? 02:23PM

A Because it doesn't make any sense when I'm taking each data point as a fraction of -- you know, arsenic as a fraction of all metals, for example.

Q The second item you mention is when you talk about how you did your PCA, is that you did a standardization method; correct? 02:24PM

A Z squared.

Q Did you do a Z score or did you use a fraction standardization method?

A I used a fraction. 02:24PM

Q Is this the only method by which you can standardize sample information?
A Well, it's probably the most common method for multimedia for combining solid and liquid results. It's basically the method we saw in Rappe. 02:24PM
Q Was it the method that we saw that was used in the basin-wide analysis that we covered earlier today?
MS. COLLINS: Object to form.
A You'd have to point me to the reference. 02:24PM
Q Was it the method used by Simeonov?
A In exhibit --
Q 24.
A Well, Simeonov is just looking at a single medium. He's just looking at surface water. 02:25PM
Q Was it the method used by him?
A No.
Q What about Kannel?
A Kannel was looking at a single media.
Q He didn't use it either, did he? 02:25PM
A No, didn't need to because he's only looking at a single medium.
Q And Zhou and --
A No. Again, I believe it's just a single medium. 02:26PM

Q In the article of Jones, Exhibit 30?
A Single medium.
Q So he didn't use that method also?
A I didn't need to.
Q Are you saying you have to do it when you do 02:26PM
multimedia?
A You're going to have to do something different
to combine liquid and solid metals. You can do what
Rappe did, and he -- Rappe divides by the sum of the
congeners, excluding the dioxins, but you've got to 02:26PM
normalize solid and liquid in some way.
Q Does that have an impact on the results?
A The normalization method?
Q Yes.
A I don't believe it will have an impact on the 02:27PM
results as far as clustering.
Q What impacts will it have?
A The various scores will change somewhat in
numerical value, depending on which method you use.
Q The loading scores? 02:27PM
A That doesn't make sense, the scores.
Q Excuse me. The PC scores.
A The PC scores.
MR. PAGE: Let's take a break.
VIDEOGRAPHER: We are now off the Record. 02:27PM

The time is 2:28 p.m.

(Following a short recess at 2:28 p.m., proceedings continued on the Record at 2:43 p.m.)

VIDEOGRAPHER: We are now back on the Record. The time is 2:43 p.m. 02:43PM

Q Dr. Murphy, would you explain for us how you standardized the data, not just taking the ratios, but, I mean, would you explain -- for example, did you group the analytes into separate groups?

A The answer to that is yes. It's contained in the last paragraph on Page 30. It was standardized by -- to reflect the percent contribution of each metal to the total metals, the percent nitrogen and percent phosphorus to their sum, the percent contribution of each bacterium to the total bacteria, and pH just as is. 02:43PM

Q Okay, and so let's talk about the metals. Would you explain how you did the metals themselves; did you use, for example, the same metals that Dr. Olsen used? 02:44PM

A The metals I used are listed above. They're the total metals, aluminum, arsenic, barium, calcium, copper, iron, potassium, magnesium, manganese, sodium, nickel and zinc.

Q Did you use dissolved metals? 02:44PM

A No, because generally they're not in the solid samples.

Q So the failure to include the dissolved would attribute some basis for your -- that would cause some separation in your results; correct? 02:44PM

MS. COLLINS: Object to form.

A Well, since it can't be done, I'm not sure what the effect would be.

Q Did any of the solid samples have dissolved quotients of metals in them? 02:45PM

A There's some. For example, there's SPLP samples for cattle manure and for poultry litter.

Q So you didn't use those dissolved quotients at all, though, in your analysis?

A No. They had to appear in enough of the different media. 02:45PM

Q Okay. How did you do your standardization for nutrients?

A The -- for nitrogen and phosphorus, the percentage nitrogen and percent phosphorus was divided by the sum of the two. 02:45PM

Q Did you use any other nutrients besides phosphorus and nitrogen?

A Just whatever -- well, total phosphorus, just whatever metals you might consider to be nutrients. 02:45PM

Q Okay. So were any nutrients left off of your analysis that were in Dr. Olsen's analysis?
A I believe so.
Q Why did you do that?
A Because I needed to have analytes that were measured in both solid and liquid media and in sufficient media to be able to look for a signature for medium to medium. 02:46PM
Q Wasn't potassium measured in both?
A There was also a criterion that samples were included only if more than 50 percent of the analytes were detected. 02:46PM
Q Okay. Was that the same as Dr. Olsen's criterion?
A His criterion was, I believe, if they were looked for. 02:46PM
Q Okay. So that's different than Dr. Olsen's methods?
A Yes.
Q Let's talk about the nutrients you did use. How did you -- what nutrients did you use; which -- you used nitrogen and total -- did you know total nitrogen and total phosphorus? 02:46PM
A Yes.
Q For both liquids and solids? 02:47PM

A Yes.
Q Let me ask you this question on nitrogen: If you used different nitrogen components when you did your nitrogen standardization for liquids as opposed to solids, would that affect your results? 02:47PM
A It would have some effect.
Q Okay. If it's true that you used only nitrate and nitrite for your water analysis and you combined it with total phosphorus and used total nitrogen and total phosphorus for your solids, would that have an 02:47PM effect on your results?
A It could have.
Q Do you know whether that in fact occurred?
A Not as I sit here.
Q If such did occur in your analysis, would that 02:47PM be a mistake?
A It would be but, since it affects one analyte it wouldn't affect the clustering very much.
Q But it would have effect on clustering, would it not? 02:48PM
A It would have effect on the numerical values and scores.
Q And then the clustering?
A Yes, but I believe it would be a small effect because it was only one analyte. 02:48PM

Q It's an important analyte, is it not?
A From the standpoint of the PCA analysis, it's equivalent to any other analyte.
Q Did you also have pH in your analysis?
A Yes. 02:48PM
Q Did Dr. Olsen employ pH when he did his analysis?
A I don't recall. I know it's in the list of things that he looked for.
Q But if he did not, that would be another 02:48PM difference between the way he performed the PCA and you did it; is that correct?
A If he did not in any of his runs, that would be the case.
Q Did you standardize or normalize the pH data? 02:48PM
A No. We used the pH data as is.
Q Why didn't you perform standardization on that variable as you did in the other variables such as nutrients and metals?
A Because there's no other variable. It's in 02:49PM the same class as pH, that I could determine pH as a percentage of that class.
Q So the -- does the -- doesn't this make the pH variable incompatible with the other variables that you did standardize? 02:49PM

A Not from the standpoint of looking at clustering, I don't believe it does.
Q Did you run it both ways to see if it had an impact on your analysis?
A I'm not sure what both ways would be, what the other way would be. 02:49PM
Q Well, with or without pH?
A I did not run it without pH.
Q Why did you add pH to the analysis?
A Because it met the criteria for inclusion. 02:49PM
Q Your criteria for inclusion?
A Yes.
Q Which is not necessarily Dr. Olsen's criteria?
A It's not identical to his.
Q Why did you leave off TOC, total organic carbon, in your analysis? 02:50PM
A I think that there probably weren't enough TOC measurements in liquids.
Q What about sulfate; why did you leave that out? 02:50PM
A Because inclusion of sulfate in the analysis resulted in only one stream sediment sample analyzed. Results including -- I'm reading the footnote -- but including that one sediment sample are unchanged from those presented here. 02:50PM

Q What about chloride; why did you not use that?
A I don't know that we have enough chloride measurements in the solid samples.
Q Why did you choose to standardize your analytes in groups rather than use an overall 02:51PM
standardization, one standardization applied to all, so let me see if I can say that another way more clearly. You divided your analytes into groups and then performed standardization within that group; correct? 02:51PM
A That's correct.
Q Isn't it typical where you just don't do that division in the groups; if you're doing this fractionalized standardization, you would do it with regard to all analytes as one group? 02:51PM
A Well, I was following the guidance of Munch, who I believe does indicate breaking into groups and standardizing.
Q Do you know of any publications that have used that method? 02:51PM
A I haven't done any search for that.
Q So it was Mudge who suggested that you do that analysis?
A It's his paper that describes it, and if I look at his paper, I might be able to find some 02:52PM

references.

Q Well, would you -- you have it there in front of you. Would you please look at that for me?

A What number is it?

MS. COLLINS: It's 27. 02:52PM

MR. PAGE: Thank you.

A Yeah. It's Page 158. He says, therefore, the most common transformation made to data is to convert it to proportions or percentages of the total concentration or by class of compound, e.g., 02:52PM sterols and PAHs treated independently, so the sum of the proportions is 2.0, and he references Mudge and Duce, I don't know how to pronounce, that, Duce, D-U-C-E, 2005.

Q Are you aware of fractionalization, 02:53PM proportions or standardization done to investigate contaminants, such as nutrients other than the work you've done here?

A I haven't done a literature search.

Q Can you think of any examples where a 02:53PM standardization process has been employed in situations other than PCBs and dioxins?

A Well, as I say, I haven't done a search, and so as I sit here today, I can't think of an example.

Q Is it your -- so is it -- did I understand you 02:54PM

correctly that you eliminated samples if they didn't -- if they had more than 50 percent non-detects?

A That's correct.

Q How does that -- does that make it more important for a PCA analysis in your mind? 02:54PM

A The alternative is to have most -- have your PCA dominated by half the detection level results.

Q Doesn't that really affect how your reference samples are affected or how they're analyzed? 02:55PM

A Well, if -- I would say it would be a problem if the reference samples aren't included in the output, but I believe they were.

Q Olsen eliminated reference samples -- okay. Olsen eliminated parameters if they had a large number of non-detects rather than samples. Why didn't you follow that criteria in your analysis? 02:56PM

MS. COLLINS: Object to form.

A Repeat the question.

(Whereupon, the court reporter read back the previous question.)

MS. COLLINS: Same objection.

A Well, I'm eliminating samples if more than 50 percent of the analytes are non-detect.

Q But Dr. Olsen didn't follow that procedure; 02:57PM

correct?
A I guess that's correct based on what you said, yes.
Q Okay. So he eliminated parameters based on non-detects. Did you follow that methodology? 02:57PM
A No. I eliminated samples. Part of what is going on here is trying to get enough samples and enough parameters when media are combined, trying to maximize that so it will be the most meaningful PCA.
Q I hand you what's marked as Exhibit 34. Do you recognize that, sir? 02:58PM
A Well, it looks familiar, but it could be any number of pages. I think it could be a single page from a multipage production that we furnished you here. 02:58PM
Q Okay. This is -- I'll represent this is one of the pages of your loadings from your PCA on the multimedia run.
A All right.
Q Okay. Would you explain this page to us, sir? 02:59PM
A The first column is the analytes that were included. The second column is the PC1 loadings, third column PC2 loadings, et cetera, out to PC5. The Eigenvalue for each PC is shown, and the amount of variance that that Eigenvalue explains is shown, 02:59PM

and then the cumulative or total variance is shown across the bottom as well.

Q For PC1, which are the highly loaded variables?

A Total aluminum, total arsenic, total barium, 02:59PM total calcium, total iron, total manganese, total zinc, and I would say pH as well.

Q Is there any significance in this, sir?

A Well, since I don't try to interpret the loadings in term of scores, I mean, what it does say 03:00PM is the things that I've mentioned that are highly -- that are the most large positive numbers vary together as if they had a single source.

Q Where do bacterial load on those plots or these PC scores? 03:00PM

A They load both positive and negative on PC1.

Q What about, do they load on PC2?

A On PC2 bacteria are, again, both positive and negative, but their contribution to PC2, both positive and negative, is larger than on PC1. 03:01PM

Q Okay. Would you read the loadings for bacteria, please, sir, and PC2?

A For PC2, it's -- coliforms minus is .66. E. coli is .478. Entero is .388. Fecal is .428.

Q Is fecal a subcategory of coliforms? 03:01PM

A I believe it is. I believe that's total coliforms.

Q If that's the case, how can one loading be negative .66 and the other be a positive .428?

A Total coliforms could be dominated by some other species of coliform. 03:01PM

Q Wouldn't these species co-vary?

A If the total coliform was largely composed of fecal coliform, you would expect them to co-vary, but if it's not, you wouldn't -- they wouldn't necessarily co-vary. 03:02PM

Q Did you check that to see if there's an explanation for the negative-positive of a subgroup to the total group?

MS. COLLINS: Object to form. 03:02PM

A I have not.

Q If the fecal coliforms were a large proportion of the total coliforms indicate that there's a problem with your PC analysis?

MS. COLLINS: Object to form. 03:02PM

A It could indicate a problem with that particular aspect.

Q Let me hand you what's been marked as Exhibit 35, sir. I've handed you two graphs, sir. The first one is your original data with 104 solid 03:03PM

samples for nitrogen and phosphorus plotted on a log scale graph; right, sir?

A All right.

Q Would you explain what you observe as to this relationship on the first page of Exhibit 35? 03:03PM

MS. COLLINS: I apologize. What did you say the origin of this was?

MR. PAGE: This is taking Dr. Murphy's data and we plotted it on an X-Y graph comparing the relationship of total phosphorus and nitrogen. 03:04PM

MS. COLLINS: Okay. So this is an exhibit that the plaintiffs -- that State has generated?

MR. PAGE: Yes.

MS. COLLINS: I raise the same objection I made earlier as to new exhibits with new analysis 03:04PM that has not been --

MR. PAGE: Well, this is cross examination. You can't just stop somebody from doing an evaluation after you submit a rebuttal report, but I understand your objection. 03:04PM

MS. COLLINS: I made my objection.

Q Okay. Could you explain the relationship?

A The nitrogen and the phosphorus tend to increase together.

Q Does that mean they're positively correlated? 03:04PM

A Yes.
Q Do you see what the calculated R value is, sir?
A Yes.
Q Okay. Now, the second graph, sir, plots the same samples from your data that you put in your PCA after you standardized the nitrogen and the phosphorus. 03:04PM
MS. COLLINS: Same objection as to the origin of the document. 03:05PM
Q Sir, can you interpret the second graph on the second page of Page 35?
A Because phosphorus is plotted as total phosphorus divided by total phosphorus and total nitrogen, it -- phosphorus decreases defined that way as nitrogen increases. 03:05PM
Q So does that mean they have a negative correlation?
A Those parameters that I've defined but, remember, it's not just phosphorus that's being plotted on the vertical axis. It's phosphorus divided by phosphorus plus nitrogen. 03:05PM
Q Okay. So the R value on the second page is a negative 1; correct?
A Correct. 03:05PM

Q That means there's no correlation shown in the data that you used for your PCA; there was no correlation between the phosphorus and the nitrogen?

MS. COLLINS: Object to form.

A If it were zero, it would mean there was no correlation. 03:06PM

Q So what does the correlation show?

A It's an inverse correlation, inverse relationship. Again, remember, that's just not phosphorus; it's phosphorus divided by the sum. 03:06PM

Q And based on your standardization, you have exactly the opposite correlation, the data you put into your input file, than what is observed in nature; correct?

A No, because the variables are different on the second page than the first page. Even though you labeled it P-T, it's really P-T divided by P-T plus nitrogen. 03:06PM

Q Do you have any explanation why there would be a perfect negative correlation between phosphorus and nitrogen on the second page? 03:06PM

A There isn't because it isn't phosphorus and nitrogen on the second page. Even though you've labeled it that way, it's a different variable.

Q Do you know what closure is, sir? 03:07PM

MS. COLLINS: Object to form.
Q In terms of PCA?
A I believe it refers to how many PCs are appropriate.
Q Would you look at Exhibit 34, sir? Do you see your loadings for nitrogen and total phosphorus for each PC? 03:07PM
A Yes, although again they're defined in terms of their value relative to the sum of the values.
Q Do you see how they're always mirror images of each other throughout the PCs? 03:08PM
A Yes.
Q How is this possible?
A Well, because it's not phosphorus and nitrogen. They -- 03:08PM
Q So your standardization created the mirror image correlations here; correct?
MS. COLLINS: Object to form.
A That appears to be the result, yes.
Q Is this a -- indicate a closure problem with your PC analysis? 03:08PM
A No, not necessarily. I haven't investigated closure.
Q Okay. Doesn't Mudge talk about closure problem with using proportional data in his paper? 03:08PM

A I'd have to --
Q You can pull it out, sir, on Page 158 of Exhibit 27.
A He does say that --
Q Where are you reading, sir? 03:09PM
A Page 159.
Q Okay. It starts on the page -- bottom of Page 158, does it not?
A Yes.
Q Would you read that into the Record, please? 03:09PM
A The potential problem with using proportion data is that as one concentration or species number go up, others must come down as the total is fixed.
Q Would you continue?
A This can lead to a condition of closure, where 03:10PM changes in the signature are artificially created by the transformation method. For example, if two samples had the same chemical signature for most compounds but a single chemical was present in a greater concentration in one of the samples due to 03:10PM the addition of another source, all the other values will decrease, and the signature underlying chemicals would be lost.
Q Isn't this what occurred in your PC analysis?
MS. COLLINS: Object to form. 03:10PM

Q With the nitrogen and the phosphorus?
MS. COLLINS: Same objection.
A Don't know if it's exactly the same problem, but it's probably related.
Q Have artificial signatures been created in your PCA? 03:10PM
A I don't believe they have been for the metals or for the bacteria or for pH, but it's possible that the signal for nitrogen and phosphorus could have been done differently with different results. 03:11PM
Q And that would affect how they plot on your PC plots showing your results?
A It wouldn't affect the scores plots very much because that's only two analytes out of the whole list. 03:11PM
Q Out of a list of how many?
A Twenty.
Q What does Mudge say as a method by which you can reduce the effects of closure?
A He says by using a log ratio transformation. 03:11PM
Q And you did not do that; correct?
A No.
Q Does this closure problem make your PC results invalid?
MS. COLLINS: Object to form. 03:12PM

A It isn't clear that there is a closure problem because I haven't investigated closure. I've simply shown five PCs, and a closure problem means that you are not able to reproduce the original data with however many PCs you choose. 03:12PM

Q And does that -- isn't that what is indicated on Exhibit 34 with your nitrogen and phosphorus?

A I haven't made any attempt to reproduce the original data.

Q Isn't that important for your analysis, sir? 03:12PM

A Again, I'm emulating Dr. Olsen, who also didn't do that. If I were trying to do a correct, quote unquote, analysis, yes, it would be important.

Q Are you -- isn't Dr. Mudge's concern about the effects of closure concerning things going up and 03:13PM down and not what you are talking about here, sir?

MS. COLLINS: Object to form.

A Well, that's why I say it isn't clear to me that this is the same issue, but what he's talking about, things going up and down, he's saying the 03:13PM concentration of one newly defined variable goes up, the concentration of the newly defined variable goes down, and that's what we did see in that straight line plot we saw. These are the loadings which are different than what he's talking about. 03:13PM

Q The loadings affect how things plot on the PC plots; correct?
A They have some effect, yes.
Q Let me hand you what's been marked as Exhibit 36. Would you identify that for me, sir? 03:14PM
A This is something that was I believe in my produced materials, and what it is is I realized -- I don't know why I didn't realize it earlier, but I realized I didn't have to do a multimedia analysis to do the point I wanted to do, that I could do just 03:14PM the liquids because I had the receptor, namely surface waters, and I had the source, namely the SPLP tests of litter, and so that's why I decided to do these.
Q This is what your lawyer handed me yesterday. 03:15PM So this must have been work that wasn't produced in your considered materials? It was produced in considered materials?
MS. COLLINS: It was produced in the considered materials. 03:15PM
MR. PAGE: Okay.
MS. COLLINS: Which was the second set I sent you approximately seven or eight days ago.
MR. PAGE: I thought that most recent set was the considered materials from the PI hearing? 03:15PM

MS. COLLINS: Primarily, yes.
MR. PAGE: So it also included this also?
MS. COLLINS: That's true.
Q This is work you performed after you submitted your report? 03:15PM
A Yes, it is.
Q Okay. How -- what kind of criteria did you use for selection of your analytes?
A I tried to use the same criteria as Dr. Olsen used, and I treated the data in the same way. 03:15PM
Q Okay. Did you do it the same way you did it in your multimedia analysis or actually the way Dr. Olsen did it?
A The way Dr. Olsen did it.
Q So you didn't follow the same procedures as Dr. Olsen -- 03:15PM
A Wasn't necessary --
Q -- excuse me, as your multimedia analysis?
A That's correct. It wasn't necessary because these are all liquid samples. 03:16PM
Q Did you use the same analytes Dr. Olsen used?
A Well, in this example, I'm using the whole sample analytes. I have a separate analysis for dissolved sample analytes.
Q Did Dr. Olsen run them together or separately? 03:16PM

A I believe he ran them together.
Q So that's a difference?
A That is a difference.
Q Did Dr. Olsen run pH?
A I don't recall. 03:16PM
Q So if he didn't run pH, that would be another difference?
A If he didn't, that would be another difference.
Q Okay, and how did you standardize the data before you ran PCA? 03:16PM
A Z-transform.
Q Did you do lognormalization also?
A Yes. Don't recall if it was done on pH but it was done on the other variables. 03:16PM
Q On the second page, sir, you have a plot --
MS. COLLINS: Mr. Page, would it be helpful if I gave you a color copy of that exhibit?
MR. PAGE: No. That's okay. Thank you, though. 03:17PM
MS. COLLINS: Would it be helpful to the witness?
MR. PAGE: The witness has a color copy.
MS. COLLINS: You do? Okay. Thanks.
MR. PAGE: It may be helpful for him, not 03:17PM

me. Maybe would help me.
Q The second page, what is that?
A That is a plot looking down the PC3 axis in a three PC space so that you're seeing a two-dimensional PC1 versus PC2 plot and -- well, on 03:17PM my version there, the three orange triangles to the right are the SPLP litter samples, and all the other samples are surface water, groundwater, that sort of thing.
Q What do you mean by downstream and Cargill? 03:17PM
A Oh, if it has a box on it, it's a sample that had been identified by Randy O'Boyle as being downstream.
Q Those are the ones we discussed in Table 3-3 earlier? 03:18PM
A Yes.
Q And where are the edge of field samples?
A I didn't include them in this analysis.
Q Why did you leave them out?
A Because I wanted to just show the source and 03:18PM the receptor to see if the receptor had any signature of the source in it.
Q So would you characterize edge of field as another source?
A Well, it can be if native soils are 03:18PM

contributing, yes.
Q Well, you left it off, sir, and you just said you included a source and a receptor. Why did you eliminate edge of field unless you believed it was another source? 03:18PM
A Because I am investigating whether there's a signature that occurs in poultry litter that also occurs in surface water, and for that, I need the poultry litter data and I need the surface water data. I don't need the edge of field data. 03:18PM
Q Why is that?
A Because that introduces another source. I'm not investigating whether native soils contribute to surface water. I'm investigating whether poultry litter contributes to surface water. 03:19PM
Q But in the papers you saw today, you could see that there is an impact of poultry litter on runoff from fields, is there not?
MS. COLLINS: Object to form.
A But this is in this specific case, and it's showing no impact, no signature. 03:19PM
Q Would you characterize SPLP, synthetic leachate, as more typical of what happens to poultry litter when water is added to it? Which is more typical to what happens to poultry litter when water 03:19PM

is added to it in the environment, the SPLP analysis or an edge of field analysis?

MS. COLLINS: Object to form.

A I would say the SPLP analysis?

Q Really? 03:19PM

A In terms of relationships, not necessarily in terms of raw concentration, but since this analysis is about relationships, relative concentrations, I would say the SPLP.

Q Did you include edge of field in any of your plots? 03:20PM

A I'd have to look at what's been furnished to you, but I'm not sure that we did.

MS. COLLINS: Just to be clear, when you say any of your plots, do you mean limited to this exhibit or to the original analysis? 03:20PM

MR. PAGE: Well, this analysis where he's added SPLP.

Q Did you do any analysis with edge of field samples along with this SPLP? 03:20PM

A No. I reviewed some of Dr. Olsen's SW18 that has edge of field as well as SPLP, and I didn't see any need to duplicate that. It also has SPLP for cow manure as well as poultry litter. That's, I think, a very interesting plot. 03:20PM

Q Did you put that in here?
A No. It's in the materials that we got from Dr. Olsen.
Q You didn't add cow SPLP in this analysis, that is, the analysis in part of Exhibit 36? 03:21PM
A No, because I already had it from Dr. Olsen.
Q Did Dr. Olsen's analysis include edge of field samples?
A Yes.
MR. PAGE: I pass the witness. 03:21PM
MS. COLLINS: Can we take just a short break so I can print that out, SW18?
VIDEOGRAPHER: We're now off the Record. The time is 3:22 p.m.
(Following a short recess at 3:22 p.m., 03:21PM proceedings continued on the Record at 3:29 p.m.)
VIDEOGRAPHER: We are now back on the record. The time is 3:29 p.m.

CROSS EXAMINATION

BY MS. COLLINS: 03:29PM
Q Dr. Murphy, I wanted to refer you back to Exhibit No. 6, and without waiving the objections we stated to the use of this exhibit earlier and accepting the representations that the State's counsel has made regarding what this exhibit 03:30PM

represents, what is the significance, if any, of the fact that the scores for the poultry waste as it's identified here are over to the right side of the plot on the first page?

A It shows that the poultry waste cluster that is the signature of the poultry waste just is not seen in the other solid samples. 03:30PM

Q And what can you tell from this diagram, as represented by the State, about the signature for cattle manure, if anything? 03:30PM

A Well, the cattle manure is the blue rectangles. If anything, the cattle manure appears to be closer to the stream samples or to the -- I'm sorry, the other solid samples, but still quite distinct. 03:31PM

Q And can you explain to us how this two-dimensional figure represents a multidimensional space?

A In a three-dimensional PC plot, you would, looking down the PC3 axis in this particular figure. 03:31PM

Q So is it the case that these scores plots are actually flat in this multidimensional space?

MR. PAGE: Object to the form, leading.

A No, they're not, and if I combined Page 2 and Page 3, I could set them sort of at right angles to 03:31PM

each other and you'd see what things actually do look like.

Q Well, turning to Page 2, is there any significance on Page 2 as to the location of the scores for the poultry waste as presented here in this diagram provided by the State? 03:32PM

A No, because we're looking down the PC1 axis, and we know from the first page that the poultry waste has higher values of PC1. So if we had on 3D glasses, we would see that the poultry waste is popped out towards us. It is distinct. 03:32PM

Q And what about the cattle manure scores on this plot?

A Those would be also popped out, although not quite as much as the poultry waste. 03:32PM

Q Turning to the third page, is there anything significant about the scores for the poultry litter samples depicted in this diagram that was presented by the State?

MR. PAGE: Object to the form. 03:32PM

A This is a different one of Dr. Olsen's corrected figures. This is his run SD 6, and in that run also the poultry waste is quite distinct from all of the other solid samples. The poultry waste signature, such as exists in PC1, PC2 space, 03:33PM

just is not shared with any of the other solid samples.

Q And what is the implication of that in your analysis?

A That this PC analysis does not demonstrate any linkage between poultry waste and any of the other solid samples. 03:33PM

Q Based on your experience, if it did show a link, what would you expect to see; where would you expect to see the plots for the scores for poultry litter in this particular figure? 03:33PM

A In this particular figure, you would expect to see the brown rectangles, that is, the poultry waste, overlaid with the solid samples to the left, that is, the surface soil samples, sediments, streams, et cetera. 03:33PM

Q Okay, and on the next page, what is the difference between the view represented in the figure -- I'm sorry, I flipped over to the same -- strike that. There's not a Page 4. And if you could turn to Exhibit 18, and again without waiving the earlier stated objections about this exhibit and taking the representation as to the origin of this exhibit and what it represents as presented by the State, is there any significant -- is there anything 03:34PM 03:34PM

significant about the scores for poultry litter as depicted in this diagram?

A Well, it's like the previous one we looked at. This is just a different -- I guess it's the same run but a different rotation or lack of rotation, 03:35PM and the poultry waste is just in a completely different part of PC1, PC2 space than the solid samples. There's no poultry waste signature on the other solid samples.

Q If you could now turn to Exhibits 31 and 32 -- 03:35PM

MR. PAGE: Which exhibit are we looking at?

MS. COLLINS: 31 and 32.

Q Again without waiving the earlier stated objections, where is the -- where are the scores for poultry litter on these two figures? 03:36PM

A Poultry litter, it doesn't occur on these figures nor either in the solid form or the SPLP poultry litter.

Q And based on your experience, is there anything -- any significance to that in your 03:36PM opinion?

A The significance is you're trying to establish a relationship between a source and a receptor, and you're not analyzing the source. So it shows nothing about the source. 03:36PM

Q What, if any, conclusion can you draw about the correlations between the scores for these various media that are depicted in these two exhibits?

A Well, there does seem to be some distinction between edge of flow -- edge of field, excuse me, and the other surface waters, and that's to be expected because the edge of field would have some solid compounds picked up. The distinction is magnified here because you don't have the SPLP samples on here. If you have the SPLP samples for poultry litter and cattle manure, which, you know, they're liquid samples, all of this would be compressed, and the poultry litter would be out here. So you wouldn't see this big spread. 03:36PM 03:37PM 03:37PM

Q Why is that?

A Because the samples -- it isn't just that you add points. Everything is recalculated each time you add a new set of samples.

Q Okay, and when you say it's recalculated, what does that mean? 03:37PM

A It means you calculate new scores as well as new loadings.

Q And does it have any impact on the spatial orientation of the scores? 03:37PM

A It would -- as I say, it would compress all of the points we see on Exhibit 31 and 32 and move them together, and it would put SPLP liquid samples off to -- I think they would be off to the upper right. That's the way they usually occur but, again, very 03:38PM distinct, and that distinction would be enhanced by the compression of all these other points.

Q Turning to the last exhibit -- was it 35 -- 36, when did you first consider doing this analysis?

A It was about the time we met at your office 03:38PM because one of the points I made then was how striking it was that the SPLP results generally weren't used, and if you're going to investigate sources and effects, cause and effect, you want to have both in your calculation and by leaving out the 03:39PM cause and just dealing with intermediate steps, I thought something was lacking. So I thought it would be interesting to see what things looked like if you put the source, potential source in.

Q And why is it important, if at all, to include 03:39PM a source in the same media as the sample analytes?

MR. PAGE: Object to the form.

A Well, doing this calculation is very similar to doing the multimedia calculation, but in the multimedia calculation, I had to deviate further 03:40PM

from what Dr. Olsen did. In this calculation I simply wanted to see what he would have seen if he had included the SPLP samples.

Q And did Dr. Olsen include the SPLP litter samples in any of his scores plots that he included in his original report to your knowledge? 03:40PM

A As I recall, they were in SW18.

Q Why didn't you include cattle manure SPLP in these scores plots, PCA analysis?

A Well, again, I was investigating Dr. Olsen's thesis that poultry litter is causing an impact on the surface waters, and so I wanted to see if there was a poultry litter signature appearing. 03:40PM

Q And --

A So I wasn't investigating cattle manure; I wasn't investigating soil runoff or any other possible sources. 03:41PM

Q And based on the PCA analysis that you performed that's reflected in this exhibit, what is your conclusion about the relationship between poultry litter and the surface water and groundwater samples collected by the State in this case in the IRW? 03:41PM

A Well, this packet is for the whole sample analysis. I have another packet for dissolved 03:41PM

samples, which basically shows the same thing, and that -- both cases, the orange triangles, no matter which combination of PCs you look at, are just completely distinct from which of -- the SPLP samples are completely distinct from the water samples. 03:42PM

Q And to be clear, what samples did you use in your analysis?

MR. PAGE: Object to the form.

A These are the stream samples, well samples, spring samples, wastewater treatment plant, as well as the SPLP for poultry litter. 03:42PM

Q And who generated that data?

A Well, the data we used was Dr. Olsen's data.

Q I'm handing you what's marked as Exhibit 36 -- 37, excuse me, and I will represent to you these are the scores plots from Dr. Olsen's run SW18 as provided in his considered materials. You referred to SW18 I believe earlier in your testimony? 03:42PM

A Yes. 03:43PM

Q If you would take a look through these plots and then tell us what your observations are, if any, regarding where the litter SPLP scores fall in comparison to the edge of field samples.

A Well, the striking thing is how different the 03:43PM

litter SPLP samples are from the edge of field samples. On the other hand, the manure SPLP samples are very close to the edge of field samples in Dr. Olsen's run SW18. That's true if you looked in PC1-PC2 space, PC2-PC3 space, PC1-PC3 space. Every 03:44PM
orientation the cow manure samples are -- SPLP samples are very close to the edge of field samples, and the SPLP litter samples are quite distinct.

Q Does that tell you anything about the likelihood of litter being a source of components 03:44PM
that are found in the edge of field samples?

A It says that, according to this PC analysis, that the edge of field samples may be being affected by cow manure but not by litter.

Q Okay. Earlier you mentioned Randy O'Boyle. 03:45PM
What is his position at Exponent?

A He's a GIS analyst.

Q And what are the duties of a GIS analyst at Exponent?

A He digitizes maps. He takes data, converts it 03:45PM
into digital form, overlays the data on maps, produces graphics, that sort of thing.

Q Did you ask him to perform any analysis in this case beyond identifying State sampling locations that were downstream or downgradient from 03:45PM

Cargill grower locations?
A I don't believe I did, no.
Q Was Brevibacteria one of the analytes Dr. Olsen used in his PCA analysis?
A No, it's not. 03:46PM
Q Do you have any knowledge of where the reference soil samples, as designated by the State, were collected or how they were collected?
A These are the CL samples?
Q I believe so. 03:46PM
A Only what's in Dr. Olsen's report.
Q Do you know if any edge of field samples were collected from any Cargill grower location?
A No, I don't believe they were.
Q And I mean in the context of this litigation 03:47PM as collected by the State or USGS for that matter.
A No, they weren't.
Q Yesterday morning Mr. Page asked you whether you used your PCA or Dr. Olsen's PCA to draw conclusions about comparisons of reference soil 03:47PM samples to soil samples collected at the Schwabe property; do you recall that generally?
A I think the same set of conclusions can be drawn from either analysis, but the Schwabe soil samples are very similar to the reference soil 03:48PM

samples.

Q And based on your knowledge of SW18 by Dr. Olsen, did that include surface water samples or edge of field samples?

A That was edge of field samples. 03:48PM

Q Okay, and, lastly, referring to your report in Figure 3-1, if you would, sir, is there any significance to the location of reference soils as depicted in this chart in comparison to surface soils? 03:49PM

A Well, the reference soils, which are the green squares, are -- overlay the Cargill soil samples, which have red boundaries. The reference soils don't appear to be any different.

Q And does this chart only include Cargill surface soil samples? 03:50PM

A No. It includes other surface soil samples, but the Cargill ones are indicated by the red boxes.

MS. COLLINS: I don't have any other questions for you. 03:50PM

REDIRECT EXAMINATION

BY MR. PAGE:

Q Let's look at Exhibit 37, Dr. Murphy. This is Dr. Olsen's analysis; correct?

A I have been told that it's Dr. Olsen's run 03:50PM

SW18.
Q So that -- Dr. Olsen's analysis includes concentrations in addition to ratios as part of his PCA analysis; correct?
A When you say Dr. Olsen's analysis, you mean more than his PC analysis? 03:50PM
Q Well, his PCA preserves concentrations in his analysis, does it not?
MS. COLLINS: Object to form.
A My recollection is he uses the Z-transform. 03:51PM
Q And that preserves the concentration gradients, does it not?
MS. COLLINS: Object to form.
A It would preserve spatial concentration gradients. 03:51PM
Q Let's look at Page 4 of this exhibit. You were asked a series of questions between relationships between the poultry, which is the bright orange, and then the edge of field and the cattle. Can you explain the orange dots in 03:51PM relationship to the cattle and the edge of field on Page 4, which is PC2 versus PC4?
A Well, here we're looking at a four-dimensional space down either the PC1 or the PC3 axis, and so it -- all you really can say is that the orange dots 03:51PM

are very distinct from the black dots and from the cattle.

Q But you can't tell one is closer to the other; in fact, the cattle are different distances from the orange; correct? 03:52PM

A Yeah. To make sense of this, you really have to start with PC1 versus PC2 and then move to PC3 and so on because you're accumulating variates at all stages.

Q And the next page, we show a different relationship again, do we not? 03:52PM

A Yes. This is PC3 versus PC4. It's a slice through a multidimensional space.

Q So -- well, PC1 or PC2 is also a slice through a multidimensional space? 03:52PM

A Yes, it is.

Q And Paragraph 6, again, we have another distinction with the poultry versus the Page 6 PC1 versus PC4?

A Yes. That also shows a distinction between poultry SPLP and other samples. 03:53PM

Q Can you account for the fact that you've got the poultry samples so widely separated on Pages 4, 5 and 6?

A As you get to the higher PCs, there are more 03:53PM

minor factors that are going to distinguish samples.

Q Does this indicate that those SPLP samples may not be related to each other?

A It indicates that they're not identical, but they're related enough that in the first couple of PCs, they occupy the same part of the space up through PC3. 03:53PM

Q Then the others, it doesn't indicate they are related, does it?

A Well, it indicates that there's some differences. 03:54PM

MR. PAGE: No further questions.

VIDEOGRAPHER: This concludes the deposition. We are now off the Record. The time is 3:54 p.m. 03:54PM

(Whereupon, the deposition was concluded at 3:54 p.m.)

SIGNATURE PAGE

I, Brian Murphy, PhD, do hereby certify that the foregoing deposition was presented to me by Lisa A. Steinmeyer as a true and correct transcript of the proceedings in the above styled and numbered cause, and I now sign the same as true and correct.

WITNESS my hand this _____ day of _____, 2009.

_____

BRIAN MURPHY, PhD

SUBSCRIBED AND SWORN TO before me this _____ day of _____, 2009.

_____

Notary Public

My Commission Expires:

_____

C E R T I F I C A T E

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

I, Lisa A. Steinmeyer, Certified Shorthand Reporter within and for Tulsa County, State of Oklahoma, do hereby certify that the above named witness was by me first duly sworn to testify the truth, the whole truth and nothing but the truth in the case aforesaid, and that I reported in stenograph his deposition; that my stenograph notes were thereafter transcribed and reduced to typewritten form under my supervision, as the same appears herein.

I further certify that the foregoing 180 pages contain a full, true and correct transcript of the deposition taken at such time and place.

I further certify that I am not attorney for or relative to either of said parties, or otherwise interested in the event of said action.

WITNESS MY HAND AND SEAL this 2nd day of April, 2009.

_____

LISA A. STEINMEYER, CRR
CSR No. 386

CORRECTIONS TO THE DEPOSITION OF
BRIAN MURPHY, PhD
Volume II

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