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.	)No. 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

- -

VOLUME I VIDEOTAPED DEPOSITION OF JOHN PATRICK CONNOLLY, produced as a witness on behalf of the State, in the above styled and numbered cause, taken on the 8th day of April, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Marlene Percefull, Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

Exhibit Y

A P P E A R A N C E S

FOR THE PLAINTIFF: Mr. David Page
Attorney at Law
502 West 6th Street
Tulsa, OK 74119

FOR TYSON: Mr. Gordon Todd
Attorney at Law
1501 K Street N.W.
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FOR CARGILL: Ms. Melissa Collins
Attorney at Law
1700 Lincoln Street
Suite 43200
Denver, CO 80203

FOR SIMMONS FOODS: Mr. John Elrod
Attorney at Law
221 East Dickson Street
Fayetteville, AR 72701

FOR GEORGE'S: Mr. Woodson Bassett
Attorney at Law
221 North College
Fayetteville, AR 72701

ALSO PRESENT: Dr. Roger Olsen
Opveon, Jason Weitholter

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(Whereupon, the deposition began at 9:10 a.m.)

THE VIDEOGRAPHER: We are now on the record for the deposition of John Connolly. Today is April 8, 2009. The time is 9:00 a.m. Would counsel please 9:00AM identify themselves for the record?

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

MR. TODD: Gordon Todd for the Tyson companies. 9:00AM

MR. BASSETT: Woody Bassett for the George's defendants.

MR. ELROD: John Elrod for Simmons.

THE VIDEOGRAPHER: Thank you. The witness may be sworn. 9:00AM

JOHN PATRICK CONNOLLY,
having first been duly sworn to testify to the truth, the whole truth and nothing but the truth, testified as follows:

DIRECT EXAMINATION 9:10AM

BY MR. PAGE:

Q Dr. Connolly, would you give us your full name and address, please?

A Yes. John Patrick Connolly, 3 Fairmont, F-A-I-R-M-O-N-T, Terrace, West Nyack, N-Y-A-C-K, New 9:00AM

York. 9:00AM

Q Dr. Connolly, when were you retained by the defendants?

A In 2005, I believe.

Q Okay. And who retained you? 9:01AM

A I don't recall who we were originally retained by. I don't remember the retention letter.

Q Was it a law firm?

A Yes, yes.

Q Do you recall whether it was the law firm that 9:01AM Mr. Todd is with in Washington, D.C.?

A I don't recall whether Sidley and Austin were the ones who originally retained us.

Q Okay. And at that time were you told what your purpose was? 9:01AM

A Not specifically. At the time we interviewed we were retained, but we didn't do any work and so -- so there really were no instructions.

Q Okay. Were you -- so you weren't given any objectives or purposes at that time? 9:01AM

A No.

Q What were you told about the case?

A Just basic information as part of the interview that we went through, that this case was alleging that the poultry industry had contaminated the water of the 9:02AM

Illinois River Watershed and caused damages that the 9:02AM
State was seeking monetary compensation for.
Q Okay. Now, were you personally retained or was your firm retained?
A The firm was retained. 9:02AM
Q And what is the name of that firm?
A At that time it was Quantitative Environmental Analysis.
Q Is it still the same firm that you're now with today? 9:02AM
A It's the same firm but we merged with another firm as of February 1st this year and the new firm is called Anchor QEA.
Q Okay. So the name is changed?
A Yes. 9:02AM
Q And you're still retained by the merged firm?
A Yes.
Q I'm going to hand you what we'll mark as Exhibit No. 1.
MR. PAGE: I only have one extra copy of this 9:03AM
today, guys. Figured you might have your own copies.
Q Dr. Connolly, can you identify, take your time, please just take a look at Exhibit No. 1 and please identify it for us.
MR. ELROD: Is this yours? 9:03AM

MR. OLSEN: No, it's yours if you want it. 9:03AM
A This looks to be a completed copy of the report we developed for this case.
Q Okay. You said "we developed." Was the report prepared by you alone or was it a joint effort with the 9:03AM other folks?
A It was a joint effort.
Q Okay. Let me ask you who those other folks are that worked on the report. And as you go through by identifying them, please, tell me if they had a 9:04AM particular role, like a section or analysis, that they performed.
A Sure. There's a fairly large group of people who worked on this. One is Jennifer Benaman. And Jennifer works closely with me and her role was to coordinate 9:04AM
the work of the rest of the staff and to help me edit the entire report.
Q What are her qualifications?
A She has a Ph.D. from Cornell University and a master's degree from the University of Texas, both of 9:05AM
which are in the area of water quality and, in particular, her Ph.D. work was looking at non-point sources of pollution from runoff in watersheds to receiving waters.
Q Do you know whether or not her work involved 9:05AM

agricultural -- watersheds that had agricultural 9:05AM sources?
A It did.
Q And did they have any application of poultry waste? 9:05AM
A Not to my knowledge.
Q What were the agricultural sources in her previous studies, if you know?
A What I do know is that it included cattle, as well as cultivated areas. 9:05AM
Q And do you know from her work did she determine whether or not cattle deposition on grazing fields -- the manures from cattle depositions on grazing fields run off into the streams and water of the watershed?
A I don't believe so. 9:06AM
Q She didn't do an evaluation of transport?
A She did an evaluation of transport but not specifically associated with that individual source.
Q Did she identify any non-point sources as contributors in her previous Ph.D. work? 9:06AM
A I believe so.
Q What were those sources?
A I don't recall. I would have to go back and look at her dissertation.
Q Did she actually perform any of the analysis or 9:06AM

was her role simply coordination of the work? 9:06AM
A She oversaw certain analyses, I don't believe she conducted the end analysis.
Q When you say "oversaw," could you give me a little bit more of a definition of that? 9:07AM
A Yes, she provided direction to other staff who were doing analyses.
Q Is that instead of your direction or was it --
A No, that was always in consultation with me.
Q Okay. And in what analysis did she provide 9:07AM direction?
A She provided direction to the comparative -- what we call the comparative watershed sections of the report.
Q Is that -- is that the sections concerning Hugo 9:07AM and Sardis watersheds?
A Yes, as well as in another section of the report we compared the water quality in Tenkiller to other reservoirs in the state.
Q Okay. Is Dr. Benaman, does she have any formal 9:07AM training in limnology?
A I believe, because I went through the program at the University of Texas as well, that limnology would have been part of the coursework that she took.
Q Okay. Has she performed any limnological studies 9:08AM

other than the work that she performed in this 9:08AM
particular report?
A Yes.
Q Do you know what those studies are?
A She is, I guess, principal investigator may be the 9:08AM
right term for a project that we have in Texas looking
at water quality in a series of reservoirs along the
lower Colorado River.
Q Okay. Anything else?
A I believe there are other studies that she's been 9:08AM
involved with along the same lines but I don't recall
them specifically right now.
Q Do you recall whether she has published anything
in a peer review journal which would be considered
limnology topic? 9:09AM
A As an environmental engineer, which is what she
is, the investigations that she works on typically
included a limnology component so that the answer to
your question is yes, that she has peer review
publications related to what watershed as sources to 9:09AM
receiving water is and fate within the receiving
waters, which would include a limnological component.
Q Has she studied -- ever studied any -- other than
the cattle example you mentioned a few minutes ago, any
other runoff from agricultural processes, the one you 9:09AM

mentioned? 9:09AM
A I believe as part of her dissertation she did.
Q And that would have been published. Anything else
that's been published considering runoff from
agricultural sources? 9:10AM
A Not to my knowledge.
Q Did she direct anything else other than what you
said, the watershed comparison work as for this report?
A She -- in her coordinating role interacting with a
lot of people, different people -- didn't specifically 9:10AM
direct any other parts of the study, other than she had
a role in the data compilation and management of the
data that we had gotten and were using for this case.
Q Okay. Who else assisted you with this analysis of
the report? 9:10AM
A Debra Chiavelli.
Q Could you spell her last name, please?
A C-H-I-A-V-E-L-L-I.
Q V as in Victor?
A Yes. 9:10AM
Q Okay. And what is her educational background?
A Debra has a Ph.D. in microbiology.
Q Okay. And what work did she perform with respect
to your report?
A She did a number of the analyses that appear in 9:11AM

the section of the report discussing bacteria. 9:11AM
Q And it's Section 5 of the report?
A Section 5 of the report, yes.
Q Anything else?
A Not to my knowledge. Not that I recall. 9:11AM
Q Did you do any of those analyses in Section 5 on
microbiology or did you rely on her work?
A I relied on her work as far as the actual
analyses. She and I communicated frequently so that
those analyses were done as a result of our 9:11AM
conversations and decisions about what steps to take.
Q Do you consider yourself a microbiologist?
A No.
Q Have you published any peer review articles on the
subject of microbiology? 9:12AM
A Yes.
Q And what are those?
A As a faculty member at Manhattan College, I was
doing research for the USEPA on genetically engineered
microorganisms. At that time, the EPA was very 9:12AM
interested in propagation of genetically engineered
traits in the natural environment, if genetically
engineered microorganisms were released into the
environment. And I was doing research on bacterial
growth in natural water systems and the ability of 9:12AM

specific genetic traits to be transferred from 9:12AM
engineered organisms to natural organisms and I
published several articles on that.
Q Other than the evaluation of fate of engineered
microorganisms in the environment, have you done any 9:13AM
other publication in the area of microbiology?
A I wouldn't characterize those articles as the fate
of the engineered organism, the work was on bacteria in
general and a component of that was the extent to which
the engineered trait would have been transferred to 9:13AM
natural organisms, would that cause that trait to be
propagated.
Q I see.
A So a lot of that work was associated with natural
organisms, natural bacteria in the environment. And 9:13AM
the publications that I have related to -- more to
natural organisms than they do to genetic organisms.
Q And what were the areas that you studied with
regard to natural organisms?
A Study of the processes that would control their 9:13AM
growth and death in the environment.
Q Okay. Have you done any study with regard to
indicator bacteria?
A Yes.
Q What studies have you done in that regard? 9:14AM

A I was involved in a project in Hawaii where the -- 9:14AM
there were indicator organisms' exceedances on the
beaches in Honolulu and there was a concern as to what
were the sources of the indicator organisms. There was
contentions that it was due to nonpoint source runoff 9:14AM
from the land as opposed to discharges from wastewater
treatment plants. And I was involved in an
investigation to try to determine the relative
contribution of those sources to the indicator
organisms' exceedances on the beaches. 9:14AM
Q Were you able to determine relative contributions?
A Yes.
Q And what did you determine?
A We determined that both the nonpoint source
contribution and the wastewater treatment were 9:15AM
contributing at different times under different
conditions to exceedances on the beaches.
Q And were the point source contributions from
wastewater treatment plants a publicly-owned treatment
works? 9:15AM
A Yes.
Q Did they chlorinate or treat their effluent?
A My recollection is they did not but I don't
remember that with authority.
Q Okay. In your experience, if a wastewater 9:15AM

treatment plant, in particular a publically-owned 9:15AM
treatment works, does chlorinate their effluent, does
it constitute a significant source of bacteria to the
environment?
A I think that would depend on the nature of the 9:15AM
chlorination process and whether it was working well or
not.
Q But if it was working properly and they were
following their state NPDS permits, would you expect
them to be significant sources of bacteria to the 9:16AM
environment?
A I would expect them to still be sources because
you don't get 100 percent kill in chlorination.
Whether that was significant or not would depend upon
the local circumstance. 9:16AM
Q You've never done any studies as to the
effectiveness of POTW treatment and whether they --
such treatment, if properly performed, would constitute
significant sources of bacteria to the environment?
A I have not. 9:16AM
Q Any other work other than the work in Hawaii
concerning indicator bacteria?
A Yes.
Q Where was that done?
A I did work to try to determine the source of a 9:16AM

cryptosporidium outbreak in Milwaukee, Wisconsin, that 9:16AM
involved looking at specifically cryptosporidium also
indicated organisms in order to attempt to trace
sources to the water intake from which the outbreak
occurred. 9:17AM
Q What methods did you use for source tracking in
that study?
A I don't remember fully but we used methods looking
at source generation from various sources, including
cattle, other wildlife, looking at a -- in particular a 9:17AM
slaughter house that was on one of the tributaries and
whether the practices in the slaughter house would have
resulted in the release of organisms and POTWs as well.
Q When you say you looked at sources, were you doing
what is commonly referred to as a sanitary survey to 9:18AM
evaluate potential sources of bacteria in the
environment? What I'm trying to find out, Doctor, is
when you said you looked at different sources, that was
the method, just looking to see what potential sources
were available in the area that would emit or release 9:18AM
the types of bacteria you're looking at? Is that what
you did?
A That was part of what we did but we were also
looking at the fate of those organisms and the water
intake was remote to any of the -- any of the sources 9:18AM

and so a key part of this was looking at the fate of 9:18AM
the organisms from the sources to the water intake to
try to determine the likely contribution of the various
sources to the water intake.
Q Okay. And how did you evaluate the fate of the 9:18AM
microorganisms?
A By looking at typical rates of die off of
organisms and developing models to simulate the
movement of the organisms.
Q Other than die off, what are the other key 9:19AM
constituents of a fate and transport model for
microorganisms?
A The other key constituents are the hydrodynamics
that move the water and the associated organisms and
the die off itself is a fairly complex process that 9:19AM
depends upon a number of other processes that we've
modeled so, for example, sunlight.
Q Anything else?
A Not as I recall.
Q Okay. Other than these two studies you've 9:19AM
mentioned, can you tell us of any other published work
you've done in the area of microbiology?
A Not that I recall.
Q Has Ms. Chiavelli?
A Chiavelli. 9:20AM

Q Chiavelli. Has she published any peer review articles in the area of microbiology? 9:20AM
A I don't know.
Q Okay. Who else helped you with the report?
A Dr. Margaret Murphy. 9:20AM
Q And tell me about Dr. Murphy's formal training.
A Dr. Murphy is a fisheries biologist. Her Ph.D. work was looking at salmon fisheries in the Atlantic.
Q Has she worked with freshwater fish?
A Yes. 9:21AM
Q Okay. And what work did she help you with in this particular report?
A She helped in developing and applying techniques to evaluate the fish community in both the Illinois River and Lake Tenkiller. 9:21AM
Q Did she do the IBI work in this particular case?
A Yes.
Q Do you consider yourself a fisheries biologist?
A No.
Q Do you have any experience in fishery biology? 9:21AM
A Yes.
Q What experience?
A Beginning in about 1980, I got involved in research on bioaccumulation of contaminants through aquatic food webs, which involved a fair amount of 9:21AM

fisheries work to understand the food web structure in 9:21AM aquatic systems and the relationship between different fish and their environment and their food sources and how that related to the migration of contaminants in the base of the food web to the fish. 9:22AM
Q Any other work in fisheries?
A No.
Q Have you ever done any work similar to what Dr. Murphy performed as part of your report in this case? 9:22AM
A No.
Q Who else helped you?
A Richardo Pettroni.
Q Richardo, R-I-C-H-A-R-D-O?
A Richardo, yes. Pettroni, P-E-T-T-R-O-N-I. 9:22AM
Q Okay. And what work did -- is it doctor or --
A It's doctor.
Q Is it Ph.D.?
A I'm sorry, Ricardo does not have a Ph.D. He is not a doctor. 9:22AM
Q What work did he help you with the report?
A Ricardo helped compile the database of the literature database that we used to evaluate poultry litter and cattle and commercial fertilizers as potential sources of phosphorus. 9:23AM

Q So what kind of literature were you interested in compiling? 9:23AM
A We were interested in compiling literature on studies that people had done to look at the release and migration of phosphorus from those various sources. 9:23AM
Q Okay. Would the Sauer paper that you cite be an example of that type of literature?
A Yes, it would.
Q Did you also -- did you study any other kinds of literature relating to the different manures, such as the relative compositions of the constituents in the different -- 9:23AM
A Yes.
Q Are those all cited in your paper?
A Yes. 9:23AM
Q And do you recall then what Mr. Pettroni's educational background is?
A He has a master's in environmental engineering from MIT.
Q Prior to the work you did in this case, had you ever done any analysis or study of runoff from the different manures, commercial fertilizers that you evaluated in this case? 9:24AM
A No.
Q Had Mr. Pettroni? 9:24AM

A Not to my knowledge. 9:24AM
Q Did he help you with anything else other than this database compilation with regard to manures?
A He helped, he -- he read the articles, alerted me to particular things in the articles, passed articles 9:24AM on to me, and then he did the first draft of that section of the report.
Q Could you help me identify what section that is by maybe referring to your table of contents in Exhibit 1?
A Yes. He did the first drafts of Sections 2.5 and 9:25AM 2.6.
Q Okay. Anything else?
A No.
Q When we spoke of the other folks that helped you earlier, Ms. Benaman, Ms. Chiavelli, and Dr. Murphy, did they draft any of the report, either a first draft or second draft? 9:25AM
A Yes.
Q Can we just kind of backtrack a little bit and help me know what portions Dr. Benaman drafted? 9:25AM
A She did the first draft of the -- what we call the comparative watershed study.
Q Okay. Can you identify those sections, please, for the record?
A Yes. Section 2.8. 9:26AM

Q Mm-hmm. 9:26AM
A Section 6, portions of Section 6, actually.
Q What about anything in Section 4?
A Not that I recall.
Q Okay. What about Dr. Chiavelli, what -- did she 9:26AM help you draft any sections?
A Yes, she helped draft Section 5.
Q She did the first drafts of that?
A Yes.
Q And Dr. Murphy? 9:26AM
A Dr. Murphy helped draft Sections 3.5 and 4.5.
Q Okay. We were with Mr. Pettroni. I think you mentioned he did the first draft of 2.5 and 2.6, right?
A Yes.
Q Anything else? 9:27AM
A Not that I recall.
Q Anyone else help you in this report?
A Yes.
Q Okay.
A Diane Achman, A-C-H-M-A-N. 9:27AM
Q Okay. Is she a Ph.D.?
A No.
Q Okay. What is her educational background?
A She has a master's degree in environmental engineering. 9:27AM

Q Okay. And what work did she help you with? 9:27AM
A She helped with the analysis of the dating of the lake sediment course.
Q Is that the Section 2.7 of your report?
A Yes. 9:28AM
Q Did she draft the first draft of that?
A Of Section 2.7.1.
Q Okay. Prior to the work in this case, had she done any study or analysis of sediment age dating?
A Yes. 9:28AM
Q And where has she done that?
A We do that routinely and so she's done it, as well as I have and others, on numerous projects and I don't particularly recall which ones.
Q You routinely use cesium-111 and lead-210 9:28AM in sediment --
A Yes.
Q -- dating.
A Yes. I do recall most recently she's done it for a site in New Jersey that we're working on for Exxon. 9:29AM
Q Have you published anything in a peer review journal concerning sediment age dating using the techniques you discussed in your report?
A No.
Q Has Ms. Achman? 9:29AM

A No. 9:29AM
Q Has anybody who's worked on this report had any publications in that area?
A No, not that I recall.
Q Okay. Did she do anything else other than the age 9:29AM dating work?
A Yes.
Q What else?
A She helped me and in examining the data in Lake Tenkiller to determine whether there was evidence that 9:29AM the water entering the Lake Tenkiller was driving through the hyperlimnion of the lake.
Q The evidence that was reviewed in that regard, was that the evidence that was collected and evaluated Drs. Cooke and Welch? 9:30AM
A In part.
Q Was there any other evidence that you considered in doing that work?
A Yes. We looked at a lot of vertical profiles of water quality data to look for evidence that the -- 9:30AM those profiles showed that what was coming from upstream had to be moving down into deeper waters.
Q Are you talking about -- the other vertical profiles, are you talking data that was not included in Cooke and Welch's report or was included? 9:30AM

A I don't recall specifically whether it was or not. 9:30AM We conducted an independent analysis and so I don't recall how much of what we did was in their report.
Q Do you recall what the sources of other data was that you think is perhaps different than what Cooke and 9:31AM Welch looked at?
A The majority of the data that we used was data collected by the plaintiffs in this case, but it was also data collected by other agencies.
Q And have either you or Ms. Achman published 9:31AM anything in peer review journals concerning this phenomenon of denser waters dropping as they enter a reservoir?
A No.
Q Have you done any study in that area in the past 9:31AM in your previous work?
A Yes.
Q Was that related to modeling work you've done on lakes and reservoirs?
A Yes. 9:31AM
Q Did she help you with anything else?
A Not that I recall.
Q Okay. Anyone else help you? Did she -- by the way, let me ask this. Did she do any drafting of that section concerning those phenomena? 9:32AM

A She did the first draft of the section. 9:32AM
Q And what section is that, sir?
A Section 4.2.
Q Anything else that she helped you with?
A Not that I recall. 9:32AM
Q Okay. Anyone else help you?
A Let me back up because I forget whether we had already covered this, but she did help with Section 2.7.1.
Q You did mention that, I believe, at least I have a note to that. 9:32AM
A Okay.
Q So thank you. Did she, Ms. Achman, help you with anything else in your report?
A Not that I remember. 9:33AM
Q Okay. Anyone else help you other than the folks we've already discussed?
A Yes. Harry Zahakos.
Q Could you spell his name -- last name, please?
A Z-A-H-A-K-O-S. 9:33AM
Q Okay. And what is Mr. Zahakos' educational background?
A He has a master's in environmental engineering.
Q Okay. And what work did he help you with?
A He helped in the review of the Lake Tenkiller 9:33AM

model developed by Dr. Scott Wells. 9:33AM
Q And what did he do in that regard?
A He reviewed Dr. Wells' report and provided his view of that report to me.
Q Okay. Has Mr. Zahakos ever done any lake modeling? 9:34AM
A Yes.
Q What lake models has he worked with?
A He's worked with numerous lake models.
Q Let me ask this question. Has he ever worked with the model that was used by Dr. Wells in the CE-QUAL-2 model? 9:34AM
A Yes.
Q Yes. In what project?
A Most recently a modeling study of Lake Travis in Texas. 9:34AM
Q Did Dr. Wells actually help you with that study?
A You just asked me if Dr. Wells helped me.
Q Yes. Did Dr. Wells help?
A Oh, I'm -- help with the Lake Travis work? 9:34AM
Q Yes.
A Not to my knowledge.
Q Has your company ever employed Dr. Wells to assist in modeling studies?
A Not to my knowledge. 9:35AM

Q So it would surprise you to know that Dr. Wells assisted you with the Lake Travis study? 9:35AM
A It would be news to me, yes.
Q Other than the CE-QUAL work done at Lake Travis, has Mr. Zahakos done any other work with CE-QUAL-2? 9:35AM
A I'm uncertain.
Q Okay. Have you personally ever used the model CE-QUAL-2?
A I've reviewed the model and I, in fact, assisted in some of the modeling for Lake Travis. 9:35AM
Q Was that your only experience with the CE-QUAL model?
A Yes.
Q Okay. Anyone else help you?
A Jonathan Baumgartner. Baumgartner, B-A-U-M-G-A-R-T-N-E-R. 9:36AM
Q And what is Mr. Baumgartner's educational background?
A He has a master's degree in geology.
Q Okay. Did he help you with any portions of your report? 9:36AM
A He assisted Dr. Benaman in the comparative watershed work.
Q So his work was just simply to help Dr. Benaman?
A Yes. 9:36AM

Q Did he write any portions of the report? 9:36AM
A I don't believe so.
Q Go back to Mr. Zahakos, did he write any sections of the report?
A He did a rough first draft of Section 8. 9:37AM
Q Anyone else help you, sir?
A Abigail Bergoffen, B-E-R-G-O-F-F-E-N.
Q Okay. Educational background?
A She has as master's degree in environmental engineering. 9:37AM
Q Okay. And what work did she help you with?
A She helped in crafting analyses of the water quality data to look at dissolved oxygen levels.
Q In particular, what sections did she work on?
A Section C.3.1. 9:38AM
Q Anything else?
A Not that I remember.
Q Did she prepare any drafts of any of the sections?
A She -- she wrote some text, not a complete subsection, but some text for one of the -- for that subsection. 9:38AM
Q Anything else?
A Not that I recall.
Q Did this Ms. Bergoffen have any prior experience evaluating dissolved oxygen levels of lakes and 9:39AM

reservoirs? 9:39AM
A Yes.
Q What would that experience be?
A She's worked on a number of projects during her
career where dissolved oxygen was one of the 9:39AM
constituents of concern.
Q Has she published any peer review articles
concerning dissolved oxygen levels in lakes and
reservoirs?
A Not to my knowledge. 9:39AM
Q How about yourself, sir, have you?
A Yes.
Q Okay. And what publications?
A I did an extensive study of eutrophication in Lake
Erie, one of the major focuses of which was dissolved 9:39AM
oxygen and peer review publications relative to that
one.
Q Did you employ a lake model for that study?
A Yes.
Q Anything else? 9:40AM
A Not that I recall.
Q Okay. Anything else for Ms. Bergoffen?
A No.
Q Okay. Anyone else help you?
A Elaine Darby, D-A-R-B-Y. 9:40AM

Q What's her educational background? 9:40AM
A She has a bachelor's in chemical engineering and a
master's degree in environmental engineering.
Q And what work did she help you with?
A She reviewed the water quality in the vicinity of 9:40AM
Lake Frances.
Q Okay. Anything else?
A I don't believe so.
Q Okay. And did she participate in any analysis
that's reflected in your report? 9:40AM
A Yes.
Q What section is that?
A That's the appendix discussing Lake Frances.
Q Other than the appendix discussing Lake Frances,
did she work on any of the actual analysis that's in 9:41AM
the main text of the report?
A Not that I recall.
Q So she didn't help you draft any other sections?
A I don't believe so.
Q Anyone else, sir? 9:41AM
A There were several lower level staff who
participated by doing directed analysis and generating
graphical output.
Q Anyone else?
A Not that I recall. 9:41AM

Q Dr. Connolly, I've tried to -- I've tried to check 9:41AM
off sections where you had folks help you in the table
of contents. Can we do a little recap as we go through
here and then if you could put maybe the person's
initials next to a section if they wrote a draft or 9:42AM
provided text for you. And then can we then assuming
if there's no initial in the section that you did all
the drafting for that particular section?
MR. TODD: Object to form.
A (Nods head.) 9:42AM
Q You understand the question I'm asking you to do?
A I believe so.
Q Okay. So do you have -- so let me give you a
pencil of some type here. Here's a red one. If you
would please go through each section and identify for 9:42AM
the record whether anyone else helped you. And we'll
put initials there. So I guess we'll start with
Section 1.1. Did you draft that, sir?
A Yes.
Q And Section 1.2? 9:42AM
A Yes.
Q What about Section 2.1?
A Section 2.1 and for all of the subsequent
sections, the .1 sections, are simply a restating of
the section headings of the subsequent subsections and 9:43AM

so that was simply getting the secretary who was typing 9:43AM
this to compile the subsection names up at the top,
so --
Q So that was just a summary of detailed findings,
so that was just someone that compiled that? 9:43AM
A Compiled that stuff. There was really no --
Q Okay. So what about Section 2.2? That particular
text in that section?
A I wrote that.
Q Okay. 2.3? 9:43AM
A Jennifer Benaman did the first draft of that.
Q That's JB then we'll put there.
A Yes.
Q 2.4?
A I wrote that. 9:43AM
Q Okay. 2.5?
A Richardo Pettroni did the first draft of that.
Q 2.6?
A Richardo Pettroni did the first draft of that.
Q 2.5, sir. I guess you had to divide it in three 9:43AM
subsections so perhaps we should look at them
separately.
A Yes. Diane Achman did the first draft of 2.7.1.
Q So put DA next to that section?
A Yes. 9:44AM

Q 2.7.2? 9:44AM
A No.
Q 2.7.3?
A It was me.
Q What about 2.8? 9:44AM
A That would have been Jennifer Benaman assisted by Jonathan Baumgartner.
Q So it would be -- okay. So it would be JB and --
A JB.
Q So put two JBs there? 9:44AM
A Mm-hmm.
Q Okay. And 2.9?
A I did that.
Q 3.1?
A 3.1 again is just a compilation. 9:44AM
Q Okay. 3.2?
A I did that.
Q 3.3?
A I did that.
Q Okay. 3.4? 9:45AM
A I believe Abigail Bergoffen did the initial draft of that.
Q And 3.5?
A Margaret Murphy did the first draft of that.
Q Let me ask you about Section 3. You consider 9:45AM

yourself a river ecologist? 9:45AM
A I'm not quite sure how to answer that.
Q Let me ask a little bit different question then. Have you done any studies of algae in relationship to nutrients in lakes and rivers -- excuse me, in streams 9:45AM and rivers?
A Yes.
Q Okay. What studies have you done in that regard?
A Throughout my career I've been involved in numerous studies looking at nutrients and impacts of 9:46AM nutrients on rivers, lakes and reservoirs, and a fair amount of that work has to do with the relationship between nutrients and growth of algae and so I've been involved throughout my career in looking at the ecology from that standpoint. 9:46AM
Q Okay. Have you published any peer review papers concerning the relationship between nutrients and algae in rivers and streams?
A Not specifically. Not that I can recall.
Q Have you done any -- excuse me. Let me strike 9:46AM that. Have you published any peer review papers concerning the quantum of algae that would be considered a nuisance from an aesthetic point of view in rivers and streams?
A No. 9:47AM

Q Okay. Let's continue on with our -- and you left 9:47AM off on 3.5. What about -- 4.1, I guess, is just the summary again?
A Yes.
Q So 4.2? 9:47AM
A 4.2, the initial draft of that was by Diane Achman.
Q Okay. What about 4.3?
A I did that.
Q 4.4? 9:47AM
A I'm forgetting whether I did that or Jennifer Benaman may have drafted the first part of that. I'm uncertain. I don't recall.
Q 4.5?
A Would have been Margaret Murphy did the first 9:47AM draft of that.
Q Okay. Let's go down to Section 5.
A Mm-hmm.
Q 5.2.
A That would have been Debra Chiavelli did the first 9:47AM draft.
Q Prior to this work in this -- on this particular report, had you ever done any review or analysis of recreational water quality standards for bacteria, indicator bacteria? 9:48AM

A Yes. 9:48AM
Q We talked about the Hawaii work. Any work other than Hawaii on the beaches there?
A The cryptosporidium study in Milwaukee.
Q Anything else? 9:48AM
A Not that I recall.
Q Okay. 5.3?
A Debra Chiavelli would have drafted the first draft.
Q 5.4? 9:48AM
A Again, Debra Chiavelli.
Q Have you ever done any analysis of mass balance of bacteria prior to the work you did in this case?
A Yes.
Q And where was that done? 9:48AM
A In both of the projects we talked about, estimating sources which would have been equivalent to a mass balance was done.
Q Is that a traditional method by which you can obtain evidence of a potential source of bacteria in a 9:49AM recreational water?
A I don't know if I would call it -- typical is the term you used there?
Q Yeah, I used typical or traditional.
A Traditional. It's certainly something we've done 9:49AM

before and I think others have, I don't know whether I 9:49AM
would call it traditional.
Q Do you believe that it's probative in that it provides evidence of sources of bacteria.
A I believe it provides evidence of potential 9:49AM
sources of bacteria.
Q And you used it in your other two analyses we've discussed, the cryptosporidium in the Hawaii studies?
A Yes.
Q And did you rely, at least in part on that type of 9:49AM a mass balance analysis to determine source in those particular instances?
A We relied on it to identify potential sources.
Q Okay. And do you know whether or not Ms. Chiavelli has ever done any mass balance analysis 9:50AM prior to the work -- with bacteria prior to the work that she did in this particular case?
A I do not.
Q What about Section 5.5?
A Debra Chiavelli drafted that as well. 9:50AM
Q Okay. Let's go down to Section 6, Section 6.2.
A I believe Jennifer Benaman did the first draft of that.
Q Okay, 6.3?
A I believe Jennifer Benaman again. 9:50AM

Q And would that be both .1 and .2 of 6.3? 9:50AM
A I believe she may have had some help from others but I think she probably did most of the first draft of it.
Q Of both 6.2 and 6.3? 9:51AM
A Yes. She would have been assisted by Abigail Bergoffen probably for 6.3 and Debra Chiavelli.
Q Section 7, Section 7.2 in particular. Did anyone else help you in drafting that section of the report?
A No. 9:51AM
Q Section 8?
A I drafted that with assistance from Harry Zamakos.
Q And Section 9?
A Section 9 was drafted by Diane Achman with assistance from another staff member who I had 9:51AM forgotten to mention when we went through the list here and that is Mark Larue.
Q Okay. And who is Mark Larue?
A Mark Larue is the director of field programs for our company. 9:52AM
Q What does that mean?
A That means that he is responsible for the design and execution of field work that we do.
Q Has he drafted sampling protocols in the past?
A Yes. 9:52AM

Q How about Diane Achman, has she? 9:52AM
A Yes.
Q Have you?
A Yes.
Q We were talking about Dr. Wells' report, the 9:52AM subject of Section 8, did you study his report?
A Yes.
Q Which reports did you study to do your work? You personally study?
A His expert report. 9:53AM
Q Okay. And other than Dr. Wells, did you review any other expert reports?
A Yes.
Q Could you give me that list, sir?
A Dr. Teaf's report. 9:53AM
Q Okay.
A Dr. Olsen's report, Dr. Stevenson's report, Dr. Engle's report, Drs. Cooke and Welch's report, Dr. Fisher's report. I may have looked at others but those are the ones that I recall. 9:53AM
Q Okay. Could you give me a summary of your education and your formal educational background, sir?
A I have a bachelor's in civil engineering from Manhattan college.
Q Is this -- is this information reflected on 9:54AM

Appendix A to your report? 9:54AM
A Yes.
Q Okay. So please consider -- continue.
A I have a master's degree in environmental engineering from Manhattan College. And I have a Ph.D. 9:54AM in environmental health engineering from the University of Texas.
Q Okay, sir. Have you testified before in other cases or litigation involving environmental issues?
A Yes. 9:54AM
Q Okay. What I'd like you to do for me is maybe do a reverse order, start with the most recent and -- and then tell me the case you testified in and the subject matter, principal subject matter you testified concerning, okay? 9:55AM
A I testified in a case where the U.S. Navy and Grumman Corporation were being sued by the Town of Oyster Bay for PCB contamination found in a park owned by the town of Oyster Bay adjacent to the Grumman facility. 9:55AM
Q Okay. When was this?
A About a year and a half ago.
Q And was it deposition testimony that you gave in that case?
A Yes. 9:55AM

Q Did you also give trial testimony? **9:55AM**
A No.
Q Is the case still pending?
A Yes.
Q Are you anticipating giving trial testimony in that case? **9:55AM**
A Yes.
Q Did you issue a report in that case?
A Yes.
Q A report, you know, like we've got here? **9:56AM**
A Yes.
Q Okay. And what were the topics of your report in that case?
A That report focused on whether there was a fate and transport pathway that would carry PCBs from the 9:56AM Grumman site to the park and whether the type of PCBs present in the park was consistent with the type of PCB used at the Grumman facility.
Q Was it like PCB fingerprinting work you did?
A Yes, yes. 9:56AM
Q And for the fate and transport pathway, did you employ a model?
A No.
Q How did you determine your analysis of that?
A By looking at concentration gradients and data and 9:57AM

determining what surface runoff pathways existed. 9:57AM
Q Could you be a little more particular about that, sir? I mean, like maybe break it up here, two things I think you mentioned. You talked about how you used concentration gradients to determine whether or not **9:57AM** **there was a pathway?**
A Along a pathway, typically you go from higher concentration to lower concentration and so we were looking at patterns to see whether there was, in fact, a concentration gradient that would be suggestive of 9:57AM movement from the Grumman facility to the park.
Q So would you expect to find higher concentrations of the chemical concern at the point of release and then some trend downward as you move away from that point? **9:57AM**
A Yes.
Q And then you mentioned another analysis you did on fate and transport and could you tell me what that was?
A Yes. These are not independent analyses, understand that. What we are looking at is in total, 9:58AM all right, does the weight of evidence support one way or the other, so the first piece was concentration gradient but in and of itself wasn't sufficient. And we then had -- looked at whether we could connect the dots, in essence, that there was a migration pathway 9:58AM

where water would have moved from this location down to 9:58AM the park.
Q How did you determine whether water would move from the location down to the park?
A We used aerial photography and historical 9:58AM information on known drainageways to see whether there was a drainage pathway to the park.
Q To see if there was a -- maybe a drainage ditch near the facility that would drain to another smaller stream into a larger stream that would get close to the **9:59AM** **park?**
A They were right next to each other so there was no smaller stream to larger stream, it simply was there a drainageway from the facility to the park.
Q Okay. I think we'd better take our break to **9:59AM** **change the tape now, sir.**
A Okay.
THE VIDEOGRAPHER: We are now off the record. The time is 9:59 a.m.
(Following a short recess, proceedings 9:59AM continued on the record.)
THE VIDEOGRAPHER: We are back on the record. The time is 10:16 a.m.
Q Dr. Connolly, just before the break we were talking about the case where you were involved in the **10:16AM**

Town of Oyster Bay? **10:16AM**
A Mm-hmm.
Q And we were talking about fate and transport I think it was you looked at concentration gradients and also to see if there was an actual water pathway **10:16AM** **between the point of release, I guess, and the location the contamination, correct?**
A Yes.
Q Then you also said you looked at the fingerprinting of PCBs in that case? **10:17AM**
A Yes.
Q And can you tell me what that analysis was, that fingerprinting analysis?
A In that case, it was fairly simplistic because the PCBs were quantified at a fairly crude level, what is 10:17AM called aroclor quantification, and it's simply looking at whether you had the same aroclors in both places.
Q Any other analysis that you performed in that case to determine whether or not there was a connection between the location of the contamination and the -- **10:17AM** **and your -- I guess it was your client's property, the Grumman property?**
A Yes. The other analysis had to do with comparing disturbed land and undisturbed land and whether we saw the PBCs on the undisturbed or on the disturbed land. 10:17AM

Q And how did you perform that analysis? 10:18AM
A Again, looking at historical records, this was an area that was not originally a park but was developed into a park so there was a lot of disturbance in areas of the park to develop facilities like ball fields and 10:18AM things. And that activity brought in a lot of fill and there were questions about whether that fill could have contained PCBs and one way we looked at that was by saying whether the PCBs tended to be concentrated in the area that was filled versus undisturbed areas that 10:18AM had not been filled.
Q And what -- did your opinion -- were you able to form an opinion -- let me strike that.
Were you able to form an opinion as to whether or not your client's property was a source 10:18AM of PCBs at the park?
A Yes.
Q And what was your opinion?
A That it was not.
Q Now, in that particular case, has there been any 10:18AM challenge to you testifying in the court?
A No.
Q Are you familiar with what is called a motion in limine or a Daubert Motion?
A Yes. 10:19AM

Q Nothing like that has been filed in that case? 10:19AM
A No.
Q Okay. Any other testimony that you've given, sir?
A Yes. I testified at deposition in a case where there's a suit between NCR Corporation and their 10:19AM insurance carriers.
Q Is that testimony mentioned in Appendix A to your Exhibit 1?
A Yes.
Q Okay. And that was deposition testimony only? 10:19AM
A Yes.
Q And who did you represent?
A NCR Corporation.
Q And what's the nature of the case?
A NCR has insurance for a particular time period and 10:20AM the issue is whether or not damage as defined by the policy was occurring during the period of the policy.
Q So it was an occurrence-type policy involved in that case?
A I don't understand the terminology, so I don't 10:20AM know if that's the appropriate terminology.
Q Okay. And what was the damage that's at issue in that particular case?
A The damage at issue, there was PCB concentrations in sediments that the government believed, or in this 10:20AM

case, the federal government believed warranted 10:20AM remediation.
Q Okay. And how did you -- what kind of -- excuse me, let's strike that.
What kind of an analysis did you perform 10:20AM in that case that you gave your opinions on?
A We looked at the accumulation of sediments containing PCBs in the sediments. We did radiodating to date the sediments and analysis -- modeling analysis whether, in fact, there were additional sediments being 10:21AM laid down during the period of the policy that would have been at concentrations requiring remediation.
Q Could you break those out separately now and explain each analysis you performed --
A Yes. 10:21AM
Q -- with regard to the PCB concentrations and the sediments?
A Yes. We examined PCBs and profiles within the sediments from the surface on downward. We used radiodating to date those sediment layers. 10:21AM
Q What do you mean by radiodating?
A The same technique that is used in this report to use cesium and lead-210 to try to date sediments at various depths in the column, which allowed us to examine what are the PCB concentrations and sediments 10:22AM

that were laid down during the policy period. 10:22AM
Q Okay. And did that particular analysis help you in your evaluation as to the timing of the PCB releases?
A Yes. 10:22AM
Q What did it show you?
A It showed us that during the policy period, sediments were accumulating at concentrations that the federal government, based on the criteria they are using, would have required to be remediated. 10:22AM
Q Okay. And did you use both the cesium and the lead-210 analysis to support your opinion?
A I believe so. I think we relied primarily upon cesium in that case but also lead-210. I don't remember the details now of what we specifically used 10:23AM and didn't use.
Q What was the time period of the -- of the insurance policy?
A 1977 to 1984, if I'm remembering correctly.
Q Okay. And did you issue a written report in that 10:23AM case?
A Yes.
Q And were you retained by a law firm in that case?
A Yes.
Q Which law firm? 10:23AM

A Sidley and Austin. 10:23AM
Q Same office that Mr. Todd's in, Washington, DC, office?
A I believe so.
Q And do you know who the lawyers on the other side 10:23AM of the case are?
A I do not recall.
Q Where is that case pending?
A In Green Bay, Wisconsin.
Q Okay. What other work did you perform in that 10:24AM case to determine whether or not there was a lead -- excuse me, a PCB released during the relevant insurance policy time period?
A We looked at measurements of PCBs in the water and what concentrations of PCBs would likely have existed 10:24AM during the policy period, which would have moved PCBs downstream potentially contaminating additional areas.
Q Are you saying you looked at PCB concentrations in the water at a particular time period?
A At the time periods which data existed and at a 10:24AM particular location because there was a single location at which there was a long term record of PCBs.
Q What was the purpose of that analysis?
A To determine whether the PCB concentrations in the water were of a sufficient magnitude to, again, cause 10:25AM

damage with damage being defined as contamination that 10:25AM would require remediation. And also as evidence that the PCBs were continuing to spread and move from the Fox River, in this case, to Green Bay.
Q Any other analysis you performed as part of your 10:25AM expert opinion in that case?
A Not that I recall.
Q You said you used a model for your analysis?
A Yes.
Q What model was used? 10:25AM
A We used a very simple model of vertical mixing in sediments to illustrate that even if PCB, the active discharge of PCBs had ceased before the policy period began in 1977, that vertical mixing in sediments would have caused PCBs to still be seen in surface sediments 10:26AM after the discharge stopped.
Q And what -- what were the mechanisms of the mixing that were employed by the model?
A The model is not mechanistic in that sense. It uses a fixing coefficient that is intended to represent 10:26AM sum total of mixing that would have occurred due to biological mixing, as well as hydrodynamics, a force of water moving past the surface sediments.
Q So the coefficients are based on both hydrological force of water moving over the sediments as well as 10:27AM

biological? 10:27AM
A Yes.
Q Were there -- was there evidence of benthic activity in the sediments in this particular circumstance? 10:27AM
A Yes.
Q So you took an analysis of the sediments to determine if there's benthic macroinvertebrates there that could actually perform mixing in the sediments?
A We did not. 10:27AM
Q Was there other data that would indicate there were benthic macroinvertebrates in the sediments that would be sufficient to support the coefficient of the model?
A There was data that demonstrated that there were 10:27AM benthic macroinvertebrates. We did not go so far as to try to relate the density of the macroinvertebrates to the mixing.
Q Is that -- is that particular coefficient of that model dependent upon the density of the 10:28AM macroinvertebrates?
A Yes.
Q But you didn't do that analysis, I guess?
A No.
Q I may have just helped the insurance company there 10:28AM

a little bit, I don't know. Let me ask you a question 10:28AM about the PCB analysis in the water. I'm not sure I followed that.
A Mm-hmm.
Q Were you looking at concentration gradients there? 10:28AM
A Temporal gradings in concentration.
Q Okay. So you wanted to determine whether or not there was water quality data indicated that there were PCBs in the relevant waters during the time period that they may have been released from your client's 10:29AM property?
A And later.
Q Okay. And that particular case, is it still pending?
A Yes. 10:29AM
Q And has there been any Daubert or motion in limine challenged in that particular case?
A No.
Q Okay. You did issue a written report in that case? 10:29AM
A Yes.
Q Any other testimony, sir?
A Yes. On my resumT, the next testimony that's shown there is administrative hearing testimony. I'm not sure if that qualifies for what you're looking for. 10:29AM

Q Well, it's not in a court proceeding, correct? 10:29AM
A No.
Q But I am curious about the type of testimony you did provide. Would you please identify that administrative hearing and what your opinions were? 10:30AM
A Yes. The State of Maine had conducted a TMDL study for the Androscoggin River and Gulf Island Pond, which is a reservoir on the Androscoggin River for phosphorus. And had made conclusions about the loading reductions that were necessary to meet water quality 10:30AM standards. We were retained by one of the paper mills that were upstream of Gulf Island Pond to evaluate the technical work that was done to come up with the loading allocations. And the administrative hearing was a hearing to review the conclusions of the TMDL 10:30AM study and to identify whether there were weaknesses or shortcomings from that work that would justify a re-analysis of the allowable loadings.
Q Okay. Let me see if I can characterize your function and correct me if I make mistakes. You were 10:31AM hired by the paper mill, which I guess was one of the sources of phosphorus in the study?
A Yes.
Q Okay. And you were evaluating whether or not the TMDL study accurately portrayed all the sources of 10:31AM

phosphorus to this particular river? 10:31AM
A In part. The other was to -- whether or not the loading allocations, in other words, the amount of phosphorus that the paper mill would be allowed to discharge to the river was appropriate given all the 10:31AM available information in the analysis that had been done.
Q Okay. That allocation that would be allowed for the paper mill, what are factors that go into an allocation of that type? 10:32AM
A The determination is made of all of the sources of phosphorus entering, in this case, Gulf Island Pond and a determination of what the maximum allowable amount is in order to meet the goals for water quality standards.
Q In a particular pond? 10:32AM
A For this pond. And then to allocate back to all the sources an allowable discharge so that the sum of those sources does not exceed what their analysis says is the maximum allowable load that the pond can handle.
Q How did the State of Maine determine what the 10:33AM maximum allowable phosphorus load should be for this particular pond at issue?
A The State developed a model of phosphorus and algae for the pond and used that model to determine what the allowable load should be. 10:33AM

Q Was part of your analysis a review of the model 10:33AM the State employed?
A Yes.
Q What model did they employ?
A WASP is the name of the model. 10:33AM
Q Did they employ a surface runoff model or just a lake model in this particular case?
A They employed a river model and a lake model.
Q And which one was WASP?
A The lake model was WASP. 10:33AM
Q And what was the river model?
A I don't recall with certainty but it may have been QUAL, QUAL model.
Q CE-QUAL?
A CE-QUAL. 10:34AM
Q Did you also review the river model in that case?
A Yes.
Q Okay. Did you find that the CE-QUAL model, as was employed in this particular instance, accurately characterized runoffs? 10:34AM
A The CE-QUAL model doesn't characterize runoff, it characterizes what's happening in the stream.
Q Okay. Was there a runoff model employed in this particular case?
A No. 10:34AM

Q Were they concerned with nonpoint sources in this 10:34AM particular study?
A No.
Q So it was only point source loading?
A Yes. 10:34AM
Q Was there any nonpoint source available in the particular watershed that you were evaluating?
A I'm not sure what you mean by "available."
Q Let me restate the question. Did you -- did you identify any non-point sources of P in the watershed? 10:35AM
A Yes.
Q And those were not part of the State's TMDL, correct?
A Correct.
Q So that was -- was that one of your comments as to 10:35AM the inadequacy of the TMDL?
A Yes.
Q And what were the nonpoint sources of phosphorus that you identified in this particular TMDL analysis?
A This watershed is largely forested and so the 10:35AM major nonpoint source was runoff from forest soils.
Q Okay. And how did you determine that there was runoff from the forest soils?
A We conducted our own fairly simple modeling analysis. 10:35AM

Q Which was? 10:35AM
A Which was using literature based estimates of runoff coefficients and information on precipitation to estimate roughly how much phosphorus would be coming off the soils. 10:36AM
Q Is that one of the methods that Dr. Engle employs in this particular case to determine whether phosphorus runs off from fields when poultry litter is applied?
A I don't recall.
Q And what was your determination with regard to non-point source? How much was the impact on this particular watershed? 10:36AM
A My memory is that we did not quantify the specific impact but concluded that it could not be ignored in the TMDL and the TMDL was deficient for not having 10:36AM examined it.
Q So your determination was that the phosphorus runoff from the forest area was significant enough to have an impact in this watershed for its phosphorus loading? 10:37AM
A That it had a potential to do that and that it needed to be examined. We didn't draw the conclusion that it was, but more that it could be and, therefore, the analysis was deficient for not having examined it.
Q Based on different types of land uses based on 10:37AM

your experience, Dr. Connolly, do forests tend to be high contributors of nutrients to watersheds relative to the other potential sources? 10:37AM
A Forests tend, per acre, to deliver less nutrients than other land uses. 10:37AM
Q Such as agricultural uses?
A Yes.
Q Were you retained by Sidley and Austin in that case?
A No. 10:38AM
Q Directly by the paper mill?
A Yes.
Q Any other testimony, sir?
A Yes, along the same lines as shown on here, in 2001, I testified before the House of Representatives 10:38AM in subcommittee.
Q And what was the topic of your testimony there?
A Approaches to examining and dealing with contaminated sediments.
Q Was there any particular contaminant that you were 10:38AM focused on in that testimony, sir?
A No. This was more a general strategy for how you would address sediments that are contaminated.
Q Okay. Any other testimony, sir?
A Yes. 10:38AM

Q Okay. 10:38AM
A I testified on a case in the Kalamazoo River in Michigan.
Q Okay. And what was that case, sir?
A There's a CERCLA site on the Kalamazoo River and 10:39AM there is a group of companies that are called, you know, PRPs, potentially responsible parties, and they made an attempt to bring in other companies to -- to the site, one of whom was Eaton Corporation, and I represented Eaton Corporation in evaluating whether, in 10:39AM fact, they contributed, in this case PCBs, to -- to the Superfund site.
Q Okay. And were you retained by a law firm in that case?
A I believe we were retained directly by Eaton 10:39AM Corporation.
Q Did you work with any lawyers in that case?
A Yes.
Q What was the law firm?
A I'm trying to remember, Dika Migassa (phonetic). 10:40AM
Q And when was this case, the time period that you testified?
A 1998 through 2000 or 2001.
Q Was this deposition testimony?
A Deposition and trial testimony. 10:40AM

Q You actually testified at trial in this case? 10:40AM
A Yes.
Q And on what subject?
A The likely contribution of Eaton Corporation to the Superfund site. 10:40AM
Q Was it were they contributing or just how much?
A It was both whether and how much.
Q And how did you perform your analysis to reach an opinion on those two issues?
A Examining PCB usage at the Eaton Corporation 10:41AM facilities, the potential for PCB releases from those facilities, the concentrations observed in the sediments and the drainageways from those facilities, and then the concentration in the Kalamazoo River upstream of the Superfund site between Eaton and the 10:41AM Superfund site in comparison to the concentrations that existed in the Superfund site.
Q Which is downstream?
A Which is downstream. And in addition, developed a model to predict the maximum concentrations in 10:41AM sediments that could have been contributed by Eaton to the Superfund site.
Q What model was that, sir?
A That was a model that, a model called WASTOX, W-A-S-T-O-X. 10:42AM

Q It's a type of an allocation model? 10:42AM
A It's a fate and transport model.
Q From runoff?
A It's an in-stream model.
Q In-stream model. Were the discharges -- were the 10:42AM potential discharges in this particular case point source discharges or nonpoint discharges from Eaton Corporation?
A Point source.
Q Okay. When you say you evaluated PCB usage at 10:42AM Eaton Corporation, what do you mean by that?
A How PCBs would have come to be at the site based upon the types of operations they had, whether in fact PCB oils would have been used in those operations, the presence of transformers and capacitors in their 10:43AM facility, which would have been PCB soils in them, as well as information about PCBs found on site.
Q So how is that important to whether or not Eaton contributed to PCBs in the contaminated sediments?
A In order to contribute to the contaminated 10:43AM sediments, obviously they need to have used PCBs on site.
Q Okay. So that's often a helpful source of determination as to whether or not the particular waste has the contaminant in it, for example, or the 10:43AM

particular part of that particular contaminant, 10:43AM correct?
MR. TODD: Object to form.
A Yes.
Q Did you say you also looked at potential for 10:44AM releases in that case?
A The pathways by which PCBs would have been able to migrate from the site.
Q Okay. I guess that presumes you did find some usage of PCBs at Eaton Corporation? 10:44AM
A Yes.
Q So what do you mean "by you looked at pathways for migration"?
A Looking at drainageways from the site and what PCB levels existed in those drainageways. 10:44AM
Q So in those particular -- at this particular facility, would it be that PCBs were in a waste stream or would they have been released to maybe soils that would then be collected in a storm water discharge?
A As I recall, it was more the latter. 10:44AM
Q Okay. And you said you looked at concentrations also?
A Yes.
Q How was that analysis employed?
A By comparing the concentrations in the river in 10:45AM

the vicinity of Eaton to the concentrations in the 10:45AM Superfund site because the concentrations outside Eaton's door were orders of magnitude lower than the concentrations in the Superfund site.
Q Okay, was that a concentration gradient analysis? 10:45AM
A In part.
Q Okay. Is that case still going on?
A No.
Q Okay. Any other testimony, sir?
A Yes. The Southern California Bight in what was 10:45AM called the Montrose case.
Q Okay. Southern California what?
A Bight.
Q Bite, B-I-T-E?
A B-I-G-H-T. 10:45AM
Q Okay. Who did you represent in that case?
A The United States Government.
Q And what case was that -- back up. What was involved in that particular case?
A That case was a natural resource damage assessment 10:46AM case in which federal and state trustees had sued several corporations for natural resource damages.
Q Okay. And was that in a court?
A Yes.
Q Do you remember which court it was in? 10:46AM

A It was in federal court in Los Angeles. 10:46AM
Q And did you testify in the court in the particular case?
A Yes.
Q What opinion did you offer in that case? 10:46AM
A That, in this case, the contaminant of concern was DDT and the opinions offered were that the DDT found in the Southern California Bight in the fish, as well as in sea lions, peregrine falcons, bald eagles, was in part attributable to the releases to the California 10:47AM Bight associated with discharges from the companies involved in the damage assessment suit.
Q Okay. And how did you reach that conclusion?
A We reached that conclusion by a combination of looking at concentration gradients and developing 10:47AM models of bioaccumulation of DDT and also PCBs, but the focus was really DDT in the food web, and looking at whether it was possible to achieve the levels that were observed in the various species, like sea lions and certain fish species unless they had been exposed to 10:48AM the high concentration sediments in the vicinity of the outfall.
Q Would you explain to me how concentration gradients were used to establish that the DDTs from Montrose were present in the wildlife that was at issue 10:48AM

in that case? **10:48AM**
A There was a large peak concentration in the sediments of Southern California Bight at the location of the outfall and a decline away from the outfall that persisted for multiple miles. And before it dissipated 10:48AM to what we would say is regional levels of DDT in the coastal sediments.
Q And so what did that gradient change tell you?
A It gave us some evidence of the potential area of the bight that may very well have been influenced by 10:49AM the discharges from this outfall.
Q Any other testimony, sir?
A I testified in a case in 1996, I think it was, an insurance case between Alcoa and its insurance carriers. 10:49AM
Q Okay. Who did you work for?
A Alcoa.
Q And where was that case?
A That case was at two locations. Alcoa had a facility in Texas and a facility in New York State, 10:49AM both of which were the subject of this case.
Q And where was the lawsuit filed?
A I'm uncertain.
Q Did you testify in court in that case?
A No. 10:50AM

Q Just deposition? **10:50AM**
A Just deposition.
Q Okay. And what was -- what were your opinions in that case?
A That the -- in one case was mercury and the other 10:50AM case was PCBs, that the area of the receiving waters, for mercury it was Lavaca Bay in Texas and for PCBs it was the Grasse River in City of New York, that the area that was contaminated had been growing over time similar to the testimony in the Fox River case. 10:50AM
Q So what methodology did you employ to establish -- was it to determine whether the releases occurred in that particular case?
A No, it was determining whether during the policy period there was increasing damage. 10:50AM
Q Increasing damage. Okay. And what methods did you employ to make that determination?
A In that case, it was simply to look at, again, verdict profiles and sediments, similar to the Fox River Case, as well as just to rely on general 10:51AM principles of sediment and contaminant movement in the environment.
Q Did you use lead-210 and cesium-137 in that particular case?
A I don't recall at this time. 10:51AM

Q If you're doing vertical profiling, can you think 10:51AM of a way you would do that -- well, I guess would you look -- if you're not using the radio nuclide analysis wouldn't you just then -- maybe just look at sedimentation rates, is that how you determine the age 10:51AM or damage?
A That's in part to the extent that we can estimate or have some knowledge of sedimentation rates. The other way is if the releases are during a known and restricted period, so for example, in Lavaca Bay in 10:52AM Texas, the active mercury releases occurred over a very short time period, from 1965 to 1969. So when you look at vertical profiles and sediments and you identify where the peak is, that peak is likely associated with that period of active release so you're able to date 10:52AM that layer in the core. And then the assumption that you have a uniform deposition above that, you can date the sediments above that peak.
Q What did you mean by you "also employed general principles of sediment transport"? **10:52AM**
A General principles of how sediments move and under what conditions they move and whether, in fact, in these environments there would be sediment movement that would have carried sediments containing, for example, mercury progressively further from the source. 10:53AM

Q How did you determine whether or not those 10:53AM activities were occurring or not occurring?
A I can only recall at this time what we did for the Texas site, but there was simply looking at hydrodynamics, the kinds of velocities that would 10:53AM occur, what kind of wind mixing may occur with the sediment in the fairly high winds in the Gulf of Mexico. And to what extent that would have re-suspended materials and spread them further down.
Q Is there a relationship between the depth of a 10:53AM water body and the potential for its mixing? That is the water mixing in the water body?
A I'm not sure that I follow the question.
Q Have you ever heard of the Osgood index?
A No. 10:54AM
Q In that particular case, did you determine that there would have been some sediment mixing based on the characteristics of the water body?
A Yes.
Q And what did those characteristics indicate to you 10:54AM that there would be some mixing of the sediments?
A Again, it was the shallowness of the embayment, the tidal velocities in the case, because this was a tidal environment, and the mixing that would have occurred during storm events with high winds. 10:54AM

Q Did you give deposition testimony in this case? 10:54AM
A Yes.
Q Did you give court testimony?
A No.
Q Was there any motions in limine or Daubert motions 10:54AM in this particular case?
A No.
Q Any other testimony, sir?
A Not that I recall.
Q Exhibit 1 before you, sir, does that contain all 10:55AM of your opinions that you have formed in this case?
A It contains all the major opinions that I have formed in this case.
Q Okay. Are there any -- have you formed any other opinions that aren't set out in your report? 10:55AM
A As I was working on this project and going through the myriad of documents that existed, I formed lots of opinions about things I was reading and looking at that didn't specifically make it into this report, so I probably have, you know, dozens of minor opinions 10:55AM related to documents I've reviewed.
Q Okay. Were any of those opinions inconsistent with the opinions you've presented in your Exhibit 1?
A No.
Q Anything that was not in the same character or 10:56AM

type of opinion? 10:56AM
A I'm not sure what you mean.
Q Would you say they were minor opinions on the same subject matters that you gave here?
A Yes. 10:56AM
Q For example, did you form any opinions with regard to microbial source tracking in this particular case?
A I did, yes.
Q I didn't see any analysis of microbial source tracking in your report, is that correct? 10:56AM
A Correct.
Q Okay. So what did you -- what opinions did you form with regard to microbial source tracking?
A I don't recall as I sit here. I remember, for example, in reading Dr. Harwood's work and having 10:56AM formed some opinions about the veracity of that work and the assumptions that she was making and such, but I don't recall them as I sit here.
Q Have you done any microbial source tracking work within your career? 10:57AM
A The project in Hawaii, Hanauma Bay, where we were trying to evaluate sources, I was working on a team that included a number of microbiologists who were looking at source tracking so I had a lot of contact with their work and we worked pretty closely as a team, 10:57AM

but I was not specifically doing any of that work 10:57AM myself.
Q Any other -- is that the only exposure you've had with microbial source tracking in your career?
A Yes. 10:57AM
Q What were the techniques they were employing in the Hawaii matter?
A Preliminary chain reaction, PCR techniques.
Q Were they library dependent or library independent techniques? 10:58AM
A I don't know.
Q Do you know the difference?
A No.
Q Have you ever done any principal component analysis in any of your work? 10:58AM
A As a group we have, so I've -- on projects that I've worked on I've had members of my staff have done principal component analysis as we're reviewing data but I myself have not done it.
Q I asked you if you recalled any opinions you might 10:58AM have formed that are not set forth in your report. You said you didn't recall, but you may have formed some opinions on Dr. Harwood's. Are you offering any opinions on Dr. Harwood's work as part of your testimony in this case? 10:58AM

A I'm certainly not offering any opinions as part of 10:59AM this report. I don't know, as I sit here, whether there would be any reason to offer opinions going forward.
Q Can you think of any other topics you might have 10:59AM reviewed during the course of your work where you may have formed opinions other than -- that are not in your report, other than when you mentioned about Dr. Harwood?
A Yes. I reviewed Dr. Olsen's report and formed 10:59AM opinions about the interpretation of the PCR analysis.
Q But you're not offering those opinions in this particular case?
A Well, I'm not offering them in the report, as I indicated. 10:59AM
Q And so you formed some opinions based on your own analysis of the PCR?
A No.
Q It was based on some other people's work in your office? 10:59AM
A No. It was simply based on reading what Dr. Olsen had written and drawing my own opinions about the validity and the veracity of some of the conclusions that Dr. Olsen was making.
Q Based on PCR? 11:00AM

A Based on PRC. 11:00AM
Q But you've never done any PCR work yourself in the past, correct?
A I've not conducted a PCR analysis in the sense that I've not assembled the data, run them through a 11:00AM PCR statistical package to get the results, but others in my office have and I've been involved in the interpretation of the PCR results and looking at the PCR results and trying to understand what they mean, so I have that level of experience. 11:00AM
Q Do you know enough about PCR to determine how you go about normalizing the data or whether normalization is important or not?
A Only in general terms.
Q What about how you select parameters for PCR analysis, have you ever gone through that process yourself? 11:01AM
A As part of a team, yes.
Q Were you the lead as part of that?
A No. 11:01AM
Q Anything else? Any other areas where you've formed opinions but you've not offered them as part of your report?
A Another I recall is reading Dr. Stevenson's report and looking at his attempts to develop relationships 11:01AM

between various parameters and poultry house density. 11:01AM
Q Did you reproduce any of those analyses?
A No.
Q How did you do your evaluation and the relationships if you didn't reproduce the analysis? 11:01AM
A I was not attempting to reproduce any of his work, I was simply reacting to the work as he presented it and the manner in which he drew conclusions from the analyses.
Q Okay. But that is not contained in your report? 11:02AM
A No.
Q Anything else?
A Not that I recall as I'm sitting here.
Q I notice that you did talk about the work you did on the TMDL in the State of Maine. Have you been involved in any other environmental projects where you worked on nonpoint source pollution? 11:02AM
A I worked on a large project associated with Lake Erie trying to understand phosphorus sources to Lake Erie and their role in oxygen depletion and algal 11:03AM growth and that involved work looking at both point and nonpoint sources.
Q How did you evaluate -- you published papers on that topic, have you not?
A Yes. 11:03AM

Q How did you -- how did you evaluate nonpoint sources in that particular study for Lake Erie? 11:03AM
A In that particular study, we were working again as a team and there were others who were actually evaluating the source contributions to tributaries. We 11:03AM were then estimating phosphorus loads to Lake Erie from those particular tributaries and relying on others to tell us what were the dominant sources of the phosphorus that we had concluded was making its way to the lake. 11:04AM
Q So was your function in this particular study primarily the lake modeling aspect?
A Yes.
Q So you would take the data others would give you as to the sources and the tributaries and model that as it entered the lake? 11:04AM
A Yes, with the goal being to be able to tie back to the efficacy of reductions in point sources and nonpoint sources in terms of improving water quality.
Q You, yourself, did not do the analysis as to point -- excuse me, nonpoint source contributions to the tributaries? 11:04AM
A I did not.
Q Who did the work in that case?
A I don't recall. 11:04AM

Q Do you recall whether there were any nonpoint source contributions for nutrients for Lake Erie in the study you did? 11:04AM
A Yes, there were.
Q And what were the nonpoint sources? 11:04AM
A The one I recall is agriculture.
Q What type of agriculture?
A Cultivated agriculture. I don't remember what particular crops.
Q Was there any pastoral-type agriculture activities that were considered contributors? 11:05AM
A I don't recall one way or the other.
Q Okay. So other than actually modeling information provided by others as to sources of nonpoint source pollution, have you done any work yourself evaluating whether or not there is a nonpoint source of pollution in a particular watershed? 11:05AM
A I have in the sense that it is fairly common to -- in the work that we do to try to assess the relative contribution of what we see coming in under non-runoff 11:06AM events and what we see coming in under runoff events under the assumption that what we're seeing under runoff events includes a nonpoint source component in order to get some sense of the magnitude of each, but I have not myself gone back and done work in the 11:06AM

watershed to try to understand the relative 11:06AM
contribution of the various sources.
Q Have you done any work in watersheds to understand the mechanisms by which non-point source pollutants enter waterways? 11:06AM
A Yes.
Q What work is that?
A That was work involved in reviews that I was involved with of particular nonpoint source models and the mechanisms that are built into those models to 11:07AM
understand runoff.
Q What are those mechanisms in those models?
A Well, they vary considerably from model to model. The one that I had most involvement with was HSPF. And HSPF is a fairly sophisticated model and looks at a 11:07AM
number of different processes that are involved in moving constituents from a soil site to receiving water, including moving of dissolved material so precipitation, dissolution, runoff, erosion.
Q Particulate runoff? 11:07AM
A Particulate runoff, either to loosening of soil particles due to the direct force of the impact of rainwater, as well as loosening of particles due to the sheer stress of runoff. And then trapping efficiency of those particles as they move off site. 11:08AM

Q Do these models you've reviewed account for nonpoint source transport of constituents from soils into waterways? 11:08AM
A Yes.
Q And do they assume that there is some component of transportation of nonpoint source constituents from lands into waterways? 11:08AM
A I wouldn't characterize it as "assume." I mean, they're mechanistic and they run a calculation and they compute what's coming off. 11:08AM
Q Have you evaluated those coefficients to determine whether they're reasonable?
A Not particularly.
Q In your judgment as an environmental scientist engineer, do you believe it's reasonable for surface runoff models to account for runoff in infiltration of nonpoint sources into waterways? 11:08AM
A My experience with those models is that they do some things well and some things not so well. They do a fairly good job at predicting water movement and so 11:09AM
delivering water to a receiving water, they do well at. They do okay at delivering solids. And then they sometimes, in some watersheds, do a decent job at delivering constituents as well and others not so well.
Q Are you -- have you ever done any work with the GLEAMS model? 11:09AM
A No.
Q Have you been involved in any cases where the focus was agricultural pollution, other than this case?
A In the Lake Erie situation, agricultural sources 11:10AM
of phosphorus were a consideration.
Q Were they significant in that case?
A I don't recall the breakdown between point and nonpoint sources.
Q Do you have a feel at all for what the breakdown was in Lake Erie? 11:10AM
A I would have to go back and review the reports.
Q That really wasn't your focus, was it?
A No.
Q Okay. So other than the Lake Erie circumstance where you did the lake model there, have you been involved in any other cases where there's agricultural pollution issues? 11:10AM
A Not that I recall.
Q And other than TMDL for the water -- excuse me, for the paper plant, phosphorus, and Lake Erie -- Lake Erie work you've testified to, have you been involved in any environmental studies of nutrient pollution? 11:11AM
A Yes.
Q What are those? 11:11AM

A I mentioned earlier the Lake Travis work. I also 11:11AM
previously did work on the Delaware River.
Q Anything else other than those you've mentioned?
A Those are the ones that come to mind now.
Q Okay. Tell me about the Delaware River work that you did. 11:11AM
A The Delaware River work was looking at bacteria and algal growth in the Delaware River as a result of nutrient inputs to the Delaware. It was part of the research work that I was doing to develop models of 11:12AM
bacterial fate in the environment.
Q Did you also look at nutrients in algal growth?
A Yes.
Q What did you conclude in that evaluation?
A Conclude with regard to? 11:12AM
Q You did a study, I assume --
A Yeah.
Q -- you had a hypothesis, you reached some conclusions with your study?
A No, in this case, the Delaware was used as a case 11:12AM
study to evaluate the ability to model both algae and bacteria and so the outcome of this was to demonstrate whether, in fact, we could develop a model that could credibly model the spatial patterns and temporal patterns that existed in both algae and bacteria in the 11:12AM

Delaware. 11:13AM
Q Were you able to do that?
A Yes.
Q Okay. And what -- and how were nutrients involved? 11:13AM
A Nutrients are involved because they control the growth of the algae.
Q And what nutrients did you look at?
A Phosphorus and nitrogen.
Q Did you look at total phosphorus? 11:13AM
A Total phosphorus as the particular phosphorus species.
Q Did you find that there was a relationship between total phosphorus and algal growth in the Delaware River? 11:13AM
A That was not a specific objective and I don't recall looking one way or the other about whether that relationship existed.
Q Okay. So there was no evaluation of the model between algae and nutrient relationships? 11:13AM
A There certainly was because we were attempting to model nutrients and algae at the same time and so the nutrient dynamics were important to the model and being able to reproduce the nutrient levels in the river as well as the algal levels in the river and, therefore, 11:14AM

the relationship between them was important. So all of 11:14AM that was part of the work.
Q Did you find that there was a relationship between, let's say, phosphorus and algal levels in the river? 11:14AM
A Yes.
Q Was it just -- was it total phosphorus or the different forms of pyrophorus?
A It was the different forms of phosphorus.
Q Did you look at total phosphorus to see there if 11:14AM there was a relationship between total phosphorus and algal growth in the river?
A No.
Q Was this benthic growth or suspended algae, what was the analysis? 11:14AM
A Suspended algae.
Q I think it's time for a break.
A Okay.
THE VIDEOGRAPHER: We are now off the record. The time is 11:15 a.m. 11:14AM
(Following a short recess, proceedings continued on the record.)
THE VIDEOGRAPHER: We are back on the record. The time is 11:20 a.m.
Q Dr. Connolly, I just wanted to make sure I 11:20AM understood. When you did your Delaware River work, 11:20AM were you evaluating total phosphorus or not?
A Indirectly because the way the models are set up is -- break phosphorus into different components and you focus on those components, the sum of which is 11:20AM total phosphorus but there was no focus on total phosphorus, per se.
Q Okay. Was there a focus on a particular form of phosphorus per se?
A On all of the forms because there is organic 11:21AM phosphorus, inorganic pyrophorus and particulate and dissolved. And those forms are interacting, but there's a rate at which organic phosphorus is breaking down into organic phosphorus and so on. So those forms are all interacting with each other in the model. 11:21AM
Q When did you do this work on the Delaware River?
A That was probably in the mid '90s.
Q Okay. Any other work on nutrient pollution that we haven't discussed?
A Not that I recall. 11:21AM
Q What about watershed-wide pollution? I know you've worked on the TMDL, but have you done any other work where you evaluated watershed-wide pollution?
A No.
Q Have you been to the IRW, the Illinois River 11:22AM

Watershed? 11:22AM
A Yes.
Q When were you there?
A July 2008.
Q Any time before that? 11:22AM
A No -- oh, I'm sorry. I had been to this area, so I've been in the watershed as part of meetings but to actually go out and see the system it was only in July of 2008.
Q Okay. And what did you do when you went out and 11:22AM looked at the system in July?
A We drove through the watershed from areas in Arkansas, through all of Oklahoma, stopped at a number of different places, went down all the way to Lake Tenkiller and to the dam at Lake Tenkiller and, in 11:22AM addition, I was taken up in a small plane for an aerial view of the watershed.
Q How much time did you spend in your review of the IRW?
A It was one day. It was a long day so probably was 11:23AM 10, 12 hours.
Q Did you observe any poultry operations when you were in the IRW?
A Yes.
Q What did you observe? 11:23AM

A Simply from the road as we were going by, it was 11:23AM
with John Elrod, and John would take the time to point
out to us different poultry operations. We'd slow down
and look at them. And after a while, it became obvious
what was a poultry operation so then it was easy to see 11:23AM
them as we were driving through the watershed.
Q Did you observe any land application of poultry
litter?
A No.
Q What do you know about land application of poultry 11:23AM
litter, if anything?
A I know that it is surface applied so it's not
incorporated in the soil and it is applied principally
to pastural land for the purposes of growing grass that
would be forage for cattle. 11:24AM
Q Do you know how it's applied, that is, the
mechanism that's used?
A My understanding is that it is just dispersed onto
the surface of the ground.
Q Have you ever seen a salt truck before for roads, 11:24AM
sanding/salting roads?
A Yes.
Q Is it your understanding that's pretty much how
poultry litter is applied to fields?
MR. TODD: Object to form. 11:24AM

A I don't know it to that specificity. 11:24AM
Q Have you seen any pictures or movies of poultry
litter application in the IRW?
A No.
Q Or anyplace else? 11:24AM
A No.
Q Do you know when poultry litter is applied
generally in the IRW?
A My understanding is that it is applied most
heavily in the late winter, early spring. 11:24AM
Q And what is your basis for that understanding?
A Documents that I have read.
Q Like the report of the plaintiffs in this case?
A Yes.
Q You mean the plaintiff's experts like Dr. Engle 11:25AM
and Dr. Fisher?
A Yes.
Q So is that the basis of your understanding of when
it's applied is based on what Dr. Engle and Dr. Fisher
have evaluated? 11:25AM
A As well as information that John Elrod provided as
we were touring around the watershed.
Q Is verbal information from him?
A Yes.
Q Do you know how much poultry litter is produced in 11:25AM

the IRW? 11:25AM
A I don't recall.
Q Okay. Would that be based on work that other
people have done in this case?
A Yes. 11:25AM
Q Okay. Do you know where poultry litter is
applied, that is, in relationship to the barn where
it's generated?
A From what I've read, my understanding is that it's
typically applied locally so that it's applied, you 11:25AM
know, within a few miles in most cases, of where it's
produced.
Q Did you do any independent evaluation of that
particular circumstance?
A No. 11:26AM
Q Did you observe any runoff from fields when you
were in the IRW?
A No.
Q Did you have any information concerning runoff
from fields where poultry litter has been applied? 11:26AM
A No, just the information that I've read in other's
reports.
Q And maybe perhaps published reports also?
A Yes.
Q Okay. Did you or anyone on your QEA team do any 11:26AM

field investigations of the IRW? 11:26AM
A Yes.
Q Okay. What field investigations did you employ?
A Margaret Murphy is participating in an
investigation of habitat in the IRW, fish habitat. 11:27AM
Q Is that going on right now?
A Yes.
Q Okay. And what work is being performed in that
regard?
MR. TODD: Object to the question. Can we 11:27AM
just stop a minute, for just a second off the record?
MR. PAGE: Sure.
(Whereupon, a discussion was held off
the record.)
Q Do you want the question re-read to you when we 11:28AM
get started?
A Yes, please.
THE VIDEOGRAPHER: We are back on the record.
The time is 11:28 a.m.
(Whereupon, the court reporter read 11:28AM
back the previous question.)
MR. TODD: Object to the question and
instruct the witness not to answer because the work in
question goes to our report that has not been produced
to the plaintiffs and once it is, and the report is 11:29AM

from Dr. Chadwick, and once it is, then you will have 11:29AM
the opportunity to do whatever discovery you want to on
the basis of that report. But I think for right now
that's still privileged work product.
MR. PAGE: Well, my problem is is that 11:29AM
unbeknownst to me we have someone from Dr. Connolly's
group working on that. I understood it was going to be
Dr. Chadwick's report and so my opportunity to
Dr. Connolly about that work is right now.
MR. TODD: Well, to the extent that 11:29AM
Dr. Connolly's group supports that, you can attempt to
do whatever discovery you think is appropriate once you
get the report. And, you know, if you feel the need to
seek another deposition then, you know, we can talk
about that then, but right now that work is privileged 11:29AM
and confidential and hasn't been produced to you yet,
the questions are inappropriate.
MR. PAGE: So you're instructing the witness
not to answer the question?
MR. TODD: I am instructing the witness not 11:30AM
to answer that question.
Q Are there any other investigations, other than the one that is currently going on, concerning fish habitat in the IRW?
A No. 11:30AM

Q So there are no other sampling or field work 11:30AM performed other than this one this spring you're aware of?
A Correct.
Q Okay. Did you want to perform any of your own 11:30AM investigations as part of your work?
A No.
Q Why not?
A After spending considerable time reviewing all of
existing data and the time line for the project, we 11:30AM
determined that we had sufficient information to do the
analysis we planned on doing and didn't need to go out
and collect additional data.
Q Did you -- have you performed any independent evaluation as to sources of contamination in the IRW, 11:31AM either nutrient or bacterial?
A Yes.
Q Okay. That's reflected in your report?
A Yes.
Q Have you worked with any other environmental data 11:31AM sets where nonpoint sources are significant contributors to surface water pollution?
A That would be the data set for Lake Erie that we
had been talking about earlier.
Q Any others? 11:31AM

A Not that I remember. 11:31AM
Q What about nonpoint sources being a significant contributor to groundwater pollution, have you worked with any other data sets?
A No. 11:32AM
Q Were you given any assignments or objectives when you undertook your evaluation? I know you said initially when you were retained you didn't have any objectives, did that ever change where you've got assignments or an objective given to you for your work? 11:32AM
A Yes.
Q When did that occur?
A There was a meeting in Fayetteville in probably
spring 2008.
Q Okay. 11:32AM
A At which we discussed, you know, the type of
analysis that would make sense to pursue. And, you
know, the overall objective of this was to evaluate the
plaintiff's case and to do independent analysis of what
our view was of the sources of -- backup -- of the 11:33AM
water quality in the system and then the sources of
nutrients and bacteria that would be affecting that
water quality.
Q And were you given any -- you and your group given a particular assignment or objective? 11:33AM

A In that -- the way that meeting went, it was 11:33AM
more -- after having looked at the plaintiff's reports
and having a general understanding of the issues, I
volunteered where I thought, given our expertise, it
would make sense for us to work, so rather than getting 11:33AM
instructions of what to do, I actually volunteered what
I thought made sense to do and everyone agreed and we
went forth and began to do that.
Q So those areas you volunteered for are the areas that are reflected in your report? 11:34AM
A Yes.
Q Have you been paid for your work?
A Yes.
Q And what's the basis for your pay?
A The basis are, you know, invoices submitted based 11:34AM
on hours, hours worked.
Q What is your hourly rate?
A My hourly rate is $348 an hour.
Q And how much total has QEA been paid for its work in this case? 11:34AM
A I don't know the precise amount, but I understand
that it's on the order of $1.4 million.
Q And who's paying you for your work?
A I actually don't know among the defendants how the
money flows. 11:35AM

Q Were you informed to retain all materials received 11:35AM or reviewed for your work?
A Yes.
Q Did you do that?
A Yes. 11:35AM
Q And have those materials been produced to the plaintiff in this case?
A It's my understanding.
Q You've provided it to counsel?
A Yes. 11:35AM
Q Okay. Did you produce all your e-mails and other communications with counsel?
A Yes.
Q What about with other communications with experts?
A Yes. 11:35AM
Q Did anyone review your report, that is, any of the other experts in the case?
A Not the final report, but work in progress.
Q Okay. And who reviewed your work in progress?
A As I -- that review was conducted as part of a 11:35AM WebEx where we display our -- the report and everyone participated in the WebEx and had an opportunity to discuss it. My recollection is is that Tim Sullivan was part of that.
Q Where he actually made comments? 11:36AM

A Yes. 11:36AM
Q So Mr. Sullivan. Do you recall anyone else?
A Alex Horn.
Q Anyone else?
A Jim Chadwick, Ron Jarman. And there may very well 11:36AM have been others, but those are the names that I recall.
Q Do you have previous drafts of your report?
A No.
Q Where are they? 11:37AM
A The way in which we operated was we have one version of the report. We had a common location where that version was kept and revisions were conducted on that version and things were just overwritten, so there was never a draft that was kept and memorialized, it 11:37AM was sort of a working copy that was continually revised.
Q Are there records of revisions in the computer?
A I don't believe so.
Q And you don't believe the computer has the records 11:37AM of the changes, and the date and time and who made them based on work station?
A I'm not familiar enough with -- you know, we weren't savings things so there wouldn't be files there. Whether or not, you know, in the bowels of the 11:37AM

computer there's something, but we were not saving 11:37AM intermediate copies, it was just one copy that was continually worked on.
Q Why not? Why don't you save any of the intermediate copies? 11:38AM
A There was really no reason to do that. This way of functioning provides great document control. Everyone is working on the same file so that there aren't multiple files around and confusion, particularly in this case because there was so many 11:38AM people working and people, you know, contributing that working with multiple versions of the report and one person working over here and another person simultaneously working over here and then somehow we would have to figure how to combine that and what was 11:38AM new, what was old. It just didn't make sense. This was a very efficient process to control document flow so we always understood that whenever you opened that document, it was the only version and the latest version of the document so it was just a very efficient 11:39AM process.
Q How did you keep track of what and who made changes to your report?
A That was through verbal communication and one of Jennifer Benaman's roles was to watch over the document 11:39AM

and understand who -- who was making changes and at 11:39AM what time.
Q Did everyone that you mentioned to me so far in the case who worked at QEA have access to modifications to the document? 11:39AM
A The -- everyone working on the case had access to the document. There were only a small subset of people who were actually involved in drafting text.
Q So Ms. Benaman would inform you if someone made a change to the document? 11:40AM
A Yes.
Q Were changes made prior to your approval?
A There were occasions where someone would make some draft changes and Jennifer would notify me of that and I would review them. 11:40AM
Q Tell me about Tim Sullivan's comment on your draft. What comments did he provide?
A I actually don't recall specific comments by anybody.
Q Do you remember the topics he commented on? 11:40AM
A I think he commented at various points throughout the report. I don't remember what in particular.
Q What about Alex Horn?
A Alex's focus in this case was largely the lake so his comments probably pertained to that part of the 11:40AM

report, but I don't remember specifically. 11:40AM
Q You don't remember any comments?
A No.
Q Did you make any changes based on either Mr. Sullivan's or Mr. Horn's comments to your report? 11:41AM
A Yes.
Q Do you recall whether any of them were substantive changes?
A My memory is that most of them were more editorial in nature than anything and in some cases, comments on 11:41AM figures and, you know, you might want to consider changing the way the figure looks because it's a little confusing to me and might be clearer if you, you know, took this out or added that.
Q What about Mr. Chadwick, did he make any comments 11:41AM on your report?
A Yes.
Q And do you recall what comment he made?
A I do not.
Q What about Mr. Jarman, do you have any of his 11:41AM comments?
A I do not.
Q Did any lawyers in the case make any comments on your report?
A Yes. 11:41AM

Q Which lawyers? 11:41AM
A As I recall, Scott McDaniel participated, Jay Jorgenson.
Q Anyone else?
A John Elrod. 11:42AM
Q Anyone else?
A I'm sure there were others, those are the ones I recall.
Q What were Mr. McDaniel's comments?
A I don't recall. 11:42AM
Q Mr. Jorgenson?
A Again, I don't recall.
Q Mr. Elrod?
A I don't recall.
Q You don't remember any of their comments? 11:42AM
A No.
Q Did you make any changes based on comments made by any of these lawyers?
A Yes.
Q You don't recall what the changes are? 11:42AM
A No, my general memory of it was largely editorial.
Q Did you make any comments on any other expert report in this case?
A Yes.
Q Whose? 11:42AM

A On Alex Horn's report. 11:42AM
Q Okay. Let's talk about what comments did you make on Dr. Horn's report?
A Again, I don't remember specifically.
Q Any other parties that you made comments on? 11:43AM
A Tim Sullivan.
Q What sections did you comment on Dr. Sullivan's report?
A On various sections throughout the report.
Q Do you recall any of the comments you made? 11:43AM
A No.
Q Did he make any changes in response comments?
A I don't know.
Q What about Dr. Horn, did he make any changes in response to your comments? 11:43AM
A Again, I don't know.
Q Anyone else?
A There was a gentleman named Bob Morrison who was involved early in the case.
Q What kind of work was he doing in the case? 11:44AM
A He was looking at soils in the watershed. That was his area of expertise.
Q Did you make comment on his report?
A Yes.
Q Did he issue a report in this case? 11:44AM

A I don't believe so. 11:44AM
Q What comments did you make on Mr. Morrison's report?
A Again, I don't recall.
Q Did you consider yourself a soil scientist? 11:44AM
A No.
Q Geologist?
A No.
Q Can we turn to Section 2.2 of your report, sir? Would you read the title of Section 2.2, please? 11:44AM
A "Naturally occurring phosphorus compounds, particularly dissolved inorganic phosphates available for algal growth are the only forms of phosphorus at issue in this case."
Q Are you suggesting by this title that total 11:45AM phosphorus is not important in this case?
A No.
Q Okay. Would you explain what you mean by your statement here, sir, in this section of the report?
A The first part of that title "Naturally occurring 11:45AM Phosphorus Compounds" is really what this is all about, trying to distinguish naturally occurring phosphorus components from, for example, elemental phosphorus and what we are really addressing here are phosphorus compounds, phosphate, and various forms, all of which 11:45AM

total up to total phosphorus as being what we are 11:45AM
concerned about here because of their potential to
cause algal growth.
Q Okay. So you're not suggesting that only
dissolved inorganic phosphates are the only important 11:46AM
phosphorus that's at issue in this case, are you?
A I am not.
Q So what you're really trying to do is distinguish
between elemental phosphorus and other types of
phosphorus that are found in the environment? 11:46AM
A Yes.
Q Is that what you mean by "naturally occurring"?
A Yes.
Q So would phosphorus that was found in poultry
litter be naturally occurring phosphorus? 11:46AM
A In the context of this discussion, yes.
Q In the first paragraph?
A Mm-hmm.
Q No, second paragraph, would you read the first
sentence, please, sir? 11:47AM
A "Dissolved inorganic phosphorus in lakes and
rivers originates from several places, mineralization
of the dissolved organic phosphorus dissolution of
particulate inorganic phosphorus or direct input from
an outside source, such as a wastewater treatment 11:47AM

plant. 11:47AM
Q Okay. Why did you select wastewater treatment
plant as a direct outside source?
A Because the vast majority of the phosphorus that
comes out of a wastewater treatment plant is dissolved 11:47AM
inorganic phosphorus.
Q Does poultry litter applied to land contribute
dissolved inorganic phosphorus to streams and rivers in
the IRW?
A In order for litter to contribute to the lakes and 11:47AM
rivers, dissolved inorganic phosphorus or otherwise
requires that a lot of transport processes that don't
need to occur with wastewater treatment plant --
wastewater treatment plant discharge directly, which is
why we use wastewater treatment plant here as the 11:48AM
example. Whether or not the poultry litter contributes
dissolved inorganic phosphorus is something that
requires a much more detailed examination because of
the pathways that have to occur before you actually can
get between where it's applied and the lake and river. 11:48AM
That wasn't the case for wastewater treatment plants,
it's easy, they put it right in, so that's why we wrote
it this way.
Q Would you restate the question, please?
(Whereupon, a discussion was held off 11:48AM

the record.) 11:48AM
Q You don't know if you can get my question back
prior to the answer? It was a long answer but a short
question, I think.
MR. TODD: If it was a short question you 11:48AM
should be able to remember it.
Q I should. I'll give it a shot. Does poultry
litter applied to lands in the IRW contribute dissolved
inorganic phosphorus to rivers and streams?
MR. TODD: Objection. You can answer. 11:49AM
A I have not seen evidence in the information that
I've looked at that that occurs.
Q Do you have an opinion one way or the other that
it does or does not contribute dissolved inorganic
phosphorus to rivers and streams in the IRW? 11:49AM
A I think as a general proposition you would think
that some phosphorus that comes from poultry litter
would make its way down. The question, I think, really
here is whether or not it happens in any substantive
amount. I mean, if we're talking about whether a 11:50AM
molecule makes its way down, as a general proposition
that's evident, I think.
Q Okay. Do you have an opinion as to whether or not
substantial or substantive, using your terminology,
contributed phosphorus in the IRW rivers and streams? 11:50AM

A I see no evidence in the data that we've looked at 11:50AM
that provides strong evidence that it does.
Q No evidence is your testimony, sir?
A Yes.
Q There's no evidence that poultry litter 11:50AM
contributes substantive amounts of phosphorus to IRW
streams and rivers?
A Yes.
Q That's your testimony?
A Yes. 11:50AM
Q Does it contribute any?
MR. TODD: Objection. Asked and answered.
A I -- as I said, you know, there is at least one
molecule and I think it's evident that it certainly
does that. 11:51AM
Q Why would you concede that it would contribute one
molecule but not more?
A I'm using one molecule as sort of an example. I
mean, it's obvious that something makes its way and
whether it's one molecule or a million molecules, what 11:51AM
matters in my view here is whether what it contributes
is substantive relative to the issues at hand at which
are effects on water quality, and so what I'm saying is
that the examination of the data that I've looked at.
I don't see evidence that poultry is having substantive 11:51AM

effects on water quality in this system. 11:51AM
Q Okay. So what is the basis for your statement? What's that basis for your underlying conclusion that it's not a substantive contributor of phosphorus in the IRW? 11:52AM
A The basis for that conclusion is, in essence, all of the analysis that went into this report, which I've concluded that water quality issues in the Illinois River and Lake Tenkiller are not extreme by any means. And that to the extent that there are water quality 11:52AM issues, the only evidence that I've seen that ties it back to a source, ties it back to wastewater treatment plants. That -- there are certainly non-point where phosphorus is coming into the system, but the nonpoint sources don't seem to be what's impacting water quality 11:52AM here, it appears to be that water quality is substantively impacted by wastewater treatment plant discharges of phosphorus.
Q Have you reviewed any USGS reports concerning contributions of nutrients to the IRW? 11:53AM
A Yes.
Q Do you recall that there's a report issued in 2004 that said between 83 and 90 percent of the phosphorus load to Lake Tenkiller is from nonpoint sources?
A Yes. 11:53AM

Q Given that, are you still willing to state that 11:53AM there's no evidence that land application of poultry litter is not an important or substantive form of phosphorus in this case?
A Again, I view substantive or important in terms of 11:53AM impact on water quality. And I acknowledge and agree that there is a significant amount of phosphorus that comes into this system associated with runoff. But the evidence, I think, supports that phosphorus that is really affecting water quality is not so much that 11:54AM phosphorus as the phosphorus that comes in every day after day from wastewater treatment plants.
Q Isn't it true, sir, that -- that the forms of runoff phosphorus includes dissolved inorganic phosphorus? 11:54AM
A Yes, that's true.
Q So how can you say that those are not important contributors to phosphorus in the rivers, streams, and lakes of the IRW?
A Largely based upon time and there are other 11:54AM factors as well, but during the growing season when we are going to grow algae in this case, the system is dominated by non-runoff days. The analysis that we've done suggests during the growing season, perhaps eight out of ten days are non-runoff days. And during those 11:55AM

eight out of ten days, what's coming down is the 11:55AM phosphorus that's not associated with runoff.
Q And what's the growing season of algae in your opinion, sir?
A We've looked at the growing season here as a 11:55AM summer season from May to September.
Q What's your basis for that?
A The basis for that is really that that is the period of time when you have substantive growth of algae. It's not meant to say that there's no algal 11:55AM growth in April or no algal growth in October, but what it is is to isolate the period of time where there is consistent algal growth year after year in this system. So it's not a hard and fast definition. Others could choose different definitions but that's the one we 11:56AM chose.
Q You will concede that there's algal growth in the IRW during the spring season, is that not true?
A Yes.
Q And during the spring season, the runoff would be 11:56AM the dominant source of phosphorus during that season, would it not?
A During certain times it would, but, again, in terms of growing algae, what matters is the type of phosphorus and the time available. Runoff events do 11:56AM

transport phosphorus. A lot of it is particulate. And 11:56AM under runoff events, the residence times is fairly short so -- and in a runoff event, phosphorus will come in, a large fraction of which will not be available for algal growth. And -- 11:56AM
Q What's your basis for that statement, sir? What all did you do to determine that a large portion of the runoff is not available for algal growth during a runoff event?
A By looking at how much of the phosphorus is 11:57AM particulate phosphorus.
Q How much is phosphorus?
A The phosphorus that's moving through the system under runoff conditions.
Q And what data did you look at to do that 11:57AM evaluation?
A We looked at data from the USGS principle and I believe also some data from the plaintiffs in this case.
Q Okay. And what is your basis for the: "There 11:57AM will be a short time that the phosphorus is available"?
A Under runoff conditions, the velocities in the river are increased so that water is moving rather quickly through and into the deeper parts of the reservoir. 11:57AM

Q Did you do a study as to the velocity and timing 11:57AM
in the spring season in the IRW?
A No.
Q So that's an assumption on your part that that
would just be a short residence time? 11:58AM
A It's more than an assumption. We did the analysis
under base flow conditions and so I have an
understanding of the time under base flow conditions.
I also --
Q That analysis was based on a median base flow, 11:58AM
correct?
A Yes.
Q So you didn't need that analysis, you didn't even
look at all the different potential flow schematics
under base flow, did you? 11:58AM
A No.
Q Did you do any analysis whatsoever as to the
residence time at flow under runoff conditions in the
IRW?
A Based on my experience and knowledge and the 11:58AM
information that we generated by the analysis that we
did, but I have a fairly good sense of what the
residence time would be, but no, I did not do a
specific analysis.
Q And is it true, sir, that even particulate 11:59AM

phosphorus will mineral -- let's say inorganic 11:59AM
phosphorus will mineralize and become available for
algae in rivers and streams?
A Yes.
Q So is it fair to ignore forms of phosphorus other 11:59AM
than dissolved inorganic phosphorus when you do
evaluation as to the affect on algae growth in rivers
and streams?
A I've not ignored anything here.
Q Okay. Let's look a little more detailed then in 11:59AM
your report. Did you evaluate -- did you evaluate the
forms of phosphorus that are in poultry litter?
A Not beyond looking at the information that was
generated and summarized in the plaintiff's records.
Q Okay. Does the data that was collected by CDM on 12:00PM
poultry litter indicate that there is water soluble
phosphorus in poultry litter?
A Yes.
Q Would that not be a potential source of dissolved
inorganic phosphorus in IRW streams? 12:00PM
MR. TODD: Object to the form.
A It would be a source.
Q In your opinion, Dr. Connolly, what is the best
way to indicate dissolved inorganic phosphorus
available to algal growth in streams and rivers? 12:01PM

A I don't follow your question. 12:01PM
Q Well, how does one -- what's the best way to
determine available phosphorus for algal growth in
streams and rivers?
A Are you asking me what measurement technique? 12:01PM
Q Yeah. What's the best way to measure?
A To measure what is termed soluble reactive
phosphorus.
Q No, no, I'm a little more broad than that. I'm
going to try to make a better question here. If we're 12:01PM
trying to determine whether or not there's phosphorus
available for algal growth in rivers and streams, what
is the best way to do that analysis?
A I believe it is to measure the soluble reactive
phosphorus. 12:02PM
Q Really? Have you studied any published papers on
evaluation of the best method to determine that
phosphorus in relationship to an algal growth in rivers
and streams?
A I've studied the literature on nutrients and algal 12:02PM
growth pretty extensively.
Q Okay.
A And I don't know that I characterize any articles
as the way you've described them.
Q Do you know of the work by Dr. Dodds at Kansas 12:02PM

State University? 12:02PM
A I don't recall.
Q Let's look at that. I'm going to hand you what's
marked Exhibit 2. Take your time to take a look at it.
And once you've had a chance to look at that, if you 12:03PM
would identify that document for the record, sir. Are
you familiar with this work, sir?
A No.
Q You've never seen it before?
A No. 12:08PM
Q Would you read for the record the title?
A "Develop nutrient targets to control benthic
chlorophyll levels in streams: A case study of the
Clark Fork River."
Q Are you familiar with Dr. Dodds, who is lead 12:08PM
author of this work?
A No.
Q Okay. Would you read the first two sentences in
the abstract, sir?
A "Approaches for assessing the effects of lowering 12:09PM
nutrients on periphyton biomass in streams and rivers
are poorly developed in contrast to those for lakes.
Here we present two complementary approaches to assess
target nutrient concentrations in streams, given
desired mean and maximum standing crops of benthic 12:09PM

algal chlorophyll." 12:09PM
Q Okay. What's benthic algal chlorophyll, sir?
A Essentially attached algae on the rocks in streams.
Q Would that include cladophora? 12:09PM
A Yes, it would.
Q Is cladophora one of the algal species that Dr. Stevenson evaluates as a nuisance algae in this system?
A Yes. 12:09PM
Q Okay. When was this article published?
A 1997.
Q Okay. Let's look at the introduction. Would you read the first sentence, please?
A "Eutrophication of most fresh waters is dependent 12:09PM upon supplies of nitrogen and phosphorus."
Q Do you agree with that, sir, that statement?
A Yes.
Q Okay. Are you familiar with the Vollenweider work that is cited there right after that statement? 12:10PM
A Yes.
Q Are you familiar with that model?
A Yes.
Q Would you read the next sentence, please?
A "In the case of lakes and reservoirs, a strong 12:10PM

quantitative framework has been developed over the past 12:10PM three decades that allows the prediction of algal biomass and other water quality parameters from nutrient loading and water quality concentrations."
Q Okay. And is it your understanding, sir, that -- 12:10PM that most limnologists when they look at phosphorus impacts in lakes and reservoirs they focus on total phosphorus?
A If you're doing a high level examination that is not particularly site specific, that's true. 12:10PM
Q You're saying that -- that it hasn't been site specific analysis, that a focus on total phosphorus as opposed to soluble reactive phosphorus for lakes and reservoirs?
MR. TODD: Object to form. 12:11PM
A No, I'm not saying that.
Q Would you read the next sentence, sir?
A "These tools are employed with great success in water quality management for lakes world wide."
Q Do you agree with that statement, sir? 12:11PM
A No.
Q You do not?
A No.
Q What is your basis for your disagreement?
A That they are -- they are useful tools to get a 12:11PM

sort of regional assessment of what levels of 12:11PM phosphorus will correlate more or less with what levels of chlorophyll, but they are much less useful to try to evaluate a site specific condition.
Q Well, this paper is on site specific condition 12:11PM evaluation, correct, Clark Fork River?
A Yes.
Q So let's see what this author concludes about which is more effective in determining benthic algal growth, SRP or Total P, okay? 12:12PM
A Mm-hmm.
Q That's the purpose of this study, is it not?
A It appears to be.
Q Let's go to the next page, 1739. The first column on the left he's talking about some different goals for 12:12PM this study. Would you read the second one that he mentions there and the third one?
A "Should total phosphorus and nitrogen be managed instead of dissolved inorganic nitrogen, DIN, and soluble reactive phosphorus when assessing potential 12:12PM algal density?"
Q Okay. So the objective of the report was to determine whether or not a better indicator of total benthic algae, this cladophora algae, is to focus on soluble reactive phosphorus as opposed to total 12:12PM

phosphorus, correct, sir? 12:12PM
A Yes.
Q Okay. Let's turn to the next page, please, under results where it says dissolved inorganic nutrient criteria? 12:13PM
A Yes.
Q Okay. Would you begin there about the second sentence down and read the next two sentences beginning with "general"?
A "General relationships between benthic chlorophyll 12:13PM and dissolved inorganic nutrients are characterized by extremely high variance. Seasonal mean values for SRP or DIN explain a very low proportion of the variance in observed chlorophyll-a."
Q Is the author stating by that that soluble 12:13PM reactive phosphorus is not a good indicator of the density of benthic algal growth in the study?
A Seasonal mean values certainly.
Q Would you go to the next column and begin reading at "thus"? 12:13PM
A "Thus, these data suggest that practical regulations for general external nutrient loading for stream eutrophication control should not be based upon instream SRP and DIN levels."
Q Would you continue, please? 12:14PM

A "Because the prediction uncertainty inherent in 12:14PM
such an approach may preclude the satisfactory
management of benthic chlorophyll-a."
Q So the author in this case concludes that SRP is
not a good indicator for algal effects in the Clark 12:14PM
River, correct?
A Yes.
Q Let's go down to Total N and P and see what the
author concludes with regard to Total N and P. Would
you read under that heading, sir? 12:14PM
A Starting with the first sentence?
Q Yes, under "another," yes?
A "Another question posed by Montana was should
instream Total P and N concentrations be managed
instead of DIN and SRP when assessing potential algal 12:14PM
biomass?"
Q Okay. Continue, please.
A "Our analysis revealed that both Total N and Total
P are related more strongly with benthic algal biomass
than are dissolved inorganic N or P." 12:15PM
Q So does this indicate for this site specific study
that Total P is a better indicator of benthic algal
biomass than SRP?
A That's certainly what the author said.
Q Okay. Do you have any reason to doubt his 12:15PM

conclusions? 12:15PM
A I would have to spend a fair amount more time with
this article and his interpretation of the data to
determine whether I agree or disagree with his
conclusion. 12:15PM
Q Were some of the co-authors on this particular
paper from the United States EPA?
A The third author is from the USEPA Region 8.
Q Okay. Let's go to the discussion section on 1744.
Would you read underneath "discussion," sir, beginning 12:15PM
with "the poor correspondence"?
A "The poor correspondence between levels of algal
biomass and DIN and SRP seen in Figures 2A and B is a
direct consequence of the biotic processes that control
upstream concentrations of DIN and SRP." 12:16PM
Q Continue, please.
A "At any given time, the concentrations of
dissolved inorganic nutrients are determined by the
balance between uptake and regeneration,
remineralization in parenthesis, which acts 12:16PM
simultaneously to control dissolved nutrients at
approximately equilibrium levels and are very resistant
to perturbations."
Q Continue.
A "Dissolved inorganic nutrients are also poorly 12:16PM

correlated with the biomass or activity of algae in 12:16PM
lakes. Lake managers use TP rather than SRP to make
recommendations for target chlorophyll levels."
Q Okay. So what is the author suggesting by this
statement you just read? 12:17PM
A He's suggesting that he believes that Total P is a
better indicator than SRP.
Q Would you read the bottom paragraph, please, sir,
where it says "the most parsimonious"?
A "The most parsimonious" -- 12:17PM
Q Thank you.
A -- "explanation for the stronger relationship
observed here between chlorophyll-a and TN and TP is
that instream TN and TP concentrations are more
indicative of the nutrients that will ultimately -- 12:17PM
that are ultimately biologically available for benthic
algal growth first" -- I'm sorry -- "than are DIN and
SRP."
Q Do you agree with that statement, sir?
A It's situation specific, so I don't agree with 12:18PM
that as a general theorem, for example.
Q Can you identify any published literature that
suggests that you use SRP as opposed to total
phosphorus to determine benthic algal growth in rivers
and streams? 12:18PM

A My belief is that to determine benthic algal 12:18PM
growth in rivers or streams is a very site specific
evaluation that requires your considering multiple
factors and that the simple use of SRP or TP will give
you a very poor evaluation of benthic algae. 12:18PM
Q I'm going to move to strike because you weren't
responsive. I asked you if you were aware of any
published papers that recommend the use of SRP as
opposed to TP to determine a benthic algal growth in
rivers and streams. 12:19PM
MR. ELROD: Object to form.
A I am not aware of articles that advocate using SRP
nor would I advocate using SRP.
Q Let's take a break for lunch.
THE VIDEOGRAPHER: We are now off the record. 12:19PM
The time is 12:19 p.m.
(Following a lunch recess, proceedings
continued on the record.)
THE VIDEOGRAPHER: We are back on the record.
The time is 1:19 p.m. 1:18PM
Q Dr. Connolly, let me hand you what's been marked
as Exhibit 3 and again ask you whether you've ever seen
that document before.
A No.
Q Okay. Would you read the title into the record, 1:19PM

please? 1:19PM
A Misuse of Inorganic N and Soluble P Concentrations To Indicate Nutrient Status Of Surface Waters."
Q Who is the author?
A Walter Dodds. 1:19PM
Q Okay. And where is it published?
A The Journal of the North American Benthological Society.
Q Are you familiar with that journal?
A Yes. 1:19PM
Q Does it have a good reputation?
A Yes.
Q Would you read this -- so we all understand what he's doing here, would you read the first two sentences of the abstract, please? 1:19PM
A "Dissolved inorganic N (DIN) and soluble reactive P (SRP) have been used by some to indicate the trophic status of waters, concentration ratios (DIN to SRP) to indicate nutrient deficiency."
Q Continue, please. 1:20PM
A "The utility of such measurements should be questioned, particularly based on well-known problems associated with determination of the concentrations of SRP, which is commonly assumed to be -- to represent phosphate." 1:20PM

Q Are you aware of any problems of the determination 1:20PM of the concentration of SRP by analytical methods?
A None that I recall.
Q Okay. Let's continue.
A "Another potential problem with the -- with using 1:20PM inorganic nutrient pools to represent trophic state and nutrient availability ratios arises because concentration values are in units of mass per unit volume, and cannot be used with certainty to estimate supply (i.e., turnover rate of the nutrient pool, 1:21PM expressed either in mass per unit volume per unit time or simply as per unit time) to organisms without information on uptake and remineralization.
Q Are you aware of that concern with using inorganic SRP phosphorus to determine nutrient effects? 1:21PM
A What he's saying here is not unique to SRPs.
Q There's some importance with mineralization in determining whether or not there are sufficient nutrients for algal production, correct?
A My understanding is what he's saying here is that 1:21PM you have to understand nutrient turnover rates.
Q Right. Because if you just measured the reactive portion of the phosphorus and determine whether that has an impact on algae production, for example, it does not consider the potential for new reactive phosphorus 1:22PM

being formed in the system by mineralization, correct? 1:22PM
A Yes.
Q Okay. So are you aware of that issue, though, generally?
A Yes. 1:22PM
Q Okay. Would you continue, please?
A "Two data sets with lotic water column nutrient values were explored, a large, continental-scale data set with analyses and collections done by many laboratories, and a more limited data set conducted and 1:22PM analyzed by the same laboratory."
Q Continue, please.
A "In concert, the data sets indicated that at high Total N (i.e. greater than five milligrams per liter) and Total P (i.e. greater than two milligrams per 1:22PM liter) concentrations greater than 60 percent of the nutrient is usually made up of dissolved inorganic forms, but at low levels the ratio of dissolved inorganic to total nutrients is highly variable. Last, DIN to SRP ratio is a weak surrogate for TN to TP, 1:22PM Total N to Total Phosphorus, and thus should be used with caution to indicate nutrient limitation."
Q Okay. So looks like Dr. Dodds here in this case looked at a couple of very large data set across the United States and the smaller data set to do his 1:23PM

evaluations in this case, correct? 1:23PM
A Yes.
Q Okay. Let's read the first paragraph in the -- first sentence in that first paragraph, sir.
A "Nutrients such an N and P are required for 1:23PM organisms and can control ecosystem production."
Q Do you agree or disagree with that statement, sir?
A Yes, I agree.
Q Okay. Would you continue?
A "The most commonly limiting nutrients in fresh 1:23PM water are N and P."
Q Do you agree with that statement?
A Yes.
Q Do you agree that in the IRW phosphorus is a limiting nutrient? 1:24PM
A I agree that it is a limiting nutrient.
Q Okay. I notice in the footnote two on Page 2-2 of your report you state, "It's generally accepted that phosphorus is the nutrient controlling eutrophication in the system, therefore, the focus of my report is on 1:24PM phosphorus."
A Mm-hmm.
Q Could you explain that statement, sir?
A A number of the plaintiff's consultants have looked at the issue of whether phosphorus or nitrogen 1:24PM

is limiting algal growth and have concluded that more 1:24PM
often than not phosphorus is limiting algal growth.
Q Do you agree with their conclusions?
A Yes.
Q For the lake, also? 1:24PM
A Yes.
Q Would you read the next statement, sir, where it starts "measurements"?
A "Measurements of Total N and Total P are useful
for determining trophic state because they present the 1:25PM
total nutrient content actually in biomass or available
for incorporation into active biomass."
Q Do you agree with that statement, sir?
A No.
Q You disagree with that? 1:25PM
A Yes.
Q What is your basis for your disagreement?
A There are forms of phosphorus and nitrogen that
will not mineralize to biologically available forms.
Q Okay. What form is that? 1:25PM
A So, for example, for phosphorus there are mineral
forms of phosphorus, calcium phosphate, iron phosphate,
aluminum phosphate molecules that are pretty
recalcitrant and so don't contribute significantly to
the bioavailable pools. 1:26PM

Q Okay. Will they, though, in the right 1:26PM circumstances contribute?
A I suppose there are some circumstances under which
you may get some contribution, but in general they're
typically not important. 1:26PM
Q Okay. Can poultry litter, are those significant, those forms you just mentioned a significant portion of the total phosphorus?
A Probably not.
Q Would you look over -- the next column over, sir, 1:26PM where he says "My paper considers"? Would you read that, please?
A "My paper considers how useful common measurements
of DIN and SRP may be for indicating trophic state and
nutrient limitation (i.e. can DIN and SRP values serve 1:27PM
as surrogates for TN and TP?).
Q Does it appear that Dr. Dodds is trying to determine which is the best methodology to determine whether nutrients are sufficient to cause increased productivity in rivers and streams? 1:27PM
A I don't think so.
Q Okay. Do you think he's trying to see whether or not it's more appropriate to use total phosphorus versus soil (sic) reactive phosphorus in determining whether or not a stream will be productive? 1:27PM

A I think you meant to say soluble reactive 1:27PM
phosphorus.
Q Yes, sir. What did I say?
A Soil reactive phosphorus.
Q Sorry. 1:27PM
A He's attempting to determine whether the inorganic
forms or the total forms are better indicators of
trophic state and nutrient limitation.
Q And trophic state really is a function of productivity, correct? 1:28PM
A Yes.
Q As algal production, for example, in a particular water body?
A Yes.
Q Okay. Let's turn to the next page, sir. Would 1:28PM you begin reading where it says "Researchers commonly" in the second paragraph down?
A "Researchers commonly include dissolved inorganic
nutrient values (example SRP or DIN) to characterize
nutrients at a site. These kinds of data can only 1:28PM
provide limited information about system
characteristics because inorganic nutrients can be
under high demand and turn over rapidly (i.e. the
pattern does not necessarily describe process).
Q Do you agree with that statement, sir? 1:29PM

A Yes. 1:29PM
Q So does that mean that you could go to a water body and find low levels of SRP that's very, very productive?
A If you're talking about at an instant in time, I 1:29PM
would agree.
Q All right. And in most sample regimes you're just measuring a particular instant in time and space, correct?
A Yes. 1:29PM
Q And is the fact that you could have low SRP in the water because the algae used it all and produced a lot of algae, is that correct?
A Yes.
Q And so if you were doing an SRP analysis of that 1:29PM particular water body at that time and space, you'd have a very productive system but have very low levels of SRP, correct?
A Yes.
Q And so then the level of the SRP would not 1:30PM necessarily explain the activity -- the large activity of the productivity of that particular stream at that time and place, correct?
A Yes.
Q Okay. In those circumstances, would total 1:30PM

phosphorus be a better measure because total phosphorus 1:30PM
would dissolve and account for the phosphorus that's
also in the algae that's part of the water sample so it
would account for the phosphorus that has been used by
the algae in that system? 1:30PM
A Can I have that question read back?
Q Let me try to say it again because I think it was
kind of confusing. What I'm trying to say is that: If
you have a particular system where you have a lot of
algae, if you do total phosphorus on that particular 1:30PM
sample would the phosphorus that's contained in the
algae be accounted for?
A Yes.
Q So in those circumstances would you agree that
total phosphorus is a better measure of productivity 1:30PM
for that stream than SRP?
A In that circumstance, yes.
Q Can we continue, please? I think right after the
parenthetical.
A "Thus, even though concentrations may be low, 1:31PM
supply may be high."
Q And that was kind of the example I've just given
there as an example of how that could occur?
A Yes.
Q Please continue. 1:31PM

A "It is well documented that nutrient regeneration 1:31PM
supplies nutrients as they are removed by biota, and
the balance between uptake and remineralization rates
determines actual concentrations of inorganic
nutrients." 1:31PM
Q Do you agree with that statement, sir?
A Not entirely.
Q Is there something -- does that statement relate
to the equilibrium that will be achieved in a
particular water body as soluble reactive phosphorus is 1:32PM
removed and there's available, let's say, inorganic
phosphorus in the system?
A It may be saying that but I don't agree with that.
Q You don't think that's a function that you see in
the environment? 1:32PM
A No.
Q Do your models that you've worked with have
coefficients that account for that process?
A Yes.
Q So why would you -- if models account for that 1:32PM
process and they include them in their analysis, why
would you say that that wouldn't be a process you would
observe in the environment?
A As you've characterized this as sort of a -- I
think you used the term "equilibrium," the nutrient 1:32PM

dynamics are rarely, if ever, at equilibrium and this 1:33PM
statement also ignores the external supply of nutrient.
It seems to reduce the world to either the nutrients
are being taken up by biota or they're being
regenerated and that is a subset of factors that are 1:33PM
controlling nutrient concentrations.
Q You do agree that those -- both those processes
are typically found in a water system?
A Yes.
Q And then if you just sample for SRP you will not 1:33PM
be accounting for the mineralization potential of new
phosphorus being added by the mineralization process,
correct?
A Correct.
Q Would you continue on then after the citation 1:33PM
there to Dodds?
A "Low dissolved inorganic concentrations could mean
high turnover related to high remineralization and
uptake rates and the system could be very productive."
Q Do you agree with that statement, sir? 1:34PM
A Yes. "Alternatively" --
Q Okay. Can we skip -- I'm not going to have you
read the whole paper --
A Thank you.
Q -- but I will try to pick a few more pages. Let's 1:34PM

skip one sentence and go to the first sentence, next 1:34PM
paragraph.
A "A problem more specific to inorganic P
measurement is the uncertainty of what SRP values
represent." 1:34PM
Q Continue, please.
A "These problems could complicate using SRP as a
surrogate for TP as well as the use of DIN to SRP ratio
to indicate N or P limitation."
Q Okay. Would you read the last sentence there? 1:34PM
A "Colorimetric assays are most often used for
determination of SRP."
Q Okay.
A "It has been known for more than 35 years that SRP
assays do not measure only phosphate." 1:35PM
Q Okay. Do you agree or disagree with that
statement concerning the accuracy of measurements of
SRP?
A I agree with that.
Q So there may be other available -- is Dr. Dodds 1:35PM
stating there that there -- the measurement for SRP may
not be actually measuring all of the bioavailable
phosphorus that's present in a water sample?
A That's not how I read it.
Q How did you read that, sir? 1:35PM

A That in addition to measuring phosphate, which is 1:35PM
a form readily taken up by algae, there may be other
forms of phosphorus that are measured in the SRP test.
Q Okay. The column over, almost the same location,
the right-hand column, the same page where it starts, 1:36PM
"It could be argued." New paragraph there towards the
bottom?
A Yes.
Q Would you read the first two sentences, please?
A "It could be argued that SRP is ultimately 1:36PM
biologically available so measuring it is useful.
However, most organic P and polyphosphates are also
biologically available."
Q Do you agree with that statement, sir?
A No. 1:36PM
Q Why not?
A Because some forms of organic P and some very
simple forms of polyphosphates may be bioavailable. I
don't degree that most organic phosphorus
polyphosphates are necessarily biologically available. 1:36PM
Q And what is your basis for that understanding?
A Just my general knowledge of the field.
Q You're not a biologist, are you, sir?
A No.
Q Okay. Let's skip over a couple pages to the 1:37PM

discussion section on Page 176. Under the discussion 1:37PM
would you begin reading following the topic discussion?
A "Are SRP and DIN measurements useful for
determining trophic state? Trophic state or nutrient
demand cannot be determined solely from inorganic 1:37PM
nutrient concentrations when dissolved inorganic
nutrient values are low."
Q Do you agree with that statement, sir?
A Yes.
Q Okay. Continue. 1:37PM
A "Concentrations cannot indicate supply because a
large biomass of produce may have a very high nutrient
demand and render inorganic nutrient concentrations low
or below detection."
Q Do you agree with that, sir? 1:38PM
A Yes.
Q We've already talked about that. Let's go to the
next page, Page 177. The right-hand column where it
starts "the ineffectiveness." Would you read that,
please, sir? 1:38PM
A "The ineffectiveness of using dissolved organic
(sic) nutrient concentrations" --
Q Inorganic, sir?
A -- "dissolved inorganic nutrient concentrations to
make predictions about trophic state is supported by 1:38PM

both lake and river data." 1:38PM
Q Do you agree with that statement, sir?
A Yes.
Q Okay. Continue.
A "Dissolved inorganic nutrients are not as strongly 1:38PM
correlated with benthic algal biomass across a variety
of streams as are TN or TP."
Q Do you agree with that statement, sir?
A Not necessarily. He's referring back to his own
publication, I believe, the one that we've already 1:39PM
looked at and I would have to look at that much more
carefully before I would determine whether I agree with
that statement or not.
Q Would you continue, sir?
A "Likewise, classification of trophic state in 1:39PM
lakes and eutrophication management generally focus on
total nitrogen and total phosphorus in the water
column, not dissolved inorganic nitrogen and soluble
reactive phosphorus because dissolved inorganic
nitrogen and soluble reactive phosphorus are not able 1:39PM
to predict algal biomass as accurately."
Q Do you agree with that statement, sir?
A Yes.
Q So would you agree, sir, that total phosphorus is
an important constituent to be evaluated in our IRW 1:39PM

study? 1:39PM
A Yes.
Q So when you stated in your topic of your -- of
your Section 2.2, I might have misinterpreted this, for
algal growth are the only forms of phosphorus at issue 1:40PM
in this case, were you trying to state or imply that
only dissolved inorganic phosphates available for algal
growth are the only forms of phosphorus at issue in
this case?
A No. 1:40PM
Q So would you strike the word only?
A No, I think as I read it and the way that I meant
it when I wrote it it's natural. Take out the phrase
between the comments "naturally occurring phosphorus
compounds are the only forms of phosphorus at issue in 1:40PM
this case."
Q Okay.
A Particularly dissolved inorganic phosphate but
that doesn't exclude the other forms of phosphorus.
Q Okay. Let's go to Section 2.3. The title there 1:40PM
is, "There are many contributors of phosphorus to the
Illinois River and Lake Tenkiller," correct?
A Yes.
Q What do you mean by "there are many contributors"?
A That this watershed has many potential sources of 1:41PM

phosphorus that include, as I go through here, various 1:41PM
point and nonpoint sources.
Q So in this case are you looking at just soluble reactive phosphorus or total phosphorus?
A Total phosphorus. 1:41PM
Q Okay. You have a diagnosis Figure 2.2. Is that your site conceptual model, so to speak?
A I wouldn't characterize this as a site conceptual model. It's more or less just a simple illustration of sources and migration pathways. 1:42PM
Q Okay. And in what non-point source -- sources do you illustrate on this figure?
A Manure, poultry litter and fertilizer. Above that, surface runoff carrying particulate dissolved P that doesn't seem to show any particular source, but is 1:42PM meant to represent naturally occurring soil sources so soil in the watershed.
Q Would that also include particulate and dissolved P from manure, poultry litter, and fertilizer?
A Yeah. 1:43PM
Q Okay. So those sources would be both interflow and surface flow?
A They show that they could potentially be.
Q Is that a reasonable assumption?
A It is a reasonable assumption that some of these 1:43PM

sources would begin to migrate and interflow. Whether 1:43PM
that results in things making their way here to the water body isn't really shown by this. It's more that this is a, as the title indicates, a possible source so interflow is a potential pathway. 1:43PM
Q So based on your experience, it's reasonable for us to propose that things that are put on the land will transport to surface water across the land surface, correct?
A Or can transport. 1:44PM
Q Yeah. And would those -- also those things could also transport through the ground into groundwaters and then eventually into surface waters, correct?
A Potentially, yes.
Q Did you do any studies yourself to determine 1:44PM whether this actually exists in the IRW?
A Whether there is interflow in the IRW?
Q Yes.
A No, I did no particular study on interflow there.
Q Did you do any studies on transport over land in 1:44PM the IRW?
A No.
Q Are you aware of the geology in the IRW?
A In general terms.
Q What is it? 1:45PM

A That it is a karst-type environment. 1:45PM
Q Does a karst environment facilitate groundwater flow through a geological system?
A I don't know if I would use the term "facilitate." I think I would say that interflow and groundwater flow 1:45PM may be higher in a karst environment than other geological formations.
Q And why is that, Dr. Connolly?
A Because of the formation in the karst soil of preferential pathways for transport. 1:45PM
Q Did you read Dr. Fisher's report when he discusses that phenomenon in the IRW?
A Yes.
Q Do you have any reason to believe Dr. Fisher is not correct in that regard? 1:46PM
A I read it quickly and didn't attempt to review it. It's really not my area of expertise so I don't have an opinion one way or the other.
Q Okay. Let's go back to Page 2-3 of your report, sir. Halfway down the first paragraph it says, correct 1:46PM me if I'm wrong, but does your report state both point and non-point sources exist as illustrated in the conceptual diagram Figure 2.2? Did I read that correctly?
A Yes, you did. 1:46PM

Q And we just discussed the diagram, did we not? 1:46PM
A Yes.
Q I'll continue, "Livestock and application of commercial fertilizers are significant." What do you mean by that statement, sir? 1:46PM
A That they are significant as potential sources of phosphorus.
Q Does that mean by using the term we talked about a few minutes ago that they are substantial?
A That they are potential sources that could be 1:47PM significant. I did no analysis to determine the absolute contribution of this.
Q I notice you did not include poultry litter application as a significant source. Was that an oversight or do you believe that they're 1:47PM distinguishable in some respect?
A I don't believe I meant here to indicate that they are distinguishable in some particular way and so I think it sort of is buried in the term "livestock."
Q Okay. So you would include within the term 1:47PM "livestock," poultry litter application in your sentence "livestock and the application of commercial fertilizers are significant."
A As the -- let me back up here. Are significant as potential sources. I just want to make sure that 1:48PM

that's clear, not necessarily that we've determined 1:48PM
that they are significant sources because at this point
we -- in the report I'm talking about potential sources
and they are significant as potential sources.
Q Okay. And you also mentioned population growth? 1:48PM
A Mm-hmm.
Q And deforestation, do you not?
A Yes.
Q And urbanization?
A Yes. 1:48PM
Q Have you done any evaluation of the relationship between population growth in the IRW and phosphorus loading into Lake Tenkiller?
A Only through the work of Ron Jarman where we use
his estimates over time of phosphorus loading from -- 1:48PM
Q Are you aware of a USGS study that determined that there was an inverse relationship between population growth in the IRW and phosphorus loadings between the years 1993 and 2004.
A I don't recall that. 1:49PM
Q Okay. You mentioned that deforestation then, that paragraph in the next paragraph. What is your basis -- are you suggesting that deforestation is a significant source of phosphorus in the IRW?
A At this point, no. Again, this entire section is 1:49PM

very much conceptual in nature and talking about, in a 1:49PM
general sense, potential sources of phosphorus.
Q Well, at some other point or as we sit here today, are you suggesting that deforestation is a significant source of phosphorus into the rivers and streams and 1:49PM lake of the IRW?
A I'm not suggesting one way or the other that they
are or aren't.
Q What about same question for livestock?
A At this point, not suggesting one way or the 1:50PM
other.
Q So you've haven't formed an opinion either way in that regard?
A In terms of their contribution to the total load,
no. 1:50PM
Q And what about with regard to commercial fertilizer?
A Same answer.
Q Okay. Do you know whether or not -- well, let me strike that. 1:50PM
If deforestation contributed phosphorus to this system, would you expect that phosphorus to be in a SRP form or soluble reactive phosphorus form?
A Not initially.
Q But you would believe that it could then -- that 1:51PM

runoff could then be mineralized and become available 1:51PM phosphorus in the system?
A Some portion of it.
Q Would you expect there to be any difference in the process for runoff of organic phosphorus that's in 1:51PM poultry litter?
A I take it from your question that you are asking
me whether some portion of the phosphorus in poultry
litter could be mineralized to biologically available
phosphorus? 1:51PM
Q Yeah, the same way if there was some inorganic phosphorus due to deforestation runoff?
A Yes, yes.
Q You expect the same process to occur?
A Yes. 1:52PM
Q Did you do any studies or evaluations, sir, to determine what the relative contribution would be of these different sources we've discussed here in Section 2.3?
A No. 1:52PM
Q Did you review any mass balance analysis?
A No.
Q Could mass balance analysis of phosphorus in the IRW provide some evidence of source?
MR. TODD: Objection. 1:52PM

A Not in and of itself. 1:52PM
Q Not by itself, but would it be part of the weight of evidence analysis that you could employ to determine sources of phosphorus in the IRW?
A I think it's a requirement to have some sense of 1:53PM
what the potential sources are, but a mass balance in
and of itself doesn't tell you anything about whether
that source has a high or low potential to contribute
to the phosphorus in the river and the lake.
Q Are you aware of mass balance studies being 1:53PM performed to determine sources -- as evidence to determine sources of constituents in a water system?
A Yes.
Q Have you employed them yourself?
A Certain types of mass balances, yes. 1:54PM
Q So not by themselves, but in conjunction with other evidence are they probative to determine whether or not the sources that are identified in the mass balance are contributors of that constituent to the water system? 1:54PM
A I'm not sure how to answer that because I'm not --
I'm not sure when we talk about mass balance that you
and I are talking about the same thing.
Q How do you define mass balance?
A I would define mass balance by measuring the 1:54PM

sources entering the water body so it would be 1:54PM
measurements of what is entering the Illinois River or
what is entering Lake Tenkiller or what is leaving Lake
Tenkiller.
Q Okay. 1:54PM
A That's the type of mass balance that I've done and
would use to try to evaluate potential sources.
Q Okay. Have you ever seen mass balances performed on environmental systems when looking at sources of a constituent into the watershed? 1:55PM
A Yes, I have.
Q Okay. They've been used to identify sources of constituents in water of that watershed?
A I don't think that's a valid use of that type of
mass balance. 1:55PM
Q You've never seen published papers that have used mass balance in that regard?
A I've not paid a whole lot of attention to that
because I find that information, in and of itself, not
all that helpful. 1:55PM
Q Why not?
A Because what really matters is the availability of
phosphorus and not simply whether phosphorus comes into
a watershed or not. This, to give you an analogy,
there's a lot of -- there's a lot of gold that comes 1:56PM

into Fort Knox, does that run off so that people should 1:56PM
be panning for gold outside of Fort Knox? Well, that
depends on what happens to the gold that went into Fort
Knox and you wouldn't want to spend your time panning
for gold unless you knew that that gold was available. 1:56PM
Q Well, let's look at maybe a different analogy that may be more, perhaps, realistic to what's going on in the IRW. If phosphorus is imported in poultry feed and then some portion of that phosphorus passes through the poultry and gets into the waste, and that waste then is 1:56PM put out on the ground it's susceptible to the elements, would that be -- a mass balance of that type be helpful in determining whether or not phosphorus is entering the watershed water bodies?
A It would be helpful in understanding whether 1:56PM
phosphorus was entering the watershed. It would not be
all that helpful about whether phosphorus is entering
the water bodies.
Q So you don't think it's reasonable to conclude that there's 354,000 tons of poultry waste put on the 1:57PM water, that some fair proportion of that is carrying phosphorus to the water bodies in the watershed?
MR. TODD: Object to form.
MR. ELROD: You said to the water bodies.
MR. PAGE: Did I? 1:57PM

MR. ELROD: Yeah. 1:57PM
MR. PAGE: Let me try it again. Thank you.
MR. ELROD: You're welcome.
MR. PAGE: Any constructive objections are
always welcome. 1:57PM
Q Is it your opinion, sir, that if there's 354,000 tons of poultry waste generated in the IRW and that's spread out on the land, that very little of that phosphorus would be traveling into the rivers and streams? 1:57PM
MR. TODD: Object to the form.
A What I'm saying is that that information tells me
nothing about phosphorus getting into the water. It
tells me that phosphorus has come into the watershed,
yes, phosphorus is being applied on the land, but 1:58PM
without a lot more work, it hasn't told me anything
about whether that phosphorus -- or how much of that
phosphorus gets into the waters.
Q In your mind, do you conceive of these pastures where the phosphorus -- the litter is being applied is 1:58PM like little Fort Knoxes that keeps all the phosphorus contained right in that field?
MR. TODD: Object to form.
A No.
Q Okay. Are you aware of any land that is not paved 1:58PM

or concrete where water would not run off in the IRW? 1:58PM
A Run off as surface runoff?
Q Yeah.
A That is a complex question because whether or not
you generated runoff depends on a whole number of 1:58PM
factors and you may, in fact, not generate any runoff
under certain conditions.
Q Yeah, but I mean I'm asking you: Can you identify any land in the IRW where there would -- under no circumstance would there ever be runoff? 1:59PM
A No.
Q That isn't reasonable, is it?
A Well, it's -- I would characterize it as unlikely.
I don't know whether there's a little bowl of land
where stuff never runs off out of that bowl. 1:59PM
Q What about for infiltration? Are you aware of any land in the IRW other than where there's been concrete or man made asphalts to put onto it where there wouldn't be infiltration?
A If it's a soil environment there would be 1:59PM
infiltration.
Q Do you have any understanding on how important non-point source flow is in rivers and streams in the IRW? That is, how much does infiltrating water add to the base flows of the IRW? 2:00PM

MR. TODD: Object to form. 2:00PM
A I'm not sure that I understand what you're asking me.
Q Is it your opinion, sir, that base flow in the IRW is solely from wastewater treatment plant discharges? 2:00PM
A No.
Q So you'll concede that a portion of the flow that's found in base flow of river and streams in the IRW comes from surfacing groundwater, so to speak, like in springs? 2:00PM
A Yes.
Q And is it plausible that that groundwater could contain particulate and dissolved constituents that are applied to land?
A It would likely contain very low amounts of 2:01PM particulate material because of the natural filtering capacity as water infiltrates the soils. So it may contain some dissolved constituents depending upon what was happening as it was traveling through the ground, but probably very little particulate. 2:01PM
Q Even in a karst system?
A In a karst system there may be some greater amount of particulate but it would still be relatively low.
Q Let me hand you what's been marked as Exhibit No. 4. And this is a page from Dr. Engle's report, who 2:02PM

did a mass balance of phosphorus in the Illinois River 2:02PM watershed. Have you seen this before, sir?
A I believe so.
Q Did you evaluate his -- him and Megan Smith's mass balance calculations? 2:02PM
A No.
Q Do you have any reason to believe that their calculations are not accurate?
A I have no opinion one way or the other.
Q How much phosphorus is shown that's contributed by 2:02PM poultry in this analysis?
A Seventy-six percent approximately.
Q This is just going into the IRW. Okay, it did remove any phosphorus that's in the flesh of chickens that are taken out, so presumably this phosphorus would 2:02PM represent what's in the manure. Do you believe that when we have a situation where you have three quarters of the phosphorus coming into the IRW and remaining there from poultry that would indicate that poultry would be a substantive contributor to phosphorus in the 2:03PM IRW waters?
MR. TODD: Object to form.
A No.
Q You don't believe that would have an indication on poultry's contribution? 2:03PM

A No. 2:03PM
Q Why not?
A As I stated before, this information says nothing about the extent to which this added phosphorus is making its way into the water. It also ignores the 2:03PM phosphorus that is not entering or leaving, but the phosphorus that is there in the soil to begin with. We have a million acres of land and there's phosphorus in all of that soil, and that's not part of this.
Q Did you evaluate background levels of phosphorus 2:04PM from this watershed?
A Yes.
Q And what are the levels?
A On the numbers on the order of about 300 parts per million would be a background phosphorus. 2:04PM
Q And did you do any calculations as to whether or not leaching from those soils would be a substantial contributor of phosphorus into the IRW rivers and streams?
A No. 2:04PM
Q Is litter -- is chicken/poultry litter a potential substantive source of phosphorus in the IRW rivers and streams?
MR. TODD: Objection, asked and answered.
A In the context of phosphorus in the watershed, you 2:05PM

can say that it is a potential source, but whether that 2:05PM potential realizes an actual source requires a whole lot of things that are not considered by any of this.
Q Did you evaluate any of the literature and CDM data that compared phosphorus in runoff of test plots 2:05PM and edge-of-field samples to what would be found in reference plots and lands in the IRW?
MR. TODD: Object to form.
A My memory of that work includes runoff from the fields that were purported to have had poultry litter 2:05PM applied and runoff from fields that were purported to have cattle on them. I don't remember edge-of-field samples from control plots.
Q Do you recall any literature that you reviewed, for example, Sauer -- 2:06PM
A Yes.
Q -- where it evaluated runoff from a controlled plot --
A Yes.
Q -- versus a plot where there had been poultry and 2:06PM cattle manure applied, right?
A Yes.
Q Okay. Did those studies, that is, evaluation of the edge-of-field data collected by CDM, as well as those published papers indicate that poultry litter, 2:06PM

when water is applied to it by rainfall, will have 2:06PM
phosphorus runoff in those fields?
A Under some conditions.
Q Okay. So if you added that kind of information to
the information that is in Exhibit 4, does that help 2:07PM
you understand the import of the amount of phosphorus
that's being imported into the IRW from poultry waste.
A No.
Q It doesn't. So you don't think that adds another
piece to the weight of evidence to determine that 2:07PM
phosphorus from poultry is significant?
MR. TODD: Object to form.
A It provides some information on phosphorus runoff
at the edge of a field but that still says nothing
about whether -- how much of that phosphorus ran off 2:07PM
versus what was applied and then how much of that
phosphorus actually makes it from that edge-of-field to
the Illinois River or Lake Tenkiller.
Q You mentioned looking at concentration gradients
as a probative method to determine whether or not 2:07PM
there's a source of a contaminant in a particular
system, correct?
A Yes.
Q Did you review concentration gradients from
poultry applied fields away from those fields to 2:08PM

MR. TODD: Object to form. 2:09PM
MR. BASSETT: Object to form.
A If one is making the argument that stuff moves
from a field to the Illinois River, one should be able
to, for at least one of those fields, trace that 2:09PM
pathway off of that field and sample that pathway.
Q So you believe there's a reference location in the
IRW that has no other influences by phosphorus other
than that particular field where you could do that
tracing? 2:10PM
MR. TODD: Object to form.
A What I'm saying is that if I were conducting the
study, I would insist on doing that. And to the extent
that I was not able to use that because there were
other sources of phosphorus that complicated that, that 2:10PM
would be information that would tell me that I could
not draw the conclusion that that field was
contributing phosphorus.
Q Let's look at some of the papers on phosphorus
runoff. Hand you what has been marked as Exhibit No. 2:10PM
5. Can you identify that for the record, sir?
A This appears to be table summarizing data
collected from edge-of-field and says poultry samples.
Q Okay.
A And then there are other sheets under here 2:11PM

determine whether or not poultry applied litter would 2:08PM
be a source of phosphorus in the IRW?
A No.
Q Did Dr. Olsen perform that analysis?
A Incorrectly. 2:08PM
Q Oh, incorrectly. How did he make a mistake?
A In order to do a gradient analysis, you need to
identify a specific pathway where you contract a parcel
of water from its point of origin to the Illinois River
and look at concentration gradients along that 2:08PM
individual pathway. And to my understanding, Dr. Olsen
did not do that.
Q And are you aware of any publication that says
that's the way you have to do concentration gradients?
A I'm aware that that is the only way to make an 2:08PM
informed determination.
Q And what is the basis for that statement, sir?
A The basis for that statement is the work that I've
been doing in this field for 30 years and methods that
have been applied to do that. 2:09PM
Q In this particular system, in the IRW where you've
had hundreds of thousands of tons of poultry waste
applied in just about every open pasture that's
available in the system, is that possible to do that
kind of an analysis? 2:09PM

summarizing data from apparently other sampling 2:11PM
programs.
Q Okay. And do you recognize this as being one of
the appendices from Dr. Olsen's report?
A It appears to be. 2:11PM
Q Okay. Would you look at the second page, sir? Do
you understand how edge-of-field samples were
collected?
A In general terms.
Q Okay. Do you understand that they were collected 2:11PM
from field runoff where poultry waste was known to have
been applied?
A I recognize that that was the objective. I have
not spent considerable time myself but others -- other
experts working on the case have informed me that they 2:11PM
believe in many cases the samples are not reflective of
runoff of fields where poultry was applied.
Q What's the basis for those statements, if you
know?
A The location at which samples were taken in many 2:12PM
cases did not appear to have a direct connection
necessarily to the field.
Q Okay. Let's look at the soluble and reactive
phosphorus. Does it show that there's -- these
edge-of-field samples show that there's soluble 2:12PM

reactive phosphorus in edge-of-field runoff collected 2:12PM
by CDM in this case?
A Yes.
Q Okay. What is the amount, the average amount
that's been identified? 2:12PM
A 3.75 and no units are given on this.
Q If you look a couple columns over?
A Okay. I'm sorry, a couple columns over and
milligrams per liter.
Q Would you expect that amount of SRP runoff from a 2:13PM
reference field in the IRW?
A No.
Q What about total phosphorus, what's the amount
that's run off there?
A There are several. 2:13PM
Q 4,500 method, 4,500 PF in total?
A Yes. The average there is 8.1 milligrams per
liter.
Q Would you expect that level of phosphorus runoff
from reference fields in the IRW? 2:13PM
A It would depend on the condition under which the
measurement was taken. If there were runoff that were
carrying with it a lot of solids, a reference field
could have numbers as high as this.
Q Do you know whether or not -- strike that. 2:13PM

What is the proportion of dissolved 2:14PM
reactive phosphorus to total phosphorus in these
edge-of-field runoffs?
A Approximately 25 percent is -- yeah,
three-eighths, about 30-some percent is soluble, right. 2:14PM
Q 3.75 to 8.13?
A Yes.
Q So you're talking about 45 percent perhaps?
A Maybe.
Q Does that indicate that a substantial quotient of 2:14PM
the phosphorus running off poultry applied fields is
soluble reactive phosphorus?
A It indicates that for these samples, yes, that's
true.
Q This is number -- let me hand you what has been 2:14PM
marked as Exhibit No. 6, Dr. Connolly, and tell me if
you have seen that document before?
A Yes.
Q Are you familiar with this study?
A Yes, I am. 2:15PM
Q And was this a study by some University of
Arkansas scientists to determine the relative
contributions of different constituents and runoff from
amended -- manure amended fields versus non-amended
fields? 2:15PM

A Yes. 2:15PM
Q Let's turn quickly to concentrations on Page Table
3 of runoff water?
A Mm-hmm.
Q Does it show, sir, that the poultry applied plots 2:15PM
substantially -- contribute substantially more
phosphorus from runoff than are found in the control or
non-applied fields?
A Yes.
Q What's the amount? How much more? 2:16PM
A About 50 times more.
Q And what about the comparison between -- between
poultry and cattle applied fields, does it show that
there's a substantial increase?
A Yes. 2:16PM
Q Does that indicate to you, sir, that poultry
applied fields would contribute more phosphorus in
runoff than a non-applied field, like a controlled
field or a reference field?
A For this is experiment, yes. 2:16PM
Q Do you think that experiment is applicable to
conditions in the IRW?
A No.
Q Why not?
A Because this experiment was conducted using 2:16PM

intense rainfall that, if I recall, was equivalent to a 2:16PM
one in 45 year storm, essentially, I think, if I
remember right, three inches of rain per hour onto the
field, so that condition would rarely occur in the IRW.
Q Do you think that even if you had less rainfall 2:17PM
that would still show that poultry litter tends to
contribute more phosphorus runoff than either a
controlled field or a cattle applied field?
A Not necessarily and if I remember from this
article, between applications of -- and the runoff 2:17PM
event, there was an inch of rain on the field, just
natural laying on the field, and there was no runoff
from the field.
Q In the particular study?
A Yes. 2:17PM
Q Would you identify that for me, please?
A It's been a while since I looked at this. It will
take me a few minutes. It's at -- on the Page 861 in
the right column, the last paragraph.
Q Mm-hmm. 2:18PM
A It says the plots were irrigated three days prior
to the second rainfall simulation, also about
25 millimeters, which is about an inch of rainfall
occurred between this irrigation and the second
simulation and no runoff occurred under -- during 2:18PM

either the irrigation or the natural runoff event. So 2:19PM
a rainfall event that put an inch of water onto this
caused no runoff.
Q That's after the first event -- that's between the
first and second event, correct? 2:19PM
A Yes.
Q Okay. Well, they also found that out even in the
second event there was a substantial reduction after
the first runoff, correct?
A Yes, but this says no runoff. 2:19PM
Q Did the water infiltrate the plot?
A The runoff, I'm sure it did.
Q So that could be another source of phosphorus to
the rivers and streams through the infiltration?
A Could be but less likely. 2:19PM
Q Why less likely?
A Because of the -- as the water is infiltrating
phosphorus and other constituents are being absorbed
out of the water that is infiltrating through the soil.
Q Have you done any study of that in the IRW to see 2:20PM
whether karst soils are actually doing that?
A I have not done that study in the IRW.
Q Let's take a break.
THE VIDEOGRAPHER: We are now off the record.
The time is 2:20 p.m. 2:20PM

(Following a short recess, proceedings 2:20PM
continued on the record.)
THE VIDEOGRAPHER: We are back on the record.
The time is 2:34 p.m.
Q Dr. Connolly, do you think that the test 2:34PM
conditions as the rainfall amounts of the Sauer paper,
Exhibit 6, are unrealistic?
A They're not representative.
Q Why would you suppose some researchers at the
University of Arkansas would do a test to see if 2:34PM
phosphorus ran off from poultry litter applied fields
would not be representative?
A You would have to ask them.
Q It's a little surprising to you as a scientist?
A Yes. 2:35PM
Q What is your basis for saying that the rainfall
amounts they used were not representative?
A In the paper they indicate that they -- the
rainfall amounts that they used were equivalent to a
one in 45-year storm. 2:35PM
Q And what -- do they have a citation for that
statement?
A Yes, I believe they do.
Q Is it -- other than that statement, do you know
whether or not a couple inches of rain in an hour is 2:35PM

unusual in the springtime in Northeastern Oklahoma and 2:35PM
Northwest Arkansas?
A I took a quick look at some of the precipitation
data and maximum rainfalls are sometimes up to several
inches an hour but they are not typical. 2:36PM
Q They occur in the springtime, do they not?
A They do occur in the springtime when they occur,
yes.
Q And that's when the poultry litter is typically
land applied, correct? 2:36PM
A But it's my understanding that the poultry litter,
according to regulation, is not to be applied when it's
going to rain.
Q What's your basis for that statement?
A My understanding of the rules and regulations for 2:36PM
the State.
Q Have you reviewed those?
A Not personally, it's based on communications from
others.
Q Let's just assume you're right that there is such 2:36PM
a regulation. Do you have any understanding whether or
not it's being followed?
A I have no reason to assume it wouldn't be
followed.
Q What is your reason to assume that it would be? 2:36PM

A Because I trust that people are law abiding 2:37PM
citizens and are not putting things down when they're
not supposed to.
Q And when did that regulation that you're not
really personally familiar with come into effect? 2:37PM
A I don't know.
Q Would it surprise you to know that that regulation
went into effect a year ago?
A Wouldn't surprise me, I just don't know what the
date was. 2:37PM
Q Let me hand you another document, Exhibit No. 7 of
Connolly. If you could tell me whether or not you're
familiar with that paper.
A I believe so, although I'm not certain.
Q Is this also an experiment concerning runoff from 2:37PM
poultry applied plots?
A Yes.
Q And were these also University of Arkansas
research?
A Yes. 2:38PM
Q Turn with me to conclusions. On Page 364 of this
Exhibit 7. Would you read the conclusion statements,
please?
A "Intense rainfall occurring soon after poultry
litter application to grassed areas can cause runoff 2:38PM

concentrations of litter constituents to be 2:38PM
significantly higher than observed for untreated
plots."
Q Do you have any reason to disagree with that
statement, sir? 2:38PM
A No.
Q Continue.
A "Both runoff concentrations and mass losses of
litter constituents were found to increase
approximately linearly with application rate." 2:38PM
Q Do you have any reason to disagree with that
statement, sir?
A No.
Q Read the next statement.
A "Runoff concentrations of litter constituents 2:38PM
decreased with increasing rainfall intensity due to
dilution but the increased runoff caused net increases
in mass losses."
Q Does that sound reasonable to you, sir?
A Yes. 2:39PM
Q Continue.
A "Proportions of applied litter constituents lost
were generally low at the low rainfall intensity, but
increased at the high rainfall intensity."
Q Does that make sense to you, sir? 2:39PM

A Yes. 2:39PM
Q Okay. And continue.
A "In view of the typically high runoff
concentrations and low losses of TKN (which is total
Kjeldahl nitrogen) and total phosphorus, particularly 2:39PM
at the low rainfall intensity, runoff losses of litter
constituents may be of greater importance from the
environmental perspective than from a crop production
perspective."
Q Does that conclusion make sense to you, sir? 2:39PM
A I'm not sure I understand it.
Q Okay. Does this paper, there's a primary author,
by Dr. Edwards, show or tend to show that poultry
litter, phosphorus, tends to runoff from fields where
rainfall occurs? 2:40PM
A For the conditions of this test, yes.
Q Do you think those are respective of conditions
that can occur in the IRW?
A I do not agree.
Q So you didn't study this in your evaluation? 2:40PM
A I believe I may have looked at it, but I don't
recall the details of this.
Q Let me hand you what's marked as Exhibit 8, ask
you to take a moment to see if you can recall that
paper or not, sir? 2:40PM

A I believe I did look at this paper at one point. 2:40PM
Q Is this another study to evaluate runoff with
poultry litter on fields?
A Yes.
Q Could you look at the lower right-hand column 2:41PM
where it says "although," would you read that, please?
A "Although it is uncertain if metal runoff is a
major problem with use of animal manures, high P
concentrations have been documented in runoff water
from pastures fertilized with low to moderate amounts 2:41PM
of poultry manure, causing concerns over the
utilization of this valuable resource in areas of the
USA where poultry production is high."
Q Do you have any reason to disagree with that
statement by Dr. Moore? 2:41PM
A I would to have review the citation that he makes
for this site. I don't have a view one way or the
other.
Q Dr. Morris is at the University of Arkansas
Fayetteville, correct? 2:41PM
A Yes.
Q Is Fayetteville within the IRW?
A Yes.
Q Would you continue reading, please?
A "Phosphorus is normally the limiting element for 2:42PM

eutrophication in freshwater bodies, such as rivers, 2:42PM
lakes and reservoirs."
Q You agree with that, don't you, sir?
A Yes.
Q Continue reading, please. 2:42PM
A The majority, 80 to 90 percent, of the phosphorus
in runoff water from fields fertilized with poultry
litter is dissolved P."
Q Do you have any reason to disagree with that
conclusion by Dr. Moore, sir? 2:42PM
A I think some of the data that's at the
edge-of-field here does not show that 80 to 90 percent
of these is dissolved P. I think in some cases that's
less, but I don't think that's unreasonable.
Q Hand you what is marked as Exhibit No. 9. I'd ask 2:42PM
you, sir, if you've ever seen that document before?
A I don't believe so.
Q Okay. Let's take a look at it. Would you read
for the record its title?
A "Trends in nutrient and sediment concentrations 2:43PM
and loads in major river basins of the South Central
United States 1993 to 2004."
Q And who's the author of this report, sir?
A The United States Geological Survey.
Q Are you familiar with USGS investigations? 2:43PM

A Yes. 2:44PM
Q Are they considered reliable?
MS. COLLINS: Object to form.
A I'm not comfortable making a blanket statement
that they are or are not reliable. I've read many USGS 2:44PM
reports that I believe are reliable. I've also read
USGS reports that I disagree with and I think they're
not reliable.
Q And with regard to -- have you relied on USGS
information in this particular case? 2:44PM
A Yes.
Q Okay. Let's turn to the abstract that is around
Page No. 1. Well, first of all, why don't we turn to
Page 2. And would you agree with me, sir, that this
study includes the IRW? 2:45PM
A It may. It's hard to say based on the drawing,
but it may very well.
Q If you would look at Page 69, Table 1. Could you
read the table title, please?
A "Stream sites in South Central United States 2:46PM
selected for trend and load computations of nutrient
and sediment data continued."
Q Is Illinois River included in that?
A Yes, it is.
Q And do you recognize those site locations from 2:46PM

your work in the IRW? 2:46PM
A I do.
Q So does it appear that map Figure Nos. 29 through
35 are within the IRW basin?
A It appears so. 2:46PM
Q Okay. So let's now look at conclusions for this
report back on Page No. 1.
A Mm-hmm.
Q The first paragraph about halfway down where it
starts "Trends observed," would you read that for the 2:46PM
record, sir?
A "Trends observed in the study area were compared
to determine potential regional patterns and determine
cause effect relations with trends in hydrologic and
human induced factors, such as nutrient sources, stream 2:46PM
flow and implementation of best management practices."
Q Okay. And what's the time period for this study,
sir?
A 1993 to 2004.
Q So does it appear that the USGS was trying to 2:47PM
determine sources and trends in nutrients as part of
the study they're evaluating here?
A They're apparently trying to determine
relationships between sources and concentrations.
Q Determine cause and effect relations? 2:47PM

A Yes. 2:47PM
Q Okay. And also trends, correct?
A Yes.
Q Okay. Would you look at the second column just to
the right from where you read where it says "although." 2:47PM
Would you read that out loud, sir?
A "Although population increased throughout the
study area during the study's period, there was no
observed relation between increasing trends and
nitrogen and study area streams and increasing trends 2:47PM
in population."
Q Okay. So as part of the evaluation in this test,
the USGS determined that there wasn't a relationship
between nitrogen in streams and population increase, is
that correct? 2:48PM
A Without reading this entire document, I'm not sure
quite how to interpret this. If this is a conclusion
sort of at a global scale, it means something different
than if it is we studied each individual site and at
each individual site we tried to look at a relationship 2:48PM
and never found one at any site as opposed to when we
have all the data from all the sites and put them all
together in a bucket and look, we don't see a trend,
that's very different. And without looking at this, I
have no idea what analysis is the basis for that 2:48PM

conclusion and so I have no sense of the veracity of 2:48PM
that conclusion.
Q Okay, sir. Let's look at the particular study
sites that are at issue then.
A Mm-hmm. 2:48PM
Q On Page 43, would you look at that Figure 28,
please?
A Okay.
Q Referring to the table, does it show on this
figure that the USGS showed an increased trend of 2:49PM
phosphorus concentrations at those study sites that are
related to the Illinois River watershed during this
time period?
A Um, it's hard to tell for sure what locations are
actually in the IRW on this map, so it's hard to 2:49PM
interpret.
Q Well, does it appear that the -- those triangles
facing with the point towards the top those are
increases, correct?
A Those are increases, correct. 2:50PM
Q And you see where it says 33?
A Yes.
Q Is there an increasing triangle there?
A Yes.
Q Is 33 the Illinois River near Tahlequah? 2:50PM

A Where are we again? 2:50PM
Q It's on Page 69.
A Yes.
Q Okay. So does that look like USGS found there was an increasing trend? 2:50PM
A Yes.
Q Okay. At least at Tahlequah and probably all those -- using that table, does it look like there's an increasing trend in all these or at least most of the IRW sites? 2:50PM
A This is very hard to interpret but I can see two upwards facing triangles and one downward facing triangle that appear to be in the IRW, so I would say from what I can see here two are up and one is down.
Q Okay. Well, that one that's down is Section 34, 2:51PM correct, and that's the Barren Fork?
A Yes.
Q Okay. Let's go to Page 45. And Page 45 shows that we are discussing sites along the Illinois River Watershed, correct? 2:51PM
A Where are you looking?
Q I'm sorry. The second full paragraph down, "Increasing total and flow adjusted trends in total phosphorus."
A Yes. 2:51PM

Q Including -- what site, sir? 2:51PM
A Sites 128, 31, 32, 33, 48 and 53.
Q Okay. So maybe it's a little bit easier now rather than do the interpretation, this shows an increased trend in phosphorus at Site No. 30, which is 2:52PM the Illinois River near Watts, correct?
A Yes.
Q Thirty-one, which Sager Creek near West Siloam Springs, correct?
A Yes. 2:52PM
Q Flint Creek near Kansas, right?
A Yes.
Q And Illinois River near Tahlequah.
A Yes.
Q Okay. Now, let's go to the next page, sir. And 2:52PM do you see where the title says "Relation of trends in phosphorus to trends in source data?"
A Yes.
Q Okay. The second paragraph down, would you begin reading that, sir? 2:52PM
A "Population throughout most of the study area either remained the same or increased during the study period, Figure 20. Such increasing trends could explain increasing trends in orthophosphorus and total phosphorus observed near urban areas (point sources) or 2:53PM

where drainages included a combination of urban and 2:53PM agricultural sources." Continue reading.
Q Yes, sir.
A "However, results of the WLS regression analysis indicated an inverse relation between population and 2:53PM flow adjusted trends in total phosphorus (Table 9), which was a result that was unexpected. Therefore, trends in population were not considered a controlling factor to explain trends in total phosphorus."
Q So the USGS concluded that the increased trends at 2:53PM those locations in the IRW that we just identified, that is increased trends of phosphorus, were not the result of population increases?
A I don't know.
Q Would you continue, sir? 2:53PM
A "Increasing trends in phosphorus from fertilizer were observed in Southern Colorado, Eastern Oklahoma, Arkansas, and Southern Missouri (Figure 32). Results of the WLS regression analysis did not indicate any statistically significant results between trends in 2:54PM phosphorus and fertilizer and trends in orthophosphorus or total phosphorus observed at study sites."
Q Okay. Continue.
A "There were more increasing trends in phosphorus from manure than were increasing trends in phosphorus 2:54PM

from fertilizer, (Figures 32 and 33). Weighted least 2:54PM squares regression results did suggest that increasing trends in phosphorus from land application of manure could be related to increasing total and flow adjusted trends in both orthophosphorus and total phosphorus at 2:54PM study sites."
Q Okay. So does this indicate that the USGS concluded that the increasing trends at those particular locations that we identified in the IRW is a result of the land application of manure rather than 2:55PM application of fertilizers or increasing population of people?
A They don't draw a strong conclusion. They use the word suggest and when scientists use the word "suggest," it means that they're not very comfortable. 2:55PM
Q Okay. But they did identify correlation between manure but not with commercial fertilizers or population growth, correct?
A I've not read this to evaluate how they made these determinations but what I know about population-related 2:55PM sources of phosphorus in this watershed would indicate to me that they are wrong.
Q Oh, really?
A Yes.
Q Okay. Let's go to the next page, Page 51, where 2:55PM

it says, "Overall Conclusions about Phosphorus Trends 2:55PM
and Loads in the Study Area"?
A Mm-hmm.
Q Before we go there, why do you suggest that the
United States Geological Survey is wrong? 2:56PM
A Because of the work that Ron Jarman did
quantifying phosphorus loads from wastewater treatment
plants in the IRW.
Q I see. And so -- and what was his work that was
particularly important to you? 2:56PM
A The annual loadings from wastewater treatment
plants in the Illinois River Watershed.
Q And what were those in percentage to all
phosphorus loads in Tenkiller, for example? What's the
percentage of phosphorus in wastewater treatment plants 2:56PM
versus all the phosphorus loading to Lake Tenkiller?
A Phosphorus in wastewater treatment plants probably
accounts for 29 percent of the total load to Lake
Tenkiller.
Q So that would be a minor source compared to 2:57PM
other --
A To potential other sources.
MR. TODD: Object to form.
Q -- other sources, correct?
MR. TODD: You're talking over each other. 2:57PM

MR. PAGE: Is that what your objection was? 2:57PM
MR. TODD: No, no, I attempted to object and
he answered your question. If you'll re-ask the
question, then I'll object and maybe he can answer it.
MR. PAGE: He answered my question anyway. 2:57PM
Q Let's look at overall conclusions about phosphorus
trends. It's on Page 51. Can we see that halfway down
where it says "Trends in population data," would you
read that, sir?
A "Trends in population data were inversely related 2:57PM
to trends in flow adjusted total phosphorus.
Therefore, trends in population were not considered a
controlling factor to explain trends in total
phosphorus."
Q And you would disagree with that? 2:58PM
A Yes.
Q Because of Mr. Jarman's work on wastewater
treatment plants?
A In part.
Q Anything else? Any other reason? 2:58PM
A Because loads of phosphorus and other constituents
in general tend to correlate with population increases
and I'm talking sort of just as a general proposition.
And so this conclusion is unusual and, in fact, I think
they say earlier here that you had me read that it was 2:58PM

unexpected. And so I am not comfortable at all with 2:58PM
this because I have not looked at any of this data or
their analysis and don't know whether I agree or
disagree with it, so --
Q You're applying a general principle to a site 2:58PM
specific evaluation suggesting the general principle
should overrule the site specific evaluation?
A No, I'm not.
MR. TODD: Object to form.
Q Well, then why is it that you believe -- if 2:58PM
wastewater treatment plants are a relatively minor
source of the phosphorus, couldn't it be that the
non-point source is a so much larger increase that it's
masking any increase from the wastewater treatment
plant contributions? 2:59PM
A The wastewater treatment plant loads are an
indicator of the human component and urbanization and
all the other things that are going on in the
watershed. So those increases are indicative of
population increases and increases in urbanization. As 2:59PM
a general proposition, those affect phosphorus loading.
The finding by these gentlemen or ladies, that that
didn't appear to be the case here is counterintuitive.
And given that immediately causes me to say, well, I'm
not comfortable with this because this is a result I 2:59PM

would not have expected, and unless I fully understand 3:00PM
what they did and agree with it, I would not accept
this conclusion.
Q Okay. Let me ask you another question, sir. What
is it about Mr. Jarman's work that is persuasive to 3:00PM
you. What did he show?
A Mr. Jarman's work is based upon site specific data
that I am familiar with and I understand the methods
that Mr. Jarman used and the data that he used to
obtain his loading estimates, so I'm comfortable with 3:00PM
those numbers. I haven't had an opportunity to do that
here.
Q I'm sorry to interrupt you, sir. Did he do an
evaluation of trends and loads from wastewater
treatment plants? 3:00PM
A Yes.
Q For what time period?
A For the time period from the early '90s through
2007.
Q And what did he find? 3:00PM
A That loads were increasing over that period and
peaked in 2002 or 2003.
Q Okay. Now, would you continue reading here where
we were reading before on Page 51?
A "No relation was observed between phosphorus from 3:01PM

fertilizer use and either orthophosphorus or total 3:01PM
phosphorus trends."
Q Does that surprise you, sir?
A I would need a lot more information to understand
the basis for this. I have no sense of how much 3:01PM
fertilizer was used and how much variability in
fertilizer use.
Q You have no sense of what the quantum of
fertilizer use is in the IRW?
A No, that's not what I'm saying. What I'm saying 3:01PM
here, this work appears to be based on statistical
correlation and your ability to do meaningful
statistical correlation in part depends upon your
ability to look across fairly broad ranges. If you're
trying to discern in a data set that doesn't cover very 3:02PM
broad ranges, the noise and the information can
confound your statistical analysis. Because I don't
understand the underlying data here and to what extent
their statistical analysis is -- what a statistician
would call robust, I have no basis to determine one way 3:02PM
or another the meaningfulness of these conclusions.
Q It could be significant if they had done their
analysis correctly?
A Or the data themselves don't lend themselves to
determining one way or the other. 3:02PM

Q Would you continue reading, please? 3:02PM
A "However, statistical results did suggest that
increasing trends in both orthophosphorus and total
phosphorus could be related to increasing trends in
phosphorus from land applications of manure." 3:03PM
Q Do you have any reason to disagree with that
statement, sir?
A Again, I have no reason to accept it or disagree
with it because I don't understand the underlying
analysis. 3:03PM
Q Could you look at the next couple of pages here
and see whether or not the USGS has concluded whether
there's been an increasing trend of sediments
concentrations in these same study sites? I'll focus
your attention on Page 55, Figure 36. 3:03PM
A It appears they have two locations in the IRW, one
of which shows a decline and one of which has something
called attempted, not analyzed.
Q Okay. So if that decline is accurate, does that
indicate that the sedimentation in the IRW is not 3:04PM
increased over the study period of 1993 through 2004?
A Sedimentation?
Q Yes.
A They're not looking at sedimentation.
Q Oh, excuse me. Total -- yeah, transport total 3:04PM

suspended solids. 3:04PM
A I'm not quite sure how to interpret this because
the range here is zero to five and I don't know whether
that bar is statistically different from zero, for
example, so I'm not sure how to interpret it. 3:04PM
Q So does it indicate there may be no or some
decrease in a sediment load in the IRW during this time
period?
A Yes, it suggests that.
Q Let's look at Section 2.4. By the way, before I 3:05PM
go there, Dr. Connolly, before you began your work, did
you investigate whether there's any literature
concerning sources of phosphorus and loading in the
IRW?
A Before the engagement? 3:05PM
Q As part of your work. As part of your work, did
you do a search for information such as the USGS papers
and other papers that would indicate phosphorus sources
and loadings and trends in the IRW?
A Yes. 3:05PM
Q Okay. So you didn't come across any of the USGS
work?
A I did come across a number of USGS studies, I
don't recall coming across that one.
Q Do you recall whether the findings in the USGS 3:05PM

indicates that phosphorus loadings have increased in 3:06PM
recent years in the IRW rivers and streams?
A My recollection is that there are two USGS reports
specific to the IRW. One which analyzes a period, I
think, that goes up to about 2001, if I remember right, 3:06PM
and then one that analyzes a more recent period. And
they came to, I think, somewhat different conclusions
in the analysis of the two periods but I would have to
look at the documents to refresh my memory.
Q On Page 2-4 -- before we get to 2-4, the 2.4 3:06PM
section, you have the statement that says, "besides
non-point source pollution, population increased in the
Illinois River Watershed had increased pollution via
septic systems and increased wastewater treatment plant
discharges." It would appear that the USGS paper we 3:07PM
just looked at is contradictory to those statements,
correct?
A It would appear so although, again, I don't know
whether I agree or disagree with the reports and
conclusions. 3:07PM
Q You mentioned increased pollution via septic
systems and cite Sullivan. What is your basis for
increased pollution in the IRW via septic systems?
A With the increased population there are increased
septic system density in the IRW and septic systems are 3:07PM

sources of pollution because of what runs of out of the 3:07PM
septic system.
Q How much increase has there been?
A I don't recall.
Q Does Sullivan have in his report how much increase 3:08PM
there is?
A I don't recall whether he has a precise number.
Q Isn't some numerical counting important to
determine whether or not there's an increase or not or
was it just the basis of more people, there must be 3:08PM
more septic systems?
MR. TODD: Object to form.
A I would have to go about back and review Tim
Sullivan's report. I don't recall.
Q Okay. So let's say there are septic systems and 3:08PM
they're releasing constituents. Is it your opinion,
sir, that septic systems would release phosphorus that
could be contributed to rivers and streams?
A That septic systems are a potential source.
Q Okay. And how would that source work? It's 3:08PM
leaching from the system that would have phosphorus in
it?
A Yes.
Q I believe a few minutes ago you told me that you
doubted that infiltration from poultry fields, 3:09PM

phosphorus from that would ever reach a stream or river 3:09PM
because of the mechanisms of absorption of phosphorus
in the soil. Do you recall that testimony, sir?
MR. TODD: Object to form.
A I don't think that's exactly what I said. 3:09PM
Q What did you say?
A I said that absorption and filtration as the water
was moving through the surface soils would tend to
intercept phosphorus and reduce phosphorus.
Q Wouldn't that same process occur with septic tank 3:09PM
leaching?
A To a much less extent because the septic tank
leaching is already below the surface soils and in an
environment that has lower organic matter and less
absorptive capacity on the surface soils. 3:10PM
Q Do you know how many people use septic tanks in
the IRW?
A No.
Q Do you know how that waste volume of people
relates to poultry waste volume in the IRW? 3:10PM
A No.
Q Have wastewater treatment phosphorus discharges
decreased since 2003 in the IRW?
A Yes.
Q So what do you mean when you say then there's 3:10PM

increased wastewater treatment plant discharges here in 3:10PM
this paragraph on Page 2-4?
A I'm talking historically over a longer period.
Q Now, let's go to Section 2.4.
A Okay. 3:11PM
Q Would you explain for us, sir, what you mean by
the statement "The pollutant fingerprints in the
Illinois River and Lake Tenkiller do not match that of
poultry litter?"
A By that I mean the relative concentration of 3:11PM
various constituents differ in poultry litter as
compared to samples from either the water or the
sediment of the Illinois River and Lake Tenkiller.
Q Okay. And what evaluation did you do to determine
that? 3:11PM
A I looked at the chemicals that Dr. Fisher used in
his effort to fingerprint poultry litter, which
included phosphorus, zinc, copper and arsenic. And in
addition, I looked at the major cations in the system,
which are dominant contaminants -- not contaminants, 3:12PM
but dominant chemicals in the runoff water, to see
whether there was any evidence that you could
fingerprint poultry litter by noticing that the
distribution of those major cations in water of the
Illinois River at Lake Tenkiller matched that of 3:12PM

poultry litter. 3:12PM
Q So what was the comparison you made?
A Comparison was based on relative concentrations of
these constituents.
Q And that was in the comparison analysis you did? 3:12PM
A Yes.
Q Okay. In the top of Page 2-5, you state, "Such a
journey," referring to runoff constituents poultry
litter, "is a complex adventure impacted by complex
physics, chemistry and biology." Do you see that, sir? 3:12PM
A Yes.
Q What analysis did you perform to support that
statement?
A No analysis.
Q And what analysis did you perform to support this 3:13PM
statement, "Along the way chemicals are diluted,
trapped and transformed"?
A No analysis.
Q Can we turn to Page 2-6, sir?
A Yes. 3:13PM
Q In the first paragraph you -- about two-thirds of
the way down there, sir, there's a sentence that begins
"looking at." Would you that read for the record,
please?
A "Looking at potassium and sodium, the 3:14PM

edge-of-field samples from alleged poultry litter 3:14PM
amended fields are unique. They have on average about
two times more potassium than sodium."
Q Okay. What is your basis for that statement, sir?
A The basis for that statement is an analysis of the 3:14PM
data collected by the plaintiffs of edge-of-field
samples.
Q Okay. What do you mean by "unique"?
A Unique in that it is not found in samples in any
other matrix sampled in the IRW. 3:14PM
Q So is your statement that the potassium is unique to poultry litter waste?
A No.
Q Okay. I'm trying to understand what you mean by that. 3:14PM
A That what is unique is the ratio of potassium to
sodium.
Q Okay. What are the relative amounts of potassium to sodium in other sources in the IRW?
MR. TODD: Object to form. 3:15PM
A I did not examine that.
Q Did you examine how they relate to background waters?
A No.
Q So what's your basis for your statement that 3:15PM

they're unique? 3:15PM
A Unique in the sense that they differ from what we
see in the Illinois River and Lake Tenkiller. The
point of this analysis was potassium and sodium are two
significant components that go into the PCR analysis. 3:15PM
For example, Dr. Olsen made statements about potassium
in his report and this importance of poultry litter
potassium as a source of potassium to the waters of the
Illinois River and Lake Tenkiller. And what I'm saying
is that there is no evidence of that, that what we see 3:16PM
in poultry runoff from edge-of-field has a potassium to
sodium ratio that we see not in the Illinois River and
not in Lake Tenkiller, and so there is no evidence from
this data of that edge-of-field water from poultry
litter applied fields showing up in Illinois River or 3:16PM
Lake Tenkiller.
Q Okay. So is it your testimony, sir, that the waters of the IRW are not elevated in potassium concentrations compared to background or reference waters? 3:17PM
A No.
Q And if they are, would that not indicate that there's a poultry influence?
A No.
Q Why not? 3:17PM

A Because potassium is not running off all by 3:17PM
itself, it is running off with other constituents. And
to the extent that it is running off with two times as
much potassium as there is sodium, you would expect
that it would have impacted what we see in the IRW -- 3:17PM
in the Illinois River. And if you look in the Illinois
River under base flow conditions or under high flow
conditions, you do not see any evidence of elevation.
You would expect, if poultry litter was a large source
of potassium, that under high flow conditions we would 3:18PM
see an elevated ratio of potassium to sodium and we do
not.
Q Do you see an elevated potassium in water of the IRW that have been impacted by poultry waste?
A I've not seen any waters other than edge-of-field 3:18PM
that you would conclude have been impacted by poultry
waste.
Q What about have you looked at potassium levels at different waters in the IRW and compared them to reference levels? 3:18PM
A No.
Q Can you identify any other source of potassium in the IRW other than poultry waste?
A There's potassium in all the soils of the IRW and
there's potassium in the wastewater treatment plants. 3:19PM

Q Did you evaluate the amount of potassium in 3:19PM reference water compared to waters that are not referenced in the IRW?
A No.
Q Let me hand you what has been marked as Exhibit 10 3:19PM and these are two figures from Dr. Olsen's expert report. Are you familiar with these figures, sir?
A I don't remember them precisely.
Q On the first page, sir, do you see the edge-of-field sample location there? 3:19PM
A Yes.
Q Okay. And do you see then the -- the contributions of potassium in edge-of-field samples?
A You mean the concentrations?
Q Yes, concentrations, excuse me. 3:20PM
A Yes.
Q Okay. Are they different than the concentrations found in reference samples?
A Yes.
Q Significantly different? 3:20PM
A Yes.
Q Okay. And when you look at the different waters of the IRW, do you see that all the waters of the IRW have increased potassium concentrations above that are referenced? 3:20PM

A There are differences. You cannot tell if this 3:20PM
figure, whether the differences are statistically
significant.
Q Would you look at the next page, sir?
A Yes. 3:21PM
Q That takes out the edge-of-field, so just focus on
the waters of the IRW.
A Mm-hmm.
Q Does it appear that the reference values are
statistically significantly different for potassium 3:21PM
than other waters of the IRW?
A You cannot tell that from this figure.
Q Why not?
A Because you need information on variance and
there's no information on variance here. 3:21PM
Q Are the -- are any of either the lower, upper or
median values for reference samples above any of the
those samples for the other waters of the IRW?
A No.
Q Is this true, sir, during both base flow and high 3:21PM
flow conditions?
A Yes.
Q Does this information here shown on this Exhibit
No. 10 suggest that there is contamination for
potassium in the Illinois River basin? 3:22PM

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A No. 3:22PM
Q So you're suggesting that just -- that even though
the reference values are well below all the other
values of the different stream types, that that doesn't
indicate that the streams have been impacted by 3:22PM
potassium?
A What do you mean by "impacted"?
Q Well, contaminated.
MR. TODD: Object to form.
A What do you mean by "contaminated"? 3:22PM
Q It's not natural, some anthropogenic source?
A No.
Q What would you -- how would you account for the
increased levels of potassium in every type of water
body in the IRW above referenced? 3:23PM
MR. TODD: Object to form.
A The geology of the IRW.
Q Well, the reference streams reflect the natural
geology of the IRW, so what you would find without any
anthropogenic sources, correct? 3:23PM
A The reference streams reflect the sub-watershed
associated with those reference streams, which may or
may not be representative of these other portions of
the watershed.
Q Do you have any basis to say that these reference 3:23PM

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streams that were selected by CDM and represented here 3:23PM
are not representative of the IRW?
A This plot says they're not representative of the
IRW.
Q How can you say that? 3:23PM
A Because potassium levels here are more or less the
same regardless of condition. It doesn't matter
whether we're in small tributaries, whether we're on
large tributaries, whether we're under base flow or
whether we are under high flow, if this was through 3:24PM
anthropogenic sources, we would see differences that
would be associated with anthropogenic sources that may
be active under high flow, not active under base flow,
active in one portion of the watershed, not active in
another portion of the watershed. 3:24PM
Q Have you studied this the -- how widespread
poultry waste is delivered within the watershed?
A Yes.
Q It's pretty widespread use, correct, throughout
the watershed? 3:24PM
MR. TODD: Object to form.
Q Is the poultry waste widely used within the
watershed?
A It is widely used but not uniformly used.
Q Okay. If the poultry waste was widely used in the 3:24PM

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IRW and it was contributing both to base flow and high 3:24PM
flow, would not these results be consistent with
poultry waste contaminants from potassium?
A No.
Q Why not? 3:25PM
A Because again, the program that was put in place
to sample all of these water bodies purposefully looked
at some watersheds that had low levels of poultry
contribution and some watersheds that potentially had
high levels, areas that had low poultry house density, 3:25PM
areas that had higher poultry house density. And the
consultants relied on that to try to look for
correlations with poultry house density. Despite that,
you get the same answer more or less. So there's no
evidence here and nor is there any analysis that I've 3:25PM
seen that would say in waters within the Illinois River
that have very low poultry house density have very low
sodium, and those that have high poultry density have
high sodium, and there are differences under base flow
and under high flow because the principal means or 3:26PM
pathway by which poultry litter constituents would get
into these waters, if they were, would be under high
flow events and you -- just like we see increases in
certain constituents you would see increases in
potassium and you don't. 3:26PM

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1 **Q Did you see Tim Cox and Bernie Engle's analysis on 3:26PM**
2 **poultry house density and phosphorus?**
3 A I probably did. I don't recall it now.
4 **Q But this particular study doesn't -- it combines**
5 **both the streams whether they have low and high 3:26PM**
6 **density, correct, all these combined together?**
7 A Yes.
8 **Q So given that, wouldn't you expect to find the**
9 **impact on all of these different stream segments**
10 **because it combines both the low and the high poultry 3:27PM**
11 **house density as stratified random sampling design so**
12 **you combine it all together, the impact of poultry**
13 **house density is not going to be shown in this**
14 **particular sample set, correct?**
15 MR. TODD: Object to form. 3:27PM
16 A No.
17 **Q Why not?**
18 A Because I would go to Las Vegas and start gambling
19 if I was going to say that I did random sampling and
20 always have the same answer, whether I was in a small 3:27PM
21 watershed, a high -- a large watershed, looking under
22 low flow, looking under high flow, and magically it
23 made no difference. Sampling in low density and high
24 density poultry house areas and magically it made no
25 difference. I find that, in fact, to be an absence of 3:27PM

1 evidence of poultry house impact. 3:27PM
2 **Q Isn't the median for the high flow always higher**
3 **than the base flow? So if you compare small tributary**
4 **high flow, it's always higher than the base flow,**
5 **correct? 3:28PM**
6 A That's meaningless.
7 **Q Why is that meaningless?**
8 A Because, first of all, the measure -- appropriate
9 measure of central tendency here is the mean not the
10 median. 3:28PM
11 **Q Why is that?**
12 A Why is that?
13 **Q Yeah.**
14 A Because if we're going to compare these
15 populations you would compare them, compare the means 3:28PM
16 and are the means statistically different from each
17 other. And there's no statistical analysis here, but
18 based just on the overlap of these distributions, it is
19 clear there is no statistical significant difference
20 among these. 3:28PM
21 **Q Did you do you a statistical evaluation of this**
22 **data?**
23 A I don't need to do a statistical evaluation of
24 this data. I did not because it's not necessary.
25 **Q Let's look at Page 2-6. Is environmental data 3:29PM**

typically logged normally distributed? 3:29PM
A Yes.
Q So if the distribution is logged normal, wouldn't
the better sample tendency be median rather than the
mean? 3:30PM
A Not for a statistical test.
Q So you did you use median evaluation, median tests
to do your work in this particular case?
A No.
Q You never look at evaluated medians? 3:30PM
A We look at medians but if we're doing statistical
tests, they will not be on the medians.
Q Let's look at Section 2-6 -- Page 2-6, second
paragraph.
A Mm-hmm. 3:30PM
Q Would you read the first sentence, please?
A "Looking at the major metals, the dominant metal
in poultry field edge-of-field samples is copper,
whereas it is zinc in all the river, stream and lake
samples." 3:30PM
Q Do you recall what the concentration of copper is
in edge-of-field samples?
A No.
Q Look back at the exhibit. I think we have an
edge-of-field Exhibit No. 5. What is the 3:30PM

concentration? 3:31PM
A I'm sorry, were you asking zinc or copper?
Q Yeah, the dissolved copper concentration.
A Dissolved copper?
Q Edge-of-field samples. And what is the average? 3:31PM
A .12.
Q Okay. And that -- and where does the copper come
from in the edge-of-field samples?
A I don't know.
Q Does the evaluating of Sauer indicate that there 3:31PM
is very small amounts of copper running off from
reference fields in the IRW? We can look at it, if
you'd like to, on page -- Exhibit No. 6.
A Sauer's analysis is for a field plot on the
university property, it's not a measure of runoff in 3:32PM
the IRW.
Q So is it a measure of runoff from a poultry
applied field?
A Poultry applied or a controlled plot, yes.
Q Does it show any copper running off of those 3:32PM
controlled plots, Sauer Exhibit 6. Look at Page 863 of
concentrations and compare those to the concentrations
to edge-of-field data?
A Which table? I'm sorry.
Q We can look at Table 4 on Page 863 shows 3:33PM

concentrations of micronutrients in runoff water? 3:33PM
A Yes.
Q And the copper is shown what for the control?
A .001.
Q And how does that compare with the runoff here in 3:33PM edge-of-field samples?
A The dissolved copper here is .12 so it's, you know, 100 times higher.
Q So wouldn't you expect that the copper that's found in edge-of-field samples here is from poultry? 3:33PM
MR. TODD: Object to form.
A Again, I have not studied the edge-of-field samples to assure myself that what was measured in those samples was coming off a poultry applied field and a field that didn't have any other potential 3:34PM sources of copper other than poultry on that field, so I can't say with authority that what's in the runoff clearly came from poultry litter.
Q This analysis would suggest it is, does it not?
A It would suggest that there are higher copper 3:34PM concentrations than you would expect from controlled field based on Sauer's, but that's all I can conclude from that.
Q Let's take a break.
THE VIDEOGRAPHER: We are now off the record. 3:34PM

The time is 3:34 p.m. 3:34PM
(Following a short recess, proceedings continued on the record at 3:48 p.m.)
THE VIDEOGRAPHER: We are back on the record the time is 3:48 p.m. 3:48PM
Q Do you still have the Sauer paper handy there? It's Exhibit 6.
A Yes.
Q Dr. Connolly, do you see any appreciable difference between the reference field for copper 3:49PM runoff and the cattle amended fields?
A Where am I looking?
Q Table 4, mean concentrations. With regard to copper, do you see any difference between the cattle amended fields and the reference fields as to copper 3:49PM runoff concentrations?
A Very little.
Q And so there's, again, a very little runoff of copper for the cattle amended fields as opposed to poultry amended fields? 3:49PM
MR. TODD: Object to form.
A For the particular conditions of this experiment.
Q Okay. And let's look at another paper, Exhibit 8. And it's the paper by Dr. Moore?
A Yes. 3:50PM

Q Look at Page 94. Is there a difference that 3:50PM Dr. Moore found in his experiment on copper runoff in reference fields and poultry amended fields in maybe the first statement under "Copper Runoff" on Page 94.
A "Soluble copper concentrations in the runoff water 3:50PM of the unfertilized control fields averaged .01 milligrams per liter for the first runoff event and .014 for the second. These values are nearly average of that for natural waters in the U.S.A."
Q Okay. Would you read the statement? 3:51PM
A "The amount of soluble copper in the runoff water increased linearly with litter application rate, regardless of litter type, but was significantly higher from normal litter than alum-treated litter."
Q Would you read the next sentence, sir? 3:51PM
A "At the highest litter application rate, the average soluble copper concentration in the runoff water from untreated litter was 93 times higher than the control, while the average copper level for this same rate of alum-treated litter was 52 times higher 3:51PM than the control."
Q Do you see Figure 1 there, sir?
A Yes.
Q Does that show that there's a linear increase of copper runoff as traditional poultry waste is applied? 3:51PM

A Yes. 3:52PM
Q So do both these studies suggest that dissolved copper tends to run off of poultry applied fields?
A These studies show that some copper runoff from poultry litter applied fields, yes. 3:52PM
Q And substantially higher concentrations than would be from unapplied or reference fields, correct?
A Yes.
Q Okay. Would you read the conclusion for me, sir, on Page 99 of this report, the conclusions of the 3:52PM authors of this investigation?
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 3:53PM untreated litter compared to alum-treated litter."
Q Do you agree that this study shows that, sir?
A Yes.
Q Okay. Continue.
A "The metal of greatest concern in poultry litter 3:53PM is copper, which was found in extremely high concentrations in the runoff of untreated litter."
Q Do you agree with that conclusion, sir?
A I don't know what they mean by "concern," so I'm not willing to agree with it because I'm not sure what 3:53PM

they mean by concern. 3:53PM
Q Would you agree that it's found in extremely high concentrations in runoff?
A It's found in high concentrations in runoff, yes.
Q Does these -- does cattle manure contain copper? 3:53PM
A Some amount, yes.
Q And same amount as poultry?
A I don't believe so.
Q And I think the Sauer paper indicated in that test that the cattle fields had very little copper runoff, 3:54PM basically, the same as a reference control field, correct?
A Again, for the conditions of that test.
Q On Page 2-8, first paragraph, there's a sentence that begins "the differences"? 3:54PM
A Mm-hmm.
Q "The differences in chemical signature." Would you read that sentence, please, sir?
A "The differences in chemical signature between poultry litter and edge-of-field samples show that the 3:54PM efforts of Dr. Olsen and Fisher were doomed from the start."
Q One more sentence.
A "Their fundamental assumption of a largely and varying chemical signature is false." 3:55PM

Q Would you explain that statement -- those 3:55PM statements, sir?
A Dr. Fisher, in his analysis, attempted to compare the relative concentrations of phosphorus, zinc, copper, and arsenic and poultry litter to environmental 3:55PM samples in an effort to determine whether environmental samples had the same signature. And by signature, he meant and I mean the relative concentrations of those four constituents. And that is the sort of invariant chemical signature that he was looking for. 3:55PM
Q Do you mean by invariant -- I'm sorry, you mean by variant some kind of a constant ratio?
A Yes.
Q So what about Dr. Olsen? How does that apply to Dr. Olsen's? How does your statement apply to 3:56PM Dr. Olsen's analysis?
A Dr. Olsen's analysis, the PCR analysis attempted to distinguish samples based on their chemical composition with the idea being that there would be a unique signature in the environment of samples that 3:56PM were -- where the dominant source was poultry litter. And that he could, therefore, then identify that these locations were impacted by poultry litter because they had a signature that was characteristic of poultry litter. 3:56PM

Q And that was through PCR, correct? 3:56PM
A Yes.
Q Okay. And what's your criticism of that, sir?
A That Dr. Olsen did not recognize that the relationships among all of these chemicals are 3:57PM constantly changing as we move through the environment and that the differences that are evident even at edge-of-field demonstrate that composition is changing in ways that it will not be the same at different points in the environment and it is difficult to use 3:57PM PCR to try to determine what samples were or were not impacted by poultry litter.
Q Do you believe that Dr. Olsen's PCR analysis and his signature is based on constant ratios of his chemicals? 3:57PM
A It is not based on constant ratios, it is based upon similarities of a chemical signature, which --
Q Is it based on constant ratios?
A It is -- it is based on nearly constant ratios.
Q Really. Is that your understanding of PCR? 3:58PM
A That is not a description of PCR.
Q Isn't it true that PCR does not use constant ratios to identify signatures?
A That's true.
Q So how can you claim that Dr. Olsen's effort was 3:58PM

doomed from the start because of largely invariant 3:58PM chemical signature assumption?
A His work is based on an assumption that there is a fingerprint, that there are samples that will group together in terms of the relationship in concentration 3:58PM among all of the constituents that he is looking at. So that you can call it ratio if you want and it is ratio in multi-dimensional space. If you look at PCR in a simple two-dimensional way you are saying when I see high phosphorus, I also see high something else, 3:59PM and I see them in a certain relationship and that relationship ties back to the source and I see that not just in two dimensions, but I see that in 20 dimensions because I'm looking at relationships among all 20 chemicals if I'm using 20 chemicals. 3:59PM
Q And those relationships have correlations, not ratios, correct, and PCR?
A They are correlations but a layman's simple view of it is to think of them like ratios.
Q Well, but PCAs don't use ratios? 3:59PM
A No, they do not.
Q Do you understand that Dr. Olsen's mathematical formulation for his PCR, which includes log and C transformation, explicitly assumes the ratios are not constant? 4:00PM

A I don't know one way or the other what his 4:00PM
transformations did to that, but as I indicated
earlier, I understand that that is not an assumption of
PCR.
Q Do you understand that Dr. Olsen's PCR analysis 4:00PM
did not mix solids and liquids, they were separately
evaluated?
A Yes.
Q Doesn't that account for your concern about
chemical transformations as they become soluble? 4:00PM
A No.
Q Why not?
A Let me restate my concern. My concern is that if
you start at a field with poultry litter that has ten
or 20, or however many compounds you want to look at, 4:01PM
in certain proportions, and now you move off of that
field, the basic assumption in the PCR analysis is that
I can find that stuff in remote locations because those
relationships, correlations, if you will, among those
contaminants will be retained. And what I've shown in 4:01PM
my analysis is that those relationships are not
retained. Those correlations are not retained.
Q Where did you start your analysis?
A At poultry litter, litter applied land,
edge-of-field. 4:01PM

Q Where did Dr. Olsen start his analysis for PCR? 4:01PM
A Where did he start his analysis?
Q Yeah.
A He started his analysis with edge-of-field.
Q So you're not doing the same comparison. You're 4:01PM
starting your analysis with poultry litter and soils,
applied soils, whereas Dr. Olsen started his analysis
with edge-of-fields, correct?
A Correct.
Q So that's a distinction between what you've done 4:02PM
that accounts for why you see differences compared to
what Dr. Olsen did, correct?
A No.
Q Well, your concern is, is the transformation of a
litter as water is added to it, isn't that correct? 4:02PM
A No.
Q Okay. So what is your concern?
A My concern is that these transformations occur
throughout the environment and made comparisons that
were specific to water only, that began with 4:02PM
edge-of-field and compared edge-of-field to samples in
the river and samples in the lake. So to -- I looked
at this in a way that was analogous to the way that Dr.
Olsen looked at it.
Q Did you -- are these transformations that you're 4:03PM

concerned with initiated by water being added to the 4:03PM
litter or the soil where it's applied?
A No.
Q What are they initiated by?
A They are initiated by the presence of these 4:03PM
constituents in the environment.
Q What are the transformation processes that you
observed?
A Absorption, desorption processes, chemical
speciation processes, degradation processes, uptake 4:03PM
processes, are all occurring in the environment.
Q Okay. And are the principles of transformations
caused by water being added to the constituents?
A Not necessarily.
Q Did you do a comparison to see which 4:04PM
transformation was the most important?
A No.
Q Did you do your analysis by just focusing
beginning with edge-of-field to see if there were
correlations between the constituents of major field 4:04PM
into the different downgrading of environmental
components?
A Yes.
Q And what did you find?
A That there was a complete mismatch between 4:04PM

edge-of-field samples and samples in surface waters. 4:04PM
Q Show me those results in your report.
A Figure 2.3 of the report shows the relative
contributions or relative concentrations of copper,
zinc and arsenic in edge-of-field samples as compared 4:05PM
to river and stream samples under base flow conditions,
river and stream samples under high flow conditions in
Lake Tenkiller.
Q Did you compare any of these to reference
conditions? 4:05PM
A No.
Q Wouldn't that be probative to determine whether or
not there has been influence of these constituents by
poultry waste?
A Not for the purposes of the analysis I was doing. 4:05PM
Q It would be helpful, though, to see how these
compare to reference, wouldn't it?
A For what purpose?
Q To see whether there's a poultry waste influence
in these different environmental components based on 4:06PM
copper, zinc and arsenic?
A I did that in another way a little bit later in
the report. In trying to replicate analysis that
Dr. Fisher did that looked at trying to see if you
could reproduce the relative composition of these 4:06PM

constituents and sediments by combining reference soil 4:06PM
or control soil with poultry litter.
Q Did you do an evaluation based on the water analysis?
A No. 4:06PM
Q Is it your contention, Dr. Connolly, that the edge-of-field concentrations -- well, the high concentrations of phosphorus, bacteria, potassium, and copper are the result of something other than poultry waste being applied to those fields? 4:07PM
MR. TODD: Object to form.
A I made no analysis to determine relative contribution of whatever sources might exist to what was measured in the water purported to come off of those fields. 4:07PM
Q Can you give us any understanding of what other sources for those constituents would be in the IRW?
A It would be very specific to each sample and where each sample was taken. It's my understanding that it was not clear, based on the locations that we sampled, 4:07PM were collected where, in fact, the water that was collected was derived from.
Q And what's your basis for that statement?
A Conversations with other defendant experts who had spent a considerable amount of time going to these 4:08PM

sites, examining these sites, and looking at 4:08PM
photographs of these sites.
Q Can you give us a reference to something that's set out in another expert report?
A That would be discussed in Dr. Sullivan's report. 4:08PM
Q Did you reference it in your report anywhere?
A I don't recall whether I do or not.
Q Okay. Turn to Section 2.5. Would you read your title at Section 2.5, please?
A "Poultry litter does not produce more phosphorus 4:08PM
runoff than cattle manure or any other fertilizer applied intentionally or naturally."
Q What's your basis for that statement -- well, first, why don't you explain the statement to me?
A That statement looks at the potential for 4:09PM
releasing phosphorus from these different sources per unit weight of those sources.
Q You're talking about potential, you're talking about actual delivery of phosphorus runoff?
A Potential, yes. 4:09PM
Q I notice your title doesn't say "potential." Did you change that after you talked with the defense counsel in this case?
A No.
Q Why didn't you use the word "potential" then in 4:09PM

the title? 4:09PM
A I didn't think to.
Q And what is your basis for that statement, sir?
A The basis for that statement is a comparison of phosphorus concentrations in edge-of-field samples from 4:09PM
fields that purportedly drained poultry -- poultry applied land and fields that, drained cattle land, so that was one line of evidence. The other line of evidence was looking at water extractable phosphorus and the mass or tonnage of manure generated in the IRW 4:10PM
and estimating that the potential, the amount of water extractable phosphorus that would be placed on the land in the IRW from those various sources.
Q Okay. Am I to assume, sir, from this title in your discussion here that from a potential point of 4:10PM view, poultry litter doesn't have any greater potential but no less potential for runoff than cattle or fertilizer applications to fields?
A That based on the information at hand, we can't discern a difference. 4:11PM
Q Okay. So they have equal potential?
A I'm not saying that they have equal potential, I'm saying based upon the data we have at hand we can't tell whether there --
Q Was any difference? 4:11PM

A -- was any difference. 4:11PM
Q Okay. Based on information you present here?
A Yes.
Q Was that all the information you had on this topic or did you select some of it? 4:11PM
A No, this is all the information that we had to look at.
Q Okay. And mass of phosphorous entry in the watershed wouldn't, in your opinion, relate to this potential for runoff? 4:11PM
MR. TODD: Object to form.
A No.
Q Well, I just was curious, sir, later when you talk about water extractable phosphorus in different manures? 4:11PM
A Mm-hmm.
Q Are you assuming that that's because the manure has the potential for runoff?
A It's because some of the phosphorus in the manure may run off. 4:12PM
Q So how can you conclude in your mind, sir, that, you know, you can look at the water extractable phosphorus in cattle and poultry and that has a potential, as information for me to understand as to whether or not there's a phosphorus runoff or potential 4:12PM

for runoff, but not look at phosphorus mass balance 4:12PM
coming into the watershed, knowing very well that the
poultry excess is in the form of that manure would
indicate some potential for runoff?
MR. TODD: Object to form. 4:12PM
Q I'm just trying to understand your logic. It
seems like you're willing to look at manures and
compare them as relative water extractable phosphorus
for potential runoff, but you're not willing then to
look at the same manure, look at mass balances to see 4:13PM
whether that created a potential for runoff.
A Again, I don't see the relevancy of that mass
balance. If the manure has a potential to be a source
of phosphorus, well, you look at how much manure was
applied and that tells you the potential for runoff. I 4:13PM
don't understand how that relates to how much
phosphorus came into the watershed from wherever.
Q Okay. Is that that the plaintiff's experts have
done an evaluation such as how much manure has been
applied and the phosphorus portions of that manure in 4:13PM
the IRW?
A We did what was in the table you just referred to.
I'm not sure what else --
Q What about the plaintiff's experts, did they do an
evaluation of the quantum of phosphorus that's been 4:13PM

applied to fields in the IRW through poultry waste? 4:14PM
A They may have, I don't recall.
Q Didn't Dr. Olsen -- excuse me, Dr. Engle do quite
a few different analyses in that report?
A He did, I just don't recall the details of those. 4:14PM
Q Did you consider that when you were evaluating the
potential for runoff in your analysis?
A No.
Q You just ignored it?
A No. 4:14PM
MR. TODD: Object to form.
A We didn't ignore it. I looked at it and we
decided to do an independent analysis.
Q Did you find that Dr. Engle's analysis was
probative on the issue of whether or not poultry litter 4:14PM
has the potential for runoff in the IRW?
A I would have to go back and review Dr. Engle's
report.
Q On Page 2-10, the bottom paragraph, would you read
that paragraph, please, almost the last sentence? 4:14PM
A "Dr. Olsen uses the SPLP study to compare the
leaching potential of poultry litter and cattle manure.
However, this study is not relevant to what happens
when it rains on fields containing poultry litter or
cattle manure because it was conducted on samples" -- 4:15PM

and missing a word there -- "samples of poultry litter 4:15PM
or cattle manure and not on amended soil samples."
Q What do you mean by that statement, sir?
A That when you apply poultry litter or cattle
manure to a field, the behavior of that and the ability 4:15PM
of constituents in that to run off that field depend
upon the interaction between the manure and the other
constituents present, the soil and the grass and
whatever else is there, and so that by simply looking
at manure samples in a laboratory experiment you really 4:16PM
are not looking at a situation that's relevant to the
environment.
Q So you wouldn't use SPLP samples to determine use
of comparison as to whether or not you can find a waste
signature of poultry in the environment? 4:16PM
MS. COLLINS: Object to form.
A I would not.
Q When you do your water extractable phosphorus, do
you do an evaluation of what happens to the manure as
it is applied to soils and the grass and the soil and 4:16PM
see if that has an impact?
A No.
Q So when you do your WAP analysis, aren't you
subjecting yourself to the same criticism you raised
with SPLP at 2-10? 4:17PM

A I think not. 4:17PM
Q Why not?
A Because there's a fair amount of literature that
says that the runoff of phosphorus from fields to which
these have been applied correlate with the water 4:17PM
extractable phosphorus in these things and so water
extractable phosphorus appears to be a reasonable
metric of potential phosphorus loss.
Q So you're saying that water extractable
phosphorus -- there's been a lot of studies that 4:17PM
evaluated that quotient with runoff of fields in the
environment?
A Yes.
Q And so what studies are those that you're
referring to? 4:17PM
A I have references here. I don't recall them
particularly off the top of my head.
Q Do they look at poultry litter in these studies?
A Yes.
Q And they found that poultry litter tended to run 4:17PM
off of fields because of this water extractable
phosphorus?
A Well, that the amount of poultry litter that ran
off the field was related to the amount of water
extractable phosphorus in the poultry litter. 4:18PM

Q Okay. Do you remember what the quotients of 4:18PM
phosphorus in the litter was found to run off in those
studies?
A Not off the top of my head, no.
Q Was it more than ten percent of phosphorus? 4:18PM
A I don't remember the number so I don't want to
guess.
Q You don't know?
A No.
Q Was it a substantial portion of the phosphorus? 4:18PM
A Yes, but I don't remember a percentage.
Q Let's go to Page 212, the bottom of the first
paragraph, where it starts, "He found." Would you read
that, please, sir?
A "He found that the time elapsed between litter 4:18PM
application and rainfall significantly affect the
runoff concentration of nutrients and recommended
avoiding litter application during periods of high
rainfall intensity. This recommendation is one of the
current United States Department of Agriculture best 4:19PM
practices for poultry litter application."
Q Okay. When you refer to "he," you're referring to
Dr. Sharply?
A Yes.
Q Okay. So do you understand what the term B-M-P 4:19PM

means or best management practices? 4:19PM
A Yes.
Q What are they?
A Specific to poultry litter?
Q Yes, sir. 4:19PM
A I'm not completely familiar with best management
practices for poultry litter, but --
Q Okay. Well, let's just step back. What would
they generally be? What would be a general definition
of a best management practice over or above poultry 4:19PM
litter?
A Best management practices would be to control the
way in which you apply something so as to minimize loss
and generation of pollution. So, for example, you
might require buffer strips that would say that I can't 4:20PM
apply within a certain distance of the edge of my
field, so I can use the edge as a buffer strip to catch
any pollutants that might be running off. So that
would be an example of a best management practice.
Q Have you done any evaluation as to whether or not 4:20PM
BMPs are applied in the IRW?
A I have not.
Q So you don't know whether they're applied or not?
A I would assume they are, but I don't know.
Q Sharpley recommends avoiding applying poultry 4:20PM

litter during periods of high rainfall probability; is 4:20PM
that correct?
A Yes.
Q Is it your understanding that it rains a lot on
the IRW in the spring? 4:21PM
MR. ELROD: Object to form.
A It's my understanding that rainfall occurs more
frequently in the spring than in other seasons.
Q Is it also your understanding that the -- one of
the major principal times of applying poultry litter in 4:21PM
the IRW is during the spring period?
MR. TODD: Objection, asked and answered.
A Late winter and into spring is my understanding.
Q How would a farmer determine whether or not there
was going to be a rainfall probability? 4:21PM
A From weather reports.
Q Get a weather report? Is that how you determine
high probability is weather reports?
A That's how I would go about it.
Q You'd take those to Vegas with your other 4:21PM
information and do bets on that?
MR. TODD: Objection.
MR. PAGE: I'll withdraw that question.
Q You mentioned Vegas first. Okay. Let's go to
Page 214 of your report, please. Tables 2.1 and 2.2. 4:22PM

I'd like to ask you a few questions about that. 4:22PM
A Yes.
Q On Table 2.1, what is the annual tons of water
extractable phosphorus contributed by poultry in your
analysis? 4:22PM
A 1301.
Q And how does that compare to non-poultry?
A Well, the non-poultry here -- shown here are just
cattle and swine and that's 2,180.
Q And what is the source of this information? 4:22PM
A There are various sources of this information.
The annual manure contribution in tons comes from the
expert report of Billy Clay. The amount of dry matter
comes from Dr. Olsen, at least for cow. And the wet
concentration, the water extractable phosphorus 4:23PM
content, comes from Kleinman.
Q Okay. My calculation indicated that poultry water
extractable phosphorus, using your numbers here from
Clay, would be about 37 percent of -- of the
contribution from other sources? 4:23PM
A Okay.
Q Would you agree that's a significant portion --
MR. TODD: Object to form.
Q -- of water extractable phosphorus?
A Significant? 4:23PM

Q Well, I think I said this wrong. 4:23PM
A My calculations indicate that 37 percent of the total water extractable phosphorus, yes.
Q Would you characterize 37 percent as a substantive or significant portion of water extractable phosphorus 4:24PM among the manures you mentioned here?
MR. TODD: Object to form.
A Yes.
Q And, too, on Table 2.2 would you tell us how that data is different than Table 2.1? 4:24PM
A The dry matter numbers come from Kleinman as opposed from Dr. Olsen, so there is a change there and the water extractable phosphorus comes from Kleinman rather than Dr. Olsen.
Q Okay. And what is the percentages of poultry 4:24PM compared to non-poultry there?
A They're close to being equal, non-poultry is slightly higher.
Q Would you characterize the poultry quotient as being substantial? 4:25PM
A A substantial fraction of the total here, yes.
Q Have you seen any evaluation as to whether or not the cattle that distributed to -- excuse me, the phosphorus that's attributed to cattle originates with cattle or simply is recycled as poultry waste? 4:25PM

A I'm not sure I understand that question. 4:25PM
Q Let me try to restate it.
Have you seen any analysis with regard to phosphorus contributions in the IRW that indicates that the cattle contribution should be ignored as a 4:25PM separate source because they're essentially recycling the phosphorus that's there from either poultry or commercial fertilizers?
A If I remember correctly, I read something like that, I think, in Megan Smith's report. 4:26PM
Q Okay. Let me hand you what has been marked as Exhibit No. 11 to your deposition, sir, and tell me if you've had a chance to review this paper in the past?
A I have not.
Q Okay. Would you read the first sentence of the 4:26PM abstract, please?
A "Knowledge of the balance between nutrient inputs and removals is required to identify regions that possess an excess or deficit of nutrients."
Q Okay. Can we turn to Page 1608, sir? By the way 4:26PM where are these researchers located?
A In Fayetteville.
Q At the University of Arkansas?
A University of Arkansas.
Q Thank you, sir. Turn to Page 1608 underneath 4:27PM

Nutrient Influx to Cattle Agricultural Source. 4:27PM
A Mm-hmm.
Q About a third of the way down that column it begins, "Nutrients contained in beef cattle." Would you read that for the record, please? 4:27PM
A "Nutrients contained in beef cattle manure were ignored in nutrient source estimates since a large portion of these nutrients are obtained from the forage and deposited directly, i.e., recycled to pastures during grazing rather than collecting them in lagoons 4:27PM or stockpiled from confined cattle operations."
Q Do you have any basis to disagree with the researchers' conclusion in that regard?
A Without reading and understanding this full article, I'm not sure that I can agree or disagree to, 4:28PM you know, what they're doing.
Q Does it make sense to you that -- that this -- they're counting the beef or cattle contributions as phosphorus as part of either commercial fertilizer or poultry because they do not incorporate into the 4:28PM watershed of feed -- substantial amount of feeds with phosphorus contributions in them, so that the phosphorus that they are depositing is, basically, phosphorus that was part of plants that were grown from either poultry or commercial fertilizers? 4:28PM

MR. TODD: Object to form. 4:28PM
A To the extent that -- that they are doing some sort of a balance here, a mass balance here, then perhaps it makes some sense to do what they've done, but for the issues at hand here, that doesn't seem to 4:29PM be the right approach.
Q Why wouldn't that be important to you to consider in your mass balance that you set forth here in pages -- on Tables 2.1 and 2.2?
A Because the phosphorus that's in the plants is not 4:29PM likely to wind up in the Illinois River and Lake Tenkiller, except for the fact that it's been processed through the cattle and put down in a form that allows some of it to run off the field. So -- so to the extent that we're talking about runoff from the field, 4:29PM and, again, I'm distinguishing runoff from the field from what gets into the lake and the river because there's a big step there. But in terms of what runs off the field, the cattle seem to be important because without the cattle a lot of that phosphorus would never 4:30PM have the opportunity to run off the field because it's tied up in the ground.
Q So are you suggesting that cattle manure does run off of fields?
MR. TODD: Object to the form. 4:30PM

A No, I'm suggesting that we've converted the 4:30PM
phosphorus to a form that's more easily available to
run off the field than the form it would exist in as
part of a grass.
Q Where did the P in grass come from, though, based 4:30PM
on Dr. Sleighton's analysis?
A I don't see where he says that.
Q Well, on 1608 where we just read.
A I'm trying to look at that and understand. I'm
confused at this point. 4:31PM
Q Let's go to Page 1614. Would you look at the
first column, middle paragraph says "the results of
this assessment"?
A "The results of this assessment may help reinforce
the thought that current nutrient application 4:31PM
strategies in Western Arkansas are not sustainable
without the danger of creating and/or exacerbating
water quality issues from excess of nutrients."
Q Have you seen any other studies in addition to
this one that suggest that current practices of 4:32PM
nutrient applications in Western Arkansas are not
sustainable in these areas?
A Not that I recall.
Q Would you read the next section, please?
A "Transport of excessive N & P contained in poultry 4:32PM

litter outside of the Central and Western Arkansas 4:32PM
districts that have restricted land area available for
nutrient application is needed if the current poultry
production levels are to be maintained."
Q Do you agree with that statement, sir? 4:32PM
A Not necessarily, no.
Q Do you have a basis for disagreement?
A I don't understand what these gentlemen have done
and so I can't comment one way or the other.
Q Do you know whether or not Benton and Washington 4:33PM
counties in Arkansas are considered nutrient surplus?
A I understand that they are.
Q And what is your basis for that?
A Just conversations.
Q What is a nutrient surplus area? 4:33PM
A Where the concentration in the soil is higher than
necessary to grow the grass.
Q Does that indicate that you should cease addition
of those nutrients to those soils?
A Not necessarily. 4:33PM
Q Do you know whether or not continued increase of
nutrients to such soils where there have been a
nutrient surplus exacerbates water quality problems in
those areas?
A I'm not aware of any studies that show that. 4:34PM

Q Are you aware of the study by Dr. Sharpley that 4:34PM
shows that increased nutrient, including poultry litter
application to soils, increases the phosphorus
concentration and runoff from those soils?
A Yes. 4:34PM
Q Okay. So doesn't that indicate that when you have
a nutrient surplus area, such as Washington and Benton
counties, that additional nutrient applications have
the potential to exacerbate water quality problems in
those areas? 4:34PM
MR. TODD: Object to form.
A I have seen no evidence in the data that I've
looked at that there are water quality problems in the
IRW that are tied back to poultry litter and,
therefore, any additional poultry litter would 4:35PM
exacerbate water quality problems.
Q Have you seen any injuries to the aesthetics of
the IRW in your evaluation?
A Some minor things in the river and in the -- some
in the riverine portion of the lake. 4:35PM
Q What are those minor things that you observed?
A Looking at the data collected by Dr. Stevenson,
there are occasionally concentrations of benthic algae
at levels that might be aesthetically displeasing.
Q What do you mean by "occasionally"? 4:35PM

A At a few locations. 4:35PM
Q Would 20 percent be occasionally? Twenty percent
locations?
A Twenty percent is 20 percent, I don't think we
have to describe it. I'm saying occasionally thinking 4:35PM
these had two years' worth of data. The first year I
think there was one or two and then the second year
there were five or ten out of something like 60 or 70
locations.
Q And Dr. Stevenson attributed those areas of 4:36PM
benthic algae growth to poultry?
A He did but I disagree with his analysis.
Q Prior to this work in this case, have you done any
nutrient evaluations of rivers with regard to benthic
algal growth? 4:36PM
A As part of my teaching I taught the development of
models relating nutrients to benthic algal growth, but
I've not been involved in a project such as this that
is looking at it.
Q Why did you choose to look at water extractable P 4:37PM
when you did your evaluation in Section 2.5?
A Because of the literature that indicated that
water extractable phosphorus was the best measure of
phosphorus runoff from litter applied fields or from
cattle fields. 4:37PM

Q And did that literature conclude that -- that there was phosphorus runoff from those fields? 4:37PM
A Yes.
Q Isn't it possible that particulate P will also run off from those fields? 4:37PM
A Yes.
Q And isn't it possible that particulate P could also undergo mineralization or other processes that would allow it to be available to algae in those rivers or streams? 4:38PM
MR. TODD: Object to form.
A Yes.
Q Let's look at Section 2.6 of your report, sir. Would you read that title, sir?
A "Poultry litter does not produce more phosphorus runoff than other applied fertilizers." 4:38PM
Q Would you read the last paragraph of this report, sir, and tell us whether that summarizes what you're saying in the section?
A The last paragraph of this section? 4:38PM
Q I'm sorry. Did I say report? Excuse me, section.
A "From the studies summarized in the previous paragraphs, it can be concluded that the potential runoff from the fertilized field will depend on many variables, like soil characteristics, field management, 4:39PM

rate, and history of application, et cetera. 4:39PM
Therefore, it is erroneous to generalize that a certain fertilizer generates a greater or bigger impact than others as they all have potentially the same impact if the application meets best management practices." 4:39PM
Q Would you explain what you mean by that statement, sir?
A That the data from studies that have looked at various types of fertilization using poultry litter, using commercial fertilizers, et cetera, have shown 4:39PM runoff in all cases, has shown different amounts of runoff, depending upon the study, has shown that the amount of runoff depends upon lots of factors. And that given all of the variability among these studies, there's no clear smoking gun that says, well, this 4:40PM fertilizer is clearly much worse than this fertilizer in terms of potential for phosphorus loss.
Q Okay. But the studies you do cite concerning evaluations of fields in which poultry litter or manure has been applied, do all these studies conclude that P 4:40PM runs off when fields have poultry litter or waste that has been applied?
A All of the studies that we looked at do measure phosphorus coming off field -- fertilized fields.
Q Are the concentrations substantial as compared to 4:40PM

reference fields? 4:40PM
A Yes.
Q Have you identified any study where poultry waste had been applied where phosphorus did not run off the field? 4:40PM
A Not that I recall.
Q Okay. The last -- the sentence we just looked at, it's -- you see -- indicate on the last paragraph of this section on Page 2.16 that it's erroneous to generalize, that's correct? 4:41PM
A Yes.
Q Okay. If you were going to go about an evaluation of two different potential fertilizers or manures being applied to determine which had the bigger impact, what factors would you consider? 4:41PM
A The application rate, how much fertilizer I was putting down. The form of the fertilizer, how much of the phosphorus was water extractable from that.
Q Would you also look at concentrations on the runoff? 4:42PM
A Yes, yes, look at concentrations in the runoff.
MR. ELROD: Were you through with all the things you were going to look at, what you were looking at?
A I was also going to say that you would also look 4:42PM

at the nature of the soil where you were doing the 4:42PM application, the type of ground cover that was there, the slope, for example.
Q Okay. If it's true that two fertilizers have the same runoff concentrations in a similar field, is the 4:42PM most important factor determining the impact the total amounts of phosphorus used?
A I'm not sure I followed that.
Q Ah, I misstated.
If there's two fertilizers that have the 4:43PM same runoff concentrations --
A Yes.
Q -- applied to the same kind of fields and soil conditions, would the most important factor in determining the impact of runoff, would be the amount 4:43PM of the fertilizer used?
A I'm confused by the question because you're saying both have the same concentration in the runoff.
Q Right.
A Wouldn't that make them equivalent? 4:43PM
Q Right. So the question whether or not is going to impact, let's say, a watershed, would you then look at the amount of each fertilizer used in that watershed?
A On a watershed, you're extrapolating from the field to a watershed? 4:43PM

Q Yeah. **4:43PM**
A It's difficult to extrapolate from a single field to the watershed because it would depend where in the watershed the different fertilizers were used and what were the conditions at those locations again in terms 4:44PM of what kind of soil, what kind of cover, slope, you know, rainfall patterns in that part of the watershed, et cetera, so it would be hard to generalize.
Q Do you know how much of the fertilizer used in the IRW -- or the Total P used in the IRW is in the form of **4:44PM** **a commercial inorganic fertilizer?**
A I do not.
Q Look back to the Sleighton paper again.
MR. TODD: What exhibit?
Q The Sleighton paper is Exhibit No. 11. **4:44PM**
A Mm-hmm.
Q Okay. The area for Benton and Washington counties, as shown on Page 1607, is area No. 1, do you see that?
A Yes. 4:45PM
Q Would you look with me then on Table 3 on Page 1610 and tell us what the quotient of nutrient inputs of phosphorus is as related to commercial fertilizers?
A Percentage of total. If I'm reading this correctly, it's 18 percent. 4:45PM

Q Okay. So does that indicate then that the balance **4:45PM** **of the phosphorus inputs in Benton and Washington Counties come from other than phosphorus that's applied in commercial fertilizers?**
A That's apparently what this table is indicating, 4:45PM yes.
Q So that would be manures, correct?
A Perhaps. I don't know that for a fact.
Q Do you know of any other source of phosphorus other than commercial or manure applications? **4:46PM**
A No. There could be, for example, biosolids or something that was used as a fertilizer.
Q I don't know if I've asked you this already, but do past applications of phosphorus on a particular field influence phosphorus runoff, so that is there a **4:46PM** **portion of the runoff that increases due to multiple applications over time?**
MR. TODD: Object to form.
A That would depend very much on variables like the frequency of application, again, the nature of 4:47PM application, the soil type, et cetera.
Q Do you know of any studies by Dr. Sharpley indicating that phosphorus runoff tends to increase on fields where there have been multiple past applications? That is, there's a greater increase of **4:47PM**

runoff as applications increase to that field? **4:47PM**
A I have a vague recollection. I've read many of Dr. Sharply's articles and that doesn't ring a bell, but I don't remember precisely.
Q Do you know how long poultry waste has been **4:47PM** **applied to fields in the IRW?**
A I do not.
Q Did you do any review of phosphorus levels in the fields where poultry waste has been applied in the IRW?
A No. 4:48PM
MR. PAGE: Let's take our break.
THE VIDEOGRAPHER: We are now off the record. The time is 4:48 p.m.
(Whereupon, the deposition was concluded at 4:48 p.m.)

SIGNATURE PAGE

I, John Patrick Connolly, do hereby certify that the foregoing deposition was presented to me by Marlene Percefull 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.

_____
John Patrick Connolly

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, Marlene Percefull, 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 241 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 ____ day of May, 2009.

_____
Marlene Percefull, CSR
CSR No. 01818

CORRECTIONS TO THE DEPOSITION OF JOHN PATRICK CONNOLLY, VOL I

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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.	)No. 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

- -

VOLUME II VIDEOTAPED DEPOSITION OF JOHN PATRICK CONNOLLY, produced as a witness on behalf of the State, in the above styled and numbered cause, taken on the 9th day of April, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Marlene Percefull, Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

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Opveon, Jason Weitholter

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(Whereupon, the deposition began at 8:59 a.m.)

THE VIDEOGRAPHER: We are now on the record for Volume II of the deposition of John Connolly. Today is April 9, 2009. The time is 8:59 a.m. Would 8:59AM counsel please identify themselves for the record?

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

MR. TODD: Gordon Todd for the Tyson Company defendants. 8:59AM

MR. BASSETT: Woody Bassett for the George's defendants.

MS. BRONSON: Vicky Bronson.

THE VIDEOGRAPHER: And on the phone?

MS. COLLINS: Melissa Collins for the Cargill 8:59AM defendants.

THE VIDEOGRAPHER: Thank you.

JOHN PATRICK CONNOLLY,

having first been duly sworn to testify the truth, the whole truth and nothing but the truth, testified as 8:59AM follows:

CONTINUED DIRECT EXAMINATION

BY MR. PAGE:

Q Good morning, Dr. Connolly.

A Good morning. 9:00AM

Q You know that you're still under oath this 9:00AM morning?

A Yes, I do.

Q Okay, thank you. Have you reviewed the levels of poultry production in the IRW? 9:00AM

A No.

Q Do you know whether or not they've increased since the closure of Tenkiller Dam?

A I do.

Q And what do you know about that? 9:00AM

A That they have increased over time.

Q Do you know what the level of the increase has been?

A I don't recall.

Q Do you recall it to be substantial? 9:00AM

A Yes.

Q I want to talk about Section 2.7 of your report regarding the cesium and lead 210 analysis, the sediments. Can you explain how you understand cesium-137 accumulated in Lake Tenkiller sediments? 9:01AM What's the process of the accumulation?

A Cesium-137 is present in the sediments because it absorbed onto settling particles that deposited on the bottom of the reservoir and remained there.

Q Okay. And was there a particular event in time 9:01AM

that caused the cesium-137 to be in the environment so 9:01AM
that it could travel to Lake Tenkiller sediments?
A Yes, cesium-137 is a fallout radioactive substance
associated with atmospheric bomb testing.
Q And when was that? 9:01AM
A Began that in approximately 1954 and peaked in
approximately 1963.
Q Okay. So is the idea -- well, then let me ask
this question: So then is it that cesium is in the
atmosphere and then it eventually gets into the soils, 9:02AM
is that correct? What's the transport from the bomb
being ignited to Tenkiller sediments?
A The cesium-137 is present in the atmosphere and
when it rains, cesium-137 comes down with the rain
precipitation to the ground surface and also to the 9:02AM
water surface and some of it that directly hits the
water surface winds up in the sediment, but also it's
absorbed onto sediment particles or soil particles in
the watershed that run off and then deposit it in the
reservoir. 9:02AM
Q Is there any significance in the 1963 date when
you do cesium-137 analysis for HD?
A Yes. The 1963 date is presumed to be the date
when you expect to see the maximum cesium-137 activity.
Q And does that always occur in lake sediments? 9:03AM

A Within a year or so. It's not always exactly 9:03AM
1963, but it's in the neighborhood of 1963.
Q So in your experience and on research papers you
have reviewed, they have all found that the cesium peak
in the sediments is usually associated at 1963? 9:03AM
A Not exactly necessarily 1963, but approximately
1963.
Q And how is that 1963 -- is there any other
support -- strike that.
Is there anything that could delay the 9:03AM
transport of the cesium to lake sediments so that
you wouldn't see those cesium peek sediments being
deposited in 1963?
A I don't follow your question.
Q Well, my understanding is, if I understand your 9:04AM
process discussion, is that the most of the cesium was
in the atmosphere in 1963, so the presumption is that I
guess it would precipitate out of the atmosphere onto
the ground of a watershed and then those waters would
then transport -- or those particulates transport in 9:04AM
those waters to the sediments all in the same year and
is there anything that would delay the transport so
that the peek in the sediments might actually be a
result of a later year?
MR. TODD: Object to form. 9:04AM

Q Do you understand my question? 9:04AM
A I think so.
Q If you want to restate what you think I'm asking
that might about helpful.
A I think what you're asking me is are there any 9:05AM
processes that would occur that would cause the peek to
be delayed so that it wouldn't appear in 1963.
Q Yes, sir, in the sediment of a particular lake or
reservoir?
A The peek deposition occurs in 1963, so the highest 9:05AM
concentration --
Q From the atmosphere?
A -- from the atmosphere raining down on the
watershed occurs in 1963. Typically, the runoff in
that year would contain the highest cesium-137. If 9:05AM
that happened to be a fairly dry year, not a lot of
runoff, the subsequent year had much more intense rain
that caused much more erosion, perhaps you could delay
the peek a little.
Q Are there any factors other than the quantity of a 9:06AM
rainfall that would delay the cesium transport to the
sediments in 1963?
A None that I can think of at this point.
Q Okay. How does lead 210 accumulate in lake
sediments? 9:06AM

A Lead-210 is present in lake sediments from two 9:06AM
sources. There is natural uranium in soil particles
that is decaying and lead-210 is part of the decay
series, so there is lead-210 naturally associated with
soil particles. In addition, part of the uranium decay 9:07AM
series is the production of radon gas and radon gas
will move from the soil to the atmosphere. Decay in
the atmosphere form lead-210 that rains down similar to
the way the cesium-137 rains down and provides an
additional source of lead-210 that absorbs onto the 9:07AM
surface of the settling particles so the particles that
enter the sediment have both of those sources of
lead-210.
Q So how does lead-210 then help us identify the age
of a particular sediment that the particularly measured 9:07AM
lead is associated with?
A The lead-210 that's associated with the uranium
that is part of the particle provides no help to us.
It is the excess lead-210 that absorbed onto the
particle as it was settling to the bottom that provides 9:08AM
the marker because that lead-210 is what is called
unsupported lead-210. In other words, there's no
uranium that's producing that lead-210, it's simply the
lead-210 that was absorbed and it is decaying away over
time. And by looking at the activity of lead-210 in 9:08AM

the sediment and knowing that that activity will be cut 9:08AM
in half approximately every 23 years allows you to
attempt to date the sediment based upon its activity
relative to the activity it likely had when it first
deposited. 9:08AM
Q So you kind of look at the decay rate of the
lead-210, unsupported by uranium?
A You look at the concentration -- I'm sorry, the
activity of the lead-210.
Q Okay. And that activity changes because it decays 9:09AM
over time, is that correct?
A Yes.
Q Is one method, that is the cesium-137 versus the
lead-210, more accurate than the other?
A They're independent measures that typically you 9:09AM
would use together. In some situations the lead-210
data give you a more accurate estimate. In our case,
the cesium gives you a more accurate estimate, but it's
typical with both of them to use them together as
methods to estimate age. 9:09AM
Q And when you did your analysis, did you do that?
A Yes.
Q You used them together?
A Yes.
Q Okay. And you used Dr. Fisher's data, correct? 9:10AM

A Yes. 9:10AM
Q Are you aware of any published articles that
suggest that lead-210 is the more precise measure for
age dating -- well, let's say -- let me strike that.
Do you know of any articles, published 9:10AM
articles, that suggest that lead-210 is the more
inherently accurate method of age dating sediments?
MR. TODD: Object to form.
A I recall articles that are on both sides of that
issue, but I don't recall any specific as I sit here. 9:10AM
Q So you said there's published articles on both
sides of that issue?
A I believe so, yes.
Q Actually, let's stay with this one. Sorry.
In your analysis, you primarily rely on 9:11AM
the cesium-137 data to suggest that there is no
relationship between phosphorus and Lake Tenkiller
sediments and the growth of the poultry industry in
the IRW?
MR. TODD: Object to form. 9:11AM
A I do not.
Q So how do you make that determination?
A Using in concert lead-210 and the cesium data.
Q Okay. And what is it about the data that
indicates to you that there's not an increase of 9:11AM

phosphorus over time in lake sediments? 9:12AM
A About what data?
Q The sediment age dating data. Is it not your
position that there has not been an increase in the
phosphorus concentrations in Lake Tenkiller over time? 9:12AM
A No.
Q Okay. Well, what is your point of Section 2.7?
A That there has been an increase over time that
appears to have reached a maximum sometime in the
1980s, early '90s, and since that time has been 9:12AM
relatively flat.
Q Okay. So since about 1990, it's been relatively
flat?
A More or less.
Q And do you do that analysis by discounting some of 9:12AM
the data? That is, by rejecting some of the data?
A Some of what data?
Q The age dating data?
A Are you referring to the lead-210 data?
Q Yes. 9:13AM
A Yes, we did not include all of the lead-210 data
in determining the sedimentation rates in the course.
Q By eliminating that data, you were then able to
conclude that there had been a leveling off at around
1990, is that correct? 9:13AM

A By using what we believe are -- or what I believe 9:13AM
is the best estimate of sedimentation rate, came to the
conclusion that the leveling off occurs in
approximately 1990.
Q Okay. And what was the basis for eliminating the 9:14AM
most recent lead-210 data? I think you might describe
that on, what, Figures 2-10a and b?
A On Figure 2-10a and 2-10b, there are certain data
points of lead-210 that have red circles around them.
Those data points were not included in the analysis of 9:14AM
deposition rate.
Q Okay. So the top figure is Lake Station No. 1,
correct?
A Yes.
Q That's in the deep custom zone? 9:15AM
A Yes.
Q Did you eliminate any of the data from that
analysis when you did your evaluation?
A For that sample -- let me just check the table in
here. For that sample, we did go through and look at 9:15AM
whether including or excluding that first surface
sample allowed us to achieve a reasonable deposition
rate and concluded that we could not reconcile the
lead-210 data regardless of whether we included or
excluded points here that we thought were appropriate 9:16AM

to or not appropriate to include. And for this core, 9:16AM
determined that cesium was the better tracer of
deposition than lead-210.
Q And what was the basis for that -- so you
eliminated all of the data, you just didn't say use 9:16AM
Core No. 1 at all, correct?
MR. TODD: Object to form.
A We did not use the lead-210 data to date that
core.
Q And what's your basis for that? 9:16AM
A In that sediment core, it was noted that the core
penetrated into native watershed soil that was present
prior to construction of the dam.
Q Yes.
A And so the interface between that soil and the 9:16AM
sediment on top of it we know to be 1954 when the
reservoir was first developed. The lead-210 data told
us that that -- those sediments were much younger than
1954, which was illogical.
Q Lead-210 data of what? 9:17AM
A These -- this lead-210 data gave us --
Q I'm sorry. The lead-210 data from the native
soils?
A No. The lead-210 data that you see in Figure
2-10a, looking at the decay of the lead-210 in that 9:17AM

core would suggest that the sediments deposited right 9:17AM
on top of the watershed soils were sediments that were
fairly young. I don't remember precisely, but they
were probably sediments in the late '70s or 1980 and
that was illogical. 9:18AM
Q Well, the activity in Lake Sed 1 at the depth of
the sediments is similar to Lake Sed 2, is it not? And
you see a progression of activity all the way up to the
top of the sediments. Do you not?
MR. TODD: Object to form. 9:18AM
A The activity at the bottom of these sediments is
similar, though not exactly the same, similar to Lake
Sed 2, but the activity at the surface is much higher
than we see in Lake Sed 2. As a result of that, when
you do the analysis, it says that there was a much 9:18AM
greater decay from the surface to the bottom and,
therefore, the ages that you get for these are very
different from each other.
Q Could it be that there could have been some
disturbance of the surface sediments in Lake Sed 2 so 9:19AM
that that could account for the difference?
A Possibly, but unlikely.
Q And what's your basis to say the disturbance of
Lake Sed 2 sediments at the top would be unlikely?
A The analysis that we did for Lake Sed 2 using the 9:19AM

lead-210 in the way in which we analyzed it said that 9:19AM
the sediments deposited near the bottom had an age that
made logical sense, it was late '50s, early '60s. It
was corroborated by the cesium-137 data, which said
those sediments are late '50s, early '60s, so we had 9:19AM
confidence in that data.
Q Okay. Did you eliminate any data from Lake Sed 2?
A Yes.
Q What data did you eliminate from Lake Sed 2?
A The data that you see with the circles around the 9:20AM
data points.
Q If you had eliminated that, would they more
closely match Lake Sed 1?
A No.
Q Why did you eliminate the lower data from Lake Sed 9:20AM
2?
A The lower data?
Q Yeah, the deeper data, the four you circled.
A Yes. Because as you see there's no longer a
decline, that there's some variability there but those 9:20AM
violate, in essence, the model that we are using. And
the model that we are using and the model that Dr.
Fisher used is that sedimentation is a layer cake
process and sediments are laid on top of each other
and, therefore, the sediments underneath are older and, 9:20AM

therefore, should have a lower lead-210. That doesn't 9:20AM
appear to be the case in the bottom here, whereas, it
is much more of the case in the midsection of this
core.
Q So what would account for the differences in 9:21AM
lead-210 or other areas?
A Our supposition is that these lower values for
lead-210 here reflect fairly rapid sedimentation that
probably occurred immediately after construction of the
dam so that they represent likely a different 9:21AM
sedimentation rate than the sedimentation rate
represented by the bulk of the data.
Q Okay. And what's your basis for that supposition?
A The basis for that supposition is the lack of a
consistent decline in lead-210 with depth. 9:21AM
Q Anything else? Any other basis?
A No, sir.
Q How come you didn't eliminate the data -- well,
did you also eliminate data at the upper end of the
Lake Sed 2? 9:22AM
A Yes.
Q Why was that?
A There's some mixing that can occur in surface
sediments that can cause vertical movement of sediments
in associated compounds, like lead-210. The model does 9:22AM

not account for that. And you can see we have that 9:22AM
initial drop but then it jumps back up and that jump
back up may be because of some vertical mixing of
recent sediments down several centimeters into the
core. And so that mixing is inconsistent with the 9:22AM
deposition model and has an effect on the deposition
rates that you would compute and we eliminated that
data because we didn't want to be confounded by surface
mixing effects.
Q Well, you eliminated data so you could match your 9:23AM
hypothesis that there has not been an increase in the
phosphorus since 1990?
MR. TODD: Objection, form.
Q If you leave that data in, wouldn't that be
contrary to your hypothesis that there's been a 9:23AM
leveling of phosphorus input in the lake since 1990?
MR. TODD: Object to form.
A The conclusion that there's been a leveling of
phosphorus in the lake segiments comes from the
phosphorus data, not from this data. This data makes 9:23AM
an estimation of over what time period that leveling
occurred, and whether or not you include these data
changes that date slightly but it doesn't change the
fact that for approximately one-third of the depth of
the cores there is no increase in phosphorus. 9:23AM

Q There's a couple other locations here on both the 9:23AM
data on Figure 2-10a, both for Lake Sed 1 and 2 which
appears to be this Z-shaped line?
A Mm-hmm.
Q Would you characterize as a mixing? Did you 9:24AM
eliminate those other locations also from the data?
A No.
Q Why not?
A The mixing is really restricted to, at most, about
the top ten centimeters of sediment. And so while we 9:24AM
have a reason to suspect that data near the surface may
not conform to the model, we have no equivalent
mechanistic reason for deeper data. And so absent a
mechanistic reason for not including the data, we did
not choose to exclude the data. 9:24AM
Q Couldn't that same mixing event have occurred in
those deeper sediments at the time they were deposited?
A There could have been some, yes.
Q So that could be the mechanism explanation, could
it not? 9:25AM
A Potentially.
Q But you did not eliminate those?
A I did not.
Q Lake Sed 3, did you eliminate data there?
A Again, the data with the red circles around the 9:25AM

points were all omitted. 9:25AM
Q Okay. But again, you selectively determined where
the mixing occurred and you didn't eliminate all points
in Lake Sed 3 where there was a jagged line showing a
change in radioactivity, right? 9:25AM
MR. TODD: Object to form.
A That is correct.
Q And why did you select certain points to
eliminate, not all the others?
A Again, for the reason that I just gave, that while 9:25AM
we are looking at this data in the surface, we felt
comfortable making the argument about mixing. We
didn't feel comfortable -- I didn't feel comfortable
taking that argument and selectively eliminating points
below largely because when we're looking at some of the 9:26AM
zigzags below, I would not know which of the points to
eliminate. It is much easier to make a reasoned
argument that surface data can be confounded by mixing,
so let's not include that surface data. The deeper
data may or may not have been influenced by that 9:26AM
mixing, I can't tell which points to exclude or include
so it would be very difficult to go into the middle of
that core and say I'm going to include or exclude
particular points.
Q Did you do a statistical test to see whether there 9:27AM

was not a consistent decline before you eliminated that 9:27AM
data?
A I don't think that would be a valid way to
evaluate this.
Q There is -- you could do a statistical trend test, 9:27AM
could you not?
A You could.
Q But you didn't do it?
A I wouldn't do it.
Q You just did a visual test? 9:27AM
A No.
Q You looked at data and you said, well, that
doesn't look like a trend anymore so it must be
invalid. That was your test, right?
A No. 9:27AM
Q What was your test to eliminate the data?
A I just described for you the way in which I went
about choosing what data to include or what data to
exclude.
Q And because the results visually didn't appear 9:27AM
that the activity declined consistently you eliminated
it, correct?
MR. TODD: Object to form.
A Yes.
Q And -- but there is a statistical trend test you 9:28AM

could have used to test your mechanism of elimination, 9:28AM
correct?
A There's insufficient data in the areas where we
made the decision to exclude data to conduct a
meaningful statistical test. 9:28AM
Q So the answer is you did not conduct a statistical
trend test on this data?
A No. My answer is that it would be inappropriate
to conduct a statistical test.
Q Because there wasn't sufficient data? 9:28AM
A Correct.
Q Any other reasons?
A No, sir.
Q Did you also claim that there is not a consistent
decline due to biological mixing? 9:29AM
A That's, I believe, what we've just been
discussing.
Q So I think it was a biological mixing that
occurred?
A It was mixing one of the mechanisms, one of which 9:29AM
is biological mixing.
Q What other mechanics would there be?
A The other mechanics would be mixing due to
physical forcing.
Q Are you saying both occurred or one or either or 9:29AM

do you know? 9:29AM
A Either or both.
Q You don't know?
A I don't know.
Q Have you determined what the level of 9:29AM
macroinvertebrate activity is in Lake Tenkiller?
A No.
Q Did you review that data that's collected by CDN
in the sediments in Lake Tenkiller?
A At one point I looked at it. 9:29AM
Q Did it show that there's very little
macroinvertebrate activity in Lake Tenkiller?
A I don't recall.
Q If the data did show there's very little
macroinvertebrate activity in Lake Tenkiller, would 9:30AM
that tend to suggest that there's not biological mixing
going on with these sediments?
A Not necessarily.
Q What would account for the biological mixing if
you did not have macroinvertebrates in the sediments? 9:30AM
A That's different than what you just asked in the
previous question.
Q Well, I didn't mean them to be different so maybe
I didn't say them very clearly. What I'm saying is
that if there isn't a lot of macroinvertebrate activity 9:30AM

sediments in Lake Tenkiller, what would account for any 9:30AM
biological mixing?
A The macroinvertebrates that are there.
Q So just a couple of insects will do the sufficient
mixing of the sediments? 9:31AM
MR. TODD: Object to form.
A A couple of insects in the entire lake.
Q Did you review the data that shows there,
essentially there's no macro-organisms present in
sediments in Lake Tenkiller? 9:31AM
MR. TODD: Object to form.
A I don't recall data that said there was no
activity in sediments.
Q Okay. Can you point to any published literature
where they eliminated lead-210 data based on a lack of 9:31AM
constant trends?
A I would have to go back and review literature.
Q At this point you can't?
A Not as I sit here.
Q And so is it your practice, Doctor, to go ahead 9:31AM
and eliminate data without statistical tests because
you don't see a trend visually?
MR. TODD: Object to form.
A No.
Q On Page 219, you talk about proper normalization 9:32AM

of sediment phosphorus concentrations. Do you see 9:32AM
that, sir?
A Yes, I do.
Q Can you explain to me what you mean by that?
A The phosphorus concentration on sediment particles 9:32AM
can change for multiple reasons. It can change because
one particle was exposed to more phosphorus than
another. It can change because the nature of one
particle is different than the other. And our
objective here is to understand differences that are 9:33AM
due to one particle seeing more phosphorus than another
particle as opposed to one particle having more
phosphorus simply because of the nature of the particle
itself independent of the source.
Q So you're suggesting that -- so why did you do 9:33AM
normalization in this case?
A For the reason I just explained.
Q Okay. And when you did normalization then it
supported your hypothesis that there has not been an
increase since 1990, correct? 9:33AM
A I did not develop a hypothesis that said that
there was no increase since 1990. I did an objective
analysis of the data and at the end of that objective
analysis, looked at the result and drew conclusions
from the result. I did not develop a hypothesis and 9:34AM

then analyze the data to evaluate. 9:34AM
Q Was this scientific method typically developing a hypothesis and then testing it?
A Not necessarily.
Q So you didn't use that method in your work in this case? 9:34AM
A That's not what I'm saying. What I used is an investigative technique that says I'm not sure yet what hypothesis to form, let the data guide me. And the proper application, scientific method, is to use 9:34AM information to generate hypotheses. Hypotheses are not grabbed out of the air. Someone does data analysis, they look at the data, they form a hypothesis from that analysis. It's called hypothesis generation. And then look at ways to evaluate that hypothesis. 9:35AM
Q Did you find in your evaluation that the phosphorus in Lake Tenkiller sediments was strongly associated with iron and aluminum?
A Yes.
Q And how was that important? 9:35AM
A That is important because if I'm looking at a sediment with a high iron and aluminum content, it will have more phosphorus than another sediment with a low iron and aluminum content regardless of whether those two sediments were exposed to the same anthropogenic 9:35AM

sources of phosphorus. 9:35AM
Q Okay. Is it possible that the iron and aluminum that you see associated with the phosphorus in Lake Tenkiller sediments was part of the poultry waste that was spread on the land? 9:36AM
A Not to any significance, no.
Q And what's your basis for that conclusion?
A That the relationship between phosphorus and iron and aluminum in poultry litter looks nothing like the relationship between phosphorus and iron and aluminum 9:36AM seen in environmental samples.
Q And what's your basis for that statement?
A The data analysis conducted in the report.
Q What data? Did you actually look at the phosphorus and aluminum and iron, a composition of 9:36AM poultry litter?
A Yes.
MR. TODD: Object to form.
Q Did you look at the phosphorus, aluminum and iron content of runoff in poultry litter applied fields? 9:36AM
A I was looking at solid samples, so I would not have looked at a runoff sample.
Q Well, if we're looking to see whether that's been impacted by poultry waste land application in the IRW, wouldn't you want to look at the runoff quotients of -- 9:37AM

shown in poultry litter rather than just the solids to 9:37AM see whether or not there's a high level of aluminum and iron associated with phosphorus runoff in poultry as compared to runoff in non-poultry applied fields?
MR. TODD: Object to form. 9:37AM
A No.
Q Why not?
A Because what we might see in the dissolved phase in the runoff is not what we're seeing on the particles and it's the particles that are settling on the bottom 9:37AM of the stream and the lake.
Q Well, if it's the dissolved phase that runs off, won't that attach to the particles after it runs off?
A Not to any significant extent.
Q What's your basis for that statement? 9:38AM
A There's more or less an equilibrium between what's dissolved and what's on the particles with regard to iron and aluminum, so --
Q Do you know whether or not poultry waste runoff has substantial phosphorus, iron and aluminum together, 9:38AM it's not seen in reference soils?
A I believe it does.
Q And isn't that important to your analysis of lake segiments?
A No. 9:38AM

Q Why not? 9:38AM
A Because that dissolved iron and aluminum is insignificant relative to the particulate iron and aluminum.
Q What's the highest level of phosphorus in Lake 9:38AM Tenkiller sediments?
A I don't remember precisely.
Q I will hand you what is marked as Exhibit 13 and those are notes I scribbled on the top and those are my notes. Otherwise, this is a figure taken from 9:39AM Dr. Fisher's report. Do you recognize it, sir?
A Yes.
Q What does it show the highest level of phosphorus to be in Lake Tenkiller sediments?
A Approximately 1,700 milligrams per kilogram. 9:40AM
Q Okay. And how does that compare to background levels of phosphorus?
A It is considerably greater. Background levels are on the order of 300 to 400.
Q So if there wasn't an anthropogenic source of 9:40AM phosphorus, would you expect to see this level of phosphorus in Tenkiller sediments, that is 1,600, 1,700 milligrams per kilogram?
A No.
Q So how do you account for this increase of 9:40AM

phosphorus in Tenkiller sediments that's five to six 9:40AM
fold over time?
A A good part of that increase appears to be
associated with the nature of the material that's
depositing in the sediment, so that there's higher iron 9:41AM
and aluminum content in general in some of these later
years than in the early years. And in addition, there
are additional sources of phosphorus, anthropogenic
sources of phosphorus that are contributing.
Q Well, there's a substantial amount of iron and 9:41AM
aluminum that run off the fields as tests have shown
from poultry litter land applied fields, is there not?
MR. TODD: Object to form.
A There is iron and aluminum in the samples that
were measured at edge of field. 9:41AM
Q And it's higher than the reference samples you
evaluated, correct?
A I would have to go back and check.
Q Do you know of any natural soils in the IRW -- or
do you know of any soils in the IRW that have 9:42AM
phosphorus levels close to 1,600 milligrams per
kilogram?
A No.
Q Have you seen any of the data where poultry litter
that's been applied for many years where it shows the 9:42AM

phosphorus levels four, five and even six times higher 9:42AM
than background?
A Yes.
Q So wouldn't those soils be some soils that are in
the IRW that have levels equivalent to the highest 9:42AM
level seen in Lake Tenkiller?
A I don't remember what the number is precisely,
so -- so I can't do that comparison in my head.
Q When you say there's been a drop since 1990, are
you using the data that's shown on Exhibit 13 that 9:43AM
shows the peek of what looks like around 1995 and then
a little bit lower after that in 2002-2005?
A I don't know what data is represented by each one
of these points. There's no identification, so I
cannot say. 9:43AM
Q Well, it says Tenkiller sediment data points?
A Yes, but it doesn't say which cores. I can't tell
which cores I'm looking at.
Q Okay. Well, did you -- so you didn't use this
exhibit from Dr. Fisher's analysis to determine whether 9:43AM
or not there had been a drop off since 1995?
MR. TODD: Object to form.
A You just asked me if I had used this figure as the
basis for that conclusion?
Q Yes. 9:44AM

A No. 9:44AM
Q Okay. Did this figure support or refute your
conclusion?
A This figure, in my view, obfuscates things and is
not useful for trend analysis at all. 9:44AM
Q How much has the phosphorus level declined since
1990 in Lake Tenkiller sediments from what phosphorus
level to what -- by looking at concentrations?
A Again, I cannot use this figure to do that.
Q Okay. Well, I want you to use whatever you used 9:44AM
to base your opinion on that phosphorus in sediments
have declined since 1990 and I want to know what the
difference in concentrations are, if you can tell me
that, sir? If you can refer to me where you're looking
in your report? 9:45AM
A Yes. I'm looking at the Figure 2-14 of the
report.
Q Yes, sir.
A And I'm looking at the phosphorus normalized to
show iron and aluminum. And if you look at Lake Sed 4, 9:45AM
the first column here and at the lower panel,
concentrations peak at a depth of about 30 centimeters
at a level of about .035 milligrams of phosphorus and
milligrams of aluminum with apparently a slight decline
over time to levels in the most recent sediments of 9:46AM

about 1.031. 9:46AM
Q What data are you looking at, sir?
A This panel.
Q So that's a ratio? Does that tell us total
concentrations? 9:46AM
A It's the normalized concentrations.
Q Okay. What's the total concentration of
phosphorus --
A Okay -- from.
Q -- comparing it from, let's say, 1990 to recent 9:46AM
years?
A Okay. In the same core, if you look, the peak in
total also occurs at about 30 centimeters and it's
about 1,500 parts per million of phosphorus. The most
recent sample at the surface of the sediment is below 9:46AM
600 parts per million.
Q And what about -- and that's the riverine portion
of the lake where there's most likelihood for
disturbance of the sediments, is it not?
A It's the riverine portion of the lake. I don't 9:47AM
think there's been an analysis to determine whether the
sediments would be disturbed.
Q Well, is it more likely the hydraulic gradients in
the upper portion of the lake likely to disturb the
upper portions of the sediments as compared to, let's 9:47AM

say, Lake Sed 2 or 1? 9:47AM
A There's a greater potential whether if that actually occurs would require a hydrodynamic analysis.
Q Okay. Does Lake Sed 2 indicate that there's been a decline since 1990? 9:47AM
A Well, these are not dated so you can't tell, but in Lake Sed 2, concentrations at about 23 centimeters to the surface show, you know, two samples that are fairly low at about 20, but if you ignore those for the moment, there are constant or perhaps slightly dropping 9:48AM from 23 centimeters to the surface.
Q So they would remain constant since 1990, is that your opinion?
A Relatively constant, perhaps a slight drop.
Q Okay. And what about Lake Sed 1, what is your 9:48AM interpretation of Lake Sed 1 phosphorus levels since about 1990?
A Again, here we're just looking at depth. Of course, they're not dated, but the peak occurs at about 15 centimeters at about 1,700 parts per million. 9:48AM There's a drop at about ten centimeters, but if we don't exclude that for the moment, then things are either slightly declining or flat from that point to the surface.
Q From about 27 meters to the top, does it look like 9:48AM

there's a trend upward? 9:48AM
A There is a trend upward. The way I interpret this core is that from the bottom samples up to about 14, 15 centimeters, there has been an upward trend, but since that time there has been no upward trend. 9:49AM
Q Okay. And does this Lake Sed 1 include the riverine sample?
A Excuse me?
Q Well, excuse me. I'm sorry. That was a terrible question. 9:49AM
Does your Lake Sed 2 include the river sediments, pushed through to the river sediment in Lake Sed 1?
A I don't recall.
Q Wasn't it around 300? 9:49AM
A I don't recall.
Q It's similar to background, wasn't it? Do you recall that the sediment they got out of Lake Sed 1 that they believe was pre-dam closure was similar to background in the IRW? 9:49AM
A Yes, that was my recollection.
Q And didn't we discuss yesterday we thought background phosphorus was around 300?
A 300 to maybe 400, yes.
Q So if you plot that on this map, Lake Sed 1, on 9:50AM

Figure 2-14 at 300, would that help us discern whether 9:50AM or not there's been trend over time?
A It would be it -- it would be inappropriate to include that sample here for trend analysis.
Q Why is that? 9:50AM
A Because these sediments are sediments that have deposited on the bottom. They represent some subset of the particles that were present in the soils and, therefore, they will have characteristics of that subset, not the bulk soil sample. 9:50AM
Q So how is that different than what was deposited before dam closure in the river sediments? Those river sediments would also be representative of what's being deposited from the watershed of prior dam closure, is it not? 9:51AM
MR. TODD: Object to form.
A River sediments would have been representative of what would have deposited in river sediments, which is different than what's deposited in the lake segiments.
Q What's your basis for that? 9:51AM
A Sediment transport theory.
Q Is that theory -- did you do an evaluation whether that theory is applicable to Lake Sed 1, the lower end of this reservoir?
A I have spent a good part of my career looking at 9:51AM

sediment transport and what settles at the downstream 9:51AM end of a reservoir are fine particles that represent a fine fraction of the material running off of the watershed, not the bulk samples, the bulk soil from the watershed. 9:52AM
Q Where do the bulk particles go if they don't settle along with the fine samples in a reservoir? Do they somehow disappear on its way down the river?
MR. TODD: Object to form.
Q I mean, Doctor, I'm not trying to be -- I guess I 9:52AM was sarcastic, let me back up here. But I don't understand how only fine samples would be collected and not the larger sediment samples would be also collected at the dam end of the reservoir?
A One of the characteristics of run-of-the-river 9:52AM reservoirs, which this is, is a gradation in particle size from the head end of the reservoir to the dam. The heavier particles, the larger particles, tend to settle out further upstream and the finer particles tend to settle out further downstream and so you see a 9:52AM sorting of particles as you move through.
Q Okay. And so did you evaluate the particle sizes of the sediments in lake one to see whether that theory of yours or that model applied to this particular sediment evaluation? 9:53AM

A Yes. 9:53AM
Q And what did you find?
A It does.
Q Okay. What were the size of the sediment particles that were found in the riverine -- not the riverine, the river sediments as in the lower parts of that sediment core as opposed to the upper part? 9:53AM
A There's -- to my knowledge, no understanding that we are looking at river sediments at any point in this core. 9:53AM
Q Okay. Well, didn't Dr. Fisher say that they pushed through what they believed to be the river sediment at the bottom of the core, which was pre-dam sedimentation?
A My view of that is they pushed into watershed soil, what would have been soil in the watershed prior to flooding of the reservoir. 9:54AM
Q You don't believe that would have been river sediments?
A No, sir. 9:54AM
Q Was the location of Lake Sed 1 in the middle of the Illinois River before it was dammed?
A Not to my knowledge.
Q What is your basis for that statement?
A The thalweg of the channel, which is where the old 9:54AM

river channel was. It isn't clear that the core penetrated right into the thalweg. 9:54AM
Q Okay. Was the -- was it just a narrow thalweg or was this river broadening at this point in a river valley so that sedimentation would have been across a large area over history of the Illinois River? 9:54AM
A I don't have information on how wide the river may have been under, for example, flood events prior to the construction of the dam.
Q Using your exhibit here, Lake Sed 1 phosphorus level is at the most recent, what level of phosphorus is that? 9:55AM
A Fifteen hundred parts per million.
Q So that's about five times background levels in the IRW? 9:55AM
A Background levels in soil?
Q Yes, sir.
A Yes.
Q Does that suggest to you that there's an anthropogenic source of phosphorus to these sediments in Lake Sed 1? 9:55AM
A That suggests it and I believe I confirmed it with what I believe is the appropriate normalization of the phosphorus to look for anthropogenic sources.
Q And it's your testimony that both aluminum and iron have also increased in sediments over time, correct? 9:56AM

A There have been some trend in aluminum and iron. That's actually pretty modest in comparison to the trends that we see in phosphorus. 9:56AM
Q And what does that tell you?
A It tells me that the nature of the soil that has settled into the reservoir changed from when it was first constructed to slightly after it was first constructed because the gradient in iron and aluminum is mostly right at the bottom of the column. 9:56AM
Q How do you -- what do you -- do you have any explanation for this change?
A Yes.
Q What is it? 9:57AM
A When the dam was first constructed, sediments that likely initially settled were sediments in the flooded soils and so we would be looking at a different process than the process that takes place later in the life of the reservoir. 9:57AM
Q What do you mean the sediments in the flooded soils?
A In other words, when we construct the dam we take areas that were formerly dry and flood them and now we're looking at initially movement of solids of 9:57AM

permanently flooded soils. That's different than later when the solids load is dominated by solids that run off the watershed and are subject to all the processes that occur as particles run down the watershed eventually reaching the river and the lake. 9:58AM
Q What's your basis for the assumption there was a movement of flooded sediments in around the flooded area of the lake?
A That's just a natural phenomenon that would happen because all of a sudden now these things are flooded and the shallow areas where we have winds and waves, those flooded soils get mobilized, they naturally move to the more quiescent deeper parts. After a while, we armor those areas. In other words, the surface soils that were easily suspendible have been taken out and they're no longer there and so that process is a process that occurs early in the life of the reservoir and not later in the life of the reservoir. 9:58AM
MR. PAGE: Let's take a break.
MR. TODD: Before we go off the record, did you actually mark Exhibit 12? You pulled it out and I thought you were going to -- 9:59AM
MR. PAGE: We can go off the record.
MR. TODD: That's fine.
THE VIDEOGRAPHER: We are now off the record. 9:59AM

The time is 9:59 a.m. 9:59AM
(Following a short recess, proceedings
continued on the record.)
THE VIDEOGRAPHER: We are back on the record.
The time is 10:16 a.m. 10:16AM
Q Dr. Connolly, have you ever done any synoptic sampling so that you look upstream and then downstream from the point of a discharge to determine whether that particular location where there's a potential discharge could have an impact on the stream? 10:16AM
A Yes.
Q Does that type of evidence help to determine whether or not there's been a release from that -- a field or a location in that area that you're investigating? 10:17AM
A Yes.
Q Did you look at the synoptic sampling information that was collected by the plaintiffs in this case?
A Which sampling would that be?
Q Well, when they sampled up and downstream from the 10:17AM poultry applied field to determine whether there's an impact on the sampling following that?
A I'm trying to remember the specific study and it's not coming to my mind.
Q Do you recall the different high flow stations 10:17AM

that were a part of IRW? 10:17AM
A Yes.
Q And that they took sampling data of the high flow sampling stations?
A Yes. 10:17AM
Q And do you recall high flow sampling Station 14?
A Not specifically.
Q Do you remember that they did synoptic sampling of some of those locations up and downstream to determine whether there were impacts from poultry applied fields? 10:18AM
A I remember that program. I forget the details of it, yes.
Q Let me hand you -- what is, Mr. Todd was exactly correct, I started to mark another exhibit as 12 and then I didn't use it so that I put it away and we 10:18AM marked 13, so I'm going to go ahead and mark the next exhibit as 12 so it's out of order.
MR. PAGE: Thank you, Mr. Todd, for being so careful.
MR. TODD: Just trying to keep it straight. 10:18AM
Q Here is Exhibit 12. It came out of materials from Dr. Olsen and Dr. Fisher. And it shows the results of the synoptic sampling on a rainfall event, HSF 14.
MR. BASSETT: Are we on speaker phone?
MR. PAGE: Oh, no. Melissa, we just started. 10:18AM

MS. COLLINS: Thank you. 10:19AM
MR. TODD: Sorry.
Q On Exhibit 12, Dr. Connolly, the information was collected on a rainfall event around June 6th through 22nd at HSF 14. 10:19AM
A Mm-hmm.
Q And the data was collected upstream where it says "upstream" there. It was upstream of the poultry applied field area of this sub-watershed and then downstream. Would this type of data indicate to you or 10:19AM be some evidence that phosphorus is running off of poultry applied fields?
A It appears from this data that there are higher concentrations downstream than upstream so phosphorus has been added between the upstream station and the 10:19AM downstream station. I would have to go back and really look to understand this to describe sources, but I would agree that there's more phosphorus on the downstream station than there is on the upstream station. 10:20AM
Q And there were two events measured here, correct, both -- one rainfall event on the 6th of June, 2006 and another on the 22nd of June, 2006, correct?
A That's what the graph indicates.
Q And on both of these events it shows that there 10:20AM

was an increase of phosphorus downstream from the 10:20AM location that was examined, that is, the poultry applied field, correct?
MR. TODD: Object to form.
A Again, I would have to review it. The downstream 10:20AM station, yes, has higher concentrations than the upstream station. I would have to review exactly where they were located.
Q If there was a poultry applied field that drained into the stream between the two locations, would this 10:20AM represent to you as evidence, at least some evidence, that phosphorus from poultry litter runs off of fields and has potential to get in -- more than a potential, gets into a stream in the IRW?
MR. TODD: Object to form. 10:20AM
A If it's the case that the only potential source of phosphorus between those two stations was that field, then that's what this would suggest.
Q I'd like to turn now to Section 2.8. I think it's on Page 224 of your report, sir. Could you read the 10:21AM title, sir?
A "The similarity of water quality in Lake Tenkiller and other lakes in the region indicates that the use of poultry litter in the Illinois River Watershed does not degrade water quality beyond what occurs because of 10:21AM

development for agriculture and urbanization in the 10:21AM
nature of run-of-the-river reservoirs."
Q Could you explain what you mean by that statement, sir?
A That the water quality in Lake Tenkiller is not 10:22AM
significantly different than the water quality in other reservoirs in the region that do not have the extent of poultry litter use and poultry production that the Illinois River Watershed has.
Q And what did you conclude from that? 10:22AM
A Concluded that, in fact, there are reservoirs in the region that have similar water quality and do not have significant poultry production in the watershed.
Q So does that lead you to conclude that the poultry is not affecting Lake Tenkiller? 10:23AM
A It leads me to conclude that the contention that the water quality issues that are perceived to exist in Lake Tenkiller are attributable to poultry litter is inaccurate.
Q Okay. Does it lead you to conclude that poultry 10:23AM litter would not be part, at least a part of the water quality issues faced in Lake Tenkiller? You said completely, so I'm trying to now parse it down to partially. Does this information lead you to conclude that poultry litter in the IRW wouldn't even be a part 10:23AM

of the problem? 10:23AM
A What it leads me to conclude is that in the absence of poultry litter, the water quality in the Illinois River Watershed would likely be not much different than it is. 10:24AM
Q Have you looked at the EPA eco-region reports concerning standards, referenced standards for nutrients in different eco-regions across the United States?
A Yes. 10:24AM
Q Did you look at them for this basin in the IRW?
A Yes.
Q And what does it suggest that the chlorophyll-a level should be in a lake like Tenkiller that's located in eco-region No. 11? 10:24AM
A I don't recall.
Q If I suggested it was eight micrograms per liter of chlorophyll, does that ring a bell to you?
A I would have to go back and reread the document.
Q If it was eight, is that similar to what we are 10:24AM witnessing in Lake Tenkiller today?
A In the lacustrine portions of Lake Tenkiller, yes.
Q During the summer months?
A Yes. And my recollection of the EPA number is it's not a not-to-exceed number but it's an average. 10:25AM

Q And what about the river and stream phosphorus 10:25AM levels, do you recall what the EPA eco-region standard is for this region?
A I do not.
Q Did you review the Cooke and Welch information 10:25AM that was collected for each of the different locations on the reservoir? That is -- well, let me just hand it to you. That would be easier. Let me hand you what is marked as Exhibit 14 and can -- let me ask you if you've seen this document before? 10:26AM
A Yes, these appear to be figures out of Dr. Cooke and Welch's report.
Q Have you seen the 2008 data that's represented here?
A I don't believe so. I don't believe that was 10:26AM actually in the report, as I recall.
MR. TODD: David, can I ask a question? Is this the same thing from the supplement?
MR. PAGE: Yeah, this is the supplement.
MR. TODD: Okay. Would you just give me the 10:26AM same standard objection we agreed to?
MR. PAGE: Yeah.
MR. TODD: Thank you.
Q Have you seen any of the 2008 data that was collected by the plaintiffs for Lake Tenkiller? 10:26AM

A Yes. 10:26AM
Q So you've seen the data but you haven't seen it represented in this format, correct?
A Correct.
Q Okay. Are any of the years we have phosphorus 10:27AM data, which is on Page 14 of Figure 7, does lake one, which is the lacustrine and lake two, which is the lacustrine area, come to an average summer mean phosphorus of eight -- let's not look at the phosphorus, excuse me. Chlorophyll-a. Look at 10:27AM chlorophyll-a. It's on Page 2. For Lake 1 and 2, the lacustrine areas, do you see any time period where it's at eight?
A No.
Q Let's hold that for a second, go back to my other. 10:27AM When you make this statement in 224, on Page 224 of your report, that there's similar water quality, what are you evaluating in terms of water quality when you compared these reservoirs? I think it was Hugo and Sardis to Tenkiller? 10:28AM
A Chlorophyll levels, phosphorus levels, and dissolved oxygen profiles.
Q Okay. Do you know Dr. Cooke?
A Not personally.
Q Do you know his reputation? 10:28AM

A Yes. 10:28AM
Q What is his reputation?
A His reputation is as a quality limnologist.
Q What about Dr. Welch?
A I don't know Dr. Welch. 10:28AM
Q Do you know his reputation?
A No, not as much.
Q Do you know Dr. Jack Jones at the University of Missouri?
A No. 10:28AM
Q Do you know of his reputation?
A No.
Q On Page 224, it appears that you actually did form a hypothesis for this section as opposed to 2-7, is that correct? 10:29AM
A Yes.
Q Okay. What is your hypothesis that you want to test in this section?
A That in the absence of poultry litter there would be minimal or no water quality issues. 10:29AM
Q Okay. And how did you test the hypothesis? Do you want to read from your report? You don't have to.
A We tried to find other lakes that we could compare to Tenkiller that had similar water quality to determine whether, in fact, they had poultry litter to 10:29AM

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test the hypothesis that in order to have such water 10:29AM quality would require poultry litter, all other things being equal.
Q And you selected which two lakes or reservoirs?
A Lake Hugo and Sardis. 10:30AM
Q Okay. And what were your criteria for selection of Hugo and Sardis?
A The first criteria were reservoirs that had similar water quality.
Q Okay. 10:30AM
A The second criteria was reservoirs that had similar land use patterns in the watershed.
Q Okay.
A The third criteria was to get as close to similar eco-region as we could. And the fourth criteria was to 10:30AM try to get systems that had similar lake surface area to watershed area.
Q Any other criteria?
A I'm sure there were others. Those are the ones that come to mind. 10:30AM
Q I guess one of the criteria might have been whether or not they had poultry in the watershed or not, land use?
A Yes, yes, of course.
Q Did you determine whether or not Hugo and Sardis 10:31AM watersheds had few poultry operations?
A We determined they had very few poultry operations.
Q How did you determine that?
A We, as I recall, worked with Dr. Sullivan in 10:31AM trying to determine poultry house density from aerial photography.
Q Do you have any reference or information in your report that supports your conclusion that they had few poultry operations? 10:31AM
A I have not checked. As it indicates here, I may have misspoken.
Q Can you tell us where you're referring to, Doctor?
A I'm sorry. Table 29, there's a footnote.
Q 29, okay. 10:31AM
A Poultry, cattle and swine animal units acquired from personal communications with Wally Jobes.
Q Who is Wally Jobes?
A I don't recall. I would have to check.
Q So if Wally Jobes is wrong then the analysis would 10:32AM have that flaw?
A Yes.
Q Okay. Do you know, did you check to see if there's any wastewater treatment plant discharge in either Hugo or Sardis watersheds? 10:32AM

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A We reviewed the EPA database to see whether there 10:32AM were permits for discharge in the watershed.
Q And were there?
A Nothing of any consequence, no.
Q Were there wastewater treatment plant discharges 10:32AM in the Hugo and Sardis watersheds?
A I don't recall now whether there were any at all. We certainly concluded that they were not of consequence, but I'm not recalling whether that meant that it was zero. 10:33AM
Q What was your basis for lack of little consequence?
A Design flow.
Q And do you have any documentation of that here in your report? 10:33AM
A No, that would be in considered materials.
Q Did you determine whether or not there were any permitted CAFOs? Do you know what a CAFO is?
A No.
Q Combined animal feeding operations in watersheds? 10:33AM
A I don't recall.
Q Do you know whether Mr. Jobes determined whether or not there was any permitted CAFOs in those watersheds?
A I do not. 10:33AM

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Q Let me hand you what's marked as Exhibit 15. 10:34AM
Do you see the source of this information
down here in the left, sir? Sources land use,
national land code, database. Are you familiar with
that source, sir? 10:35AM
A Yes, I am.
Q Are you familiar with Oklahoma Department of
Agriculture, Food and Forestry?
A Yes, sir.
Q And USEPA for wastewater requirements? 10:35AM
A Yes.
Q Okay. Can you identify, sir, how many CAFOs there
are in the Sardis watershed on Exhibit 15?
A Some of these are overlapping, so probably I can
not. 10:36AM
Q Okay. But looks like there's maybe about an eight
to ten?
A Something on that order.
Q And what about in the Hugo watershed?
A Maybe another ten. 10:36AM
Q Okay. And are there other POTWs within the Hugo
watershed?
A This is a little bit like Where's Waldo.
Q We've got some marks on here. They've tried to
label them. 10:36AM

A Okay. 10:36AM
Q But I admit it's hard to find the dashes there in
all the information.
A Yes.
Q Okay. How many are there within the Hugo 10:36AM
watershed?
A Appears there are three.
Q What are the discharges of phosphorus from those
public works authorities, do you know?
A I do not. 10:37AM
Q Did you evaluate that when you did your analysis?
A One of the staff working for me did.
Q Okay. And are those results reflected anywhere in
your report?
A No, sir. 10:37AM
Q Do you know whether Mr. Jobes used the
information, Mr. Jobes, Wally Jobes, that you
referenced there, used the information seen on Page 2
of this report on a number of animals in CAFOs as
reported by the Oklahoma Department Agriculture? 10:37AM
A I would have to check. I don't know.
Q Do you have any report from Mr. Jobes in your
considered materials or was it just simply a verbal
conversation where he gave you the data in Table 2-9?
A I don't know. 10:38AM

Q Says "personal communication." Was that your 10:38AM
personal communication or someone else's?
A Someone else's personal communication.
Q Dr. Connolly, when you did your analysis of your
hypothesis comparing these reservoirs, was it important 10:38AM
that you compared reservoirs that had similar
characteristics?
A Yes.
Q How about the characteristics of a reservoir
impact water quality of a reservoir? 10:38AM
A In numerous ways. The size of reservoir in
comparison to the watershed is important because it
determines the amount of land contributing to the
reservoir relative to the size of the reservoir. The
residence time of the reservoir is important, how long 10:39AM
water stays in the reservoir, the depth of the
reservoir as well is important.
Q Is it reasonable then using some of the criteria
you mentioned to compare trophic states of deep
thermally stratified reservoirs with shallow, 10:39AM
unstratified reservoirs?
A Can you repeat that question, the front part of
it?
(Whereupon, the court reporter read
back the previous question.) 10:40AM

Q Let me repeat the question. Is it reasonable to 10:40AM
compare the trophic states of deep thermally stratified
reservoirs with shallow unstratified reservoirs?
A Yes, so long as you keep that difference in mind
as you're doing the comparison and with the implication 10:40AM
of what that difference might be.
Q What is the implication of that difference?
A The implication of that difference is whether or
not in the stratified reservoir you have a source of
phosphorus from the sediments that may be important to 10:40AM
the water quality of that reservoir.
Q So in an unstratified reservoir there could be an
additional source of phosphorus to the epilimnion
that's not present during the summer months of a
stratified reservoir, correct? 10:41AM
A No.
Q So what do you mean by that? I don't understand.
Wouldn't an unstratified reservoir have an additional
source of phosphorus from sediments that is not present
in the epilimnion of the stratified reservoir? 10:41AM
MR. TODD: Object to form.
A Not of consequence.
Q And how did you make that determination?
A In order to have a significant source of
phosphorus from the sediments you have to drive the 10:41AM

water column to near zero or zero dissolved oxygen. 10:41AM
Q Don't sediments release oxygen when they're oxidized also?
A I don't understand what you just said.
Q Are you saying that the only time sediments contribute oxygen to lakes is when they're anoxic -- excuse me. The only time that sediments contribute phosphorus to lakes is when they're anoxic? 10:42AM
A The only time they contribute substantive amounts of phosphorus is when they're anoxic. 10:42AM
Q And what's your basis for that statement?
A That's a well known concept that a limnologist or engineer working on reservoirs understands. It's in every textbook.
Q What about shallow lakes? 10:42AM
A What do you mean "what about shallow lakes"?
Q Would you expect sediments to contribute phosphorus to the waters of shallow reservoirs to a greater degree than deep reservoirs?
A I think I've answered that, that not unless they were going anoxic. 10:43AM
Q Okay. Would you expect a shallow reservoir to respond the same way to watershed events as a deep reservoir?
A Not necessarily. 10:43AM

Q Did you consider when you did your evaluation in 2.8, the depths, temperature profiles, and phosphorus loadings of the three different systems? 10:43AM
MR. TODD: Object to form.
A We did no quantitative analysis of phosphorus loadings. We used land use as a surrogate as a potential for loadings, but we did consider those other factors, yes. 10:44AM
Q Did you consider depths?
A Yes. 10:44AM
Q And temperature profiles?
A Yes.
Q But you don't consider loading?
MR. TODD: Object to form, mischaracterizes.
A We considered loading in terms of land use characteristics, but made no quantitative assessment of loading. 10:44AM
Q Well, you didn't actually determine whether the loading, the actual loading in Tenkiller were comparable or not to the loading in Sardis and Hugo, correct, the actual phosphorus loadings? 10:44AM
A We did not do a quantitative calculation of loadings.
Q Okay. You didn't calculate how much phosphorus was going into Sardis or Hugo, correct? 10:44AM

A Correct. 10:44AM
Q Is that information available?
A Not as far as I know.
Q Did you look for it?
A Yes. 10:45AM
Q Did you look for it from USGS studies?
A I believe so.
Q And did you find any?
A I would have to go back and check.
Q Let's look at Table 2.8. This is a comparison of watershed characteristics, correct? 10:45AM
A Yes, it is.
Q Okay. In Tenkiller, what is the ratio of watershed area and lake volume?
A Watershed area and lake volume? 10:45AM
Q Yeah. What is the relative -- you have watershed area there, 1,052,800 acres?
A Yes.
Q And the storage acre feed pool?
A Mm-hmm. 10:46AM
Q Okay. What is the ratio between those two?
A About 1.7, 1.8 to one.
Q And how is that compared to Lake Hugo in the same reservoir?
A Lake Hugo is probably seven or eight to one. 10:46AM

Q So are they comparable with that metric, that is, Tenkiller to Hugo? 10:46AM
A No.
Q So Hugo has a lot smaller water volume with approximately equivalent same size of watershed? 10:46AM
A Yes.
Q Wouldn't that size of lake volume have a -- difference in lake volume have an impact on the water quality of the lake when you're trying to compare it to Tenkiller? 10:46AM
A Probably not significant.
Q And what's your basis for that?
A If you turn to Table 2.10.
Q Mm-hmm.
A And you look at residence time, how long water remains in the lake, for Hugo the residence time is 1.3 months, which is considerably shorter than Tenkiller, which is 8.8 months. But 1.3 months is sufficient time to allow settling, so that the difference in these volumes here is significant only in the sense of whether or not we can settle out material or whether that material remains in the water column. A 1.3 month residence time is sufficient to settle material out. 10:47AM 10:47AM
Q Not as much settling as you would find in Lake Tenkiller, correct? 10:48AM

A Probably not that much different. 10:48AM
Q Are you really suggesting there's not that much difference in settling between Tenkiller and Hugo when you have an 8.8 versus a 1.3 residence time?
MR. TODD: Object to form. 10:48AM
Q Is that your testimony, sir?
A Yes, it is.
Q And did you do any analysis to justify that opinion?
A Analysis wasn't necessary. 10:48AM
Q What does watershed area to lake volume tell you about the reservoir?
A Tells you something about the likely residence time.
Q Okay. Does it tell you anything about dilution of 10:48AM the water?
A Not a lot.
Q It doesn't?
A No.
Q Wouldn't you expect a reservoir with a shorter 10:49AM residence time to have more dilution by inflow to the lake?
A No.
Q Doesn't the residence time of Hugo indicate that Hugo is highly flushed by the inflow? That is, it has 10:49AM

1.3 versus 8.8 residence time? 10:49AM
A Yes.
Q And much more flush than Tenkiller, correct?
A Yes.
Q So the hydrology of Hugo is different than 10:49AM Tenkiller, is it not?
A Yes.
Q Okay. Now, let's look at Sardis Reservoir. How does the watershed size of Sardis compare to Tenkiller?
A It's about seven or eight times more. 10:50AM
Q About 15 percent?
A Mm-hmm.
Q Wouldn't this have an impact on the -- the effect of Tenkiller versus Sardis on the water quality in the two reservoirs? 10:50AM
A Yes.
Q So that makes them not quite as comparable, correct?
A It makes them different but as long as you keep those differences in consideration, you can still make 10:50AM comparisons.
Q How does the volume of Sardis as a storage volume compare to Tenkiller?
A It's about 35, 40 percent of Tenkiller.
Q So that's another significant difference, is it 10:50AM

not? 10:50AM
A Yes.
Q I think you mentioned earlier you're familiar with the Vollenweider model to predict concentrations in lakes and reservoirs? 10:51AM
A Mm-hmm.
Q Can you tell us what that is?
A Not off the top of my head.
Q Did you perform that analysis on these three reservoirs to determine whether there would be any 10:51AM effect of the hydrology and characteristics on phosphorus concentrations?
A No.
Q Okay. Let me hand you what has been marked as Exhibit 16. This is a document that we've prepared -- 10:51AM
MR. TODD: Go off the record real quickly.
THE VIDEOGRAPHER: We're now off the record. The time is 10:51 a.m.
(Whereupon, a discussion was held off the record.) 10:52AM
THE VIDEOGRAPHER: We are back on the record. The time is 10:52 a.m.
Q Dr. Connolly, I've handed you Exhibit 16 where it shows the -- a model, a simple Vollenweider model of Tenkiller to Sardis, doesn't it? 10:52AM

A Yes. 10:52AM
Q Would you read the first sentence, please, under the title?
A "The model takes into account nutrient input, in this case concentration is held constant, hydrology, 10:53AM inflow of volume and lake morphology, depth divided by volume."
Q Those are some of the subsets in model?
A Mm-hmm.
Q Okay. Read the next statement, please. 10:53AM
A "With inflow phosphorus concentration as a constant, any differences in the predictions of the model are the result of differences among hydrology and morphology."
Q Do you agree that that would be the result running 10:53AM the simple Vollenweider model on these three lakes?
A Yes.
Q And what is the equation?
A Phosphorus equals loading of total phosphorus milligrams per square meter divided by mean depth in 10:53AM meters and flushing rate per year plus sedimentation rate per year.
Q Okay. And what was the substance of the model?
A Assumes an inflowing total phosphorus concentration of 25 micrograms per liter to each 10:54AM

reservoir. 10:54AM
Q Okay. And the sedimentation?
A Sedimentation was estimated as ten divided by mean depth as suggested by Vollenweider in 1975.
Q Okay. And what was the loading calculation? 10:54AM
A Loading was calculated by dividing inflow concentration of 25 micrograms per liter total phosphorus times inflow volume for each lake and that product was divided by the area of each reservoir.
Q Okay. So the loading was calculated by 10:54AM multiplying the inflow, not dividing, correct?
A By multiplying inflow.
Q Okay. And where did the data for lake volume, inflow volume, lake area, mean depth come from.
A From my report. 10:54AM
Q Okay. Tables 2-8 and 2-10?
A Mm-hmm.
Q Okay. What were the results of the model?
A This indicates 17 micrograms per liter for Tenkiller. 10:55AM
Q That's the lake phosphorus concentration?
A Yes. And 24 micrograms per liter for Hugo and nine micrograms per liter for Sardis.
Q Okay. So given the inflow of phosphorus concentration, are the predicted P concentrations in a 10:55AM

reservoir different using the simple model? 10:55AM
A This page says they're different, yes.
Q Okay. Well, do you understand that -- you understand the Vollenweider model? You can check his calculations yourself, correct? 10:55AM
A Yes, I can.
Q Do you have any reason to believe the calculations are incorrect in what you see here today?
A I can't tell one way or the other.
MR. TODD: Would you put on the record who 10:55AM prepared this? I think you were about to say that whether the watershed, the table --
Q Oh, Dr. Coale prepared this.
MR. TODD: Yes.
Q As rebuttal for the report. 10:55AM
A Mm-hmm.
Q I certainly did not prepare it.
MR. TODD: I thought it looked like your handiwork to me.
Q Assuming these calculations are correct, what 10:56AM would cause the differences in the phosphorus?
A Essentially the differences in the phosphorus here are associated with the loss of phosphorus by sedimentation. That's what the Vollenweider model attempts to take account of. 10:56AM

Q And would that be affected by the hydrology and 10:56AM morphology of the different reservoirs?
A Yes, it would.
Q Doesn't -- if this is correct, doesn't this model indicate that it's difficult to discern relative 10:56AM impacts of poultry in these three different reservoirs?
A I can't say one way or the other based on this.
Q Let me ask you another question then. If these three different water bodies, Tenkiller, Hugo and Sardis, were similar or identical, wouldn't they model 10:57AM identically or nearly so if they were loaded with the same phosphorus concentrations?
A Not necessarily.
Q Well, how would you account for the changes then?
A Account for the changes? I'm not sure what 10:57AM your --
Q In phosphorus concentrations, if they're not different, if this model doesn't show that these reservoirs are not functioning differently, for example, we looked at residence time a few minutes ago. 10:57AM
A Yes.
Q And Hugo's residence time is a lot different than Tenkiller's, correct?
A Yes.
Q And we see a difference in phosphorus 10:58AM

concentration where Hugo is much higher than Tenkiller, 10:58AM correct?
A (Nods head.)
Q In fact, Hugo's concentration in the reservoir equals almost the inflow concentration, correct? 10:58AM
A According to this, yes.
Q So that would indicate that the high flushing rate maintains a very high phosphorus level in Hugo, correct?
A That's what this calculation shows. That doesn't 10:58AM mean that's what happens.
Q What is your evidence that something different than that is going on in Hugo? Not necessarily the specific concentration but that this flushing, in effect, is maintaining or would maintain high 10:58AM concentrations of phosphorus that are entering the reservoir?
MR. BASSETT: Object to form.
A If it took -- if the -- backup and say this a different way. 10:59AM
If in 1.3 months of time you could settle out almost none of the phosphorus that entered, then our ability to treat phosphorus in wastewater treatment plants would be fruitless because there is not a single wastewater treatment plant that has a 10:59AM

settling tank with the amount of residence time to 10:59AM
settle out particulate phosphorus.
Q Do they add materials to wastewater treatment plants to facilitate precipitation in those facilities?
A They do. 10:59AM
Q Okay. So you're not really suggesting that a wastewater treatment plant is a good analogy to what's going on in the reservoir, are you?
A What I'm suggesting is that this simple model, the only difference is that it considers the fate of a 10:59AM phosphorus in these three reservoirs is the difference in the ability to settle the phosphorus in the reservoirs. The basic assumption here is that all three reservoirs have equivalent amounts of particulate matter coming in and this model is now saying that in 11:00AM 1.3 three months I settle almost none of that particulate matter in Lake Hugo and that is unreasonable.
Q Okay. Can you tell us what activities or circumstances that are going on in Hugo and -- and 11:00AM Sardis that indicate that this is not an accurate representation of the relative differences between the three reservoirs?
A This model was not developed for run-of-the-river reservoirs and so its applicability run of a river 11:00AM

reservoir is different than its applicability to the 11:00AM lakes.
Q Is Sardis a run-of-the-river reservoir?
A Yes.
Q Sardis is a run-of-the-river reservoir? 11:01AM
A Yes.
Q Didn't you actually admit in your material that Sardis was not a run-of-the-river reservoir?
A I don't recall.
Q Let's look at the top of Page 227. Read the 11:01AM second sentence at the top of Page 227.
A "Hugo and Sardis are somewhat unique in that the transition from river to lake because of short distances and these lakes lack the type of river reading zones in Tenkiller." 11:01AM
Q So doesn't that indicate that these aren't typical run-of-the-river reservoirs?
A No.
Q The lakes certainly have riverines like Tenkiller, do they not? 11:01AM
A Yes, they do.
Q And that would account for potential significant differences in how they deal with phosphorus loading, correct?
A Yes. 11:02AM

Q That's another difference between Tenkiller and 11:02AM Lake Hugo and Sardis?
A Yes.
Q How can a riverine zone have an impact on reservoir processes? 11:02AM
A On what processes?
Q On processes that occur in a reservoir, what's the impact of riverine zone on, let's say, eutrophication processes in a reservoir?
A It's very site specific, so it's hard to make a 11:02AM general statement about riverine zones.
Q Well, you seem to have made a notation here about Hugo and Tenkiller having a different type of riverine zones?
A Mm-hmm. 11:03AM
Q And Sardis and Tenkiller being different also in that regard, correct?
A Yes.
Q Okay. So what does that difference -- does that difference have any impact on reservoir processes? 11:03AM That is the fact that Tenkiller has a long riverine zone and Sardis and Hugo do not, does that have any impact on reservoir processes? Let me say it another way. Does the lack of riverine zone in Hugo and Sardis change their processes and make them distinct from some 11:03AM

of the processes that are occurring in Tenkiller? 11:03AM
A Potentially.
Q And what processes would it affect?
A Where phytoplankton growth may occur in the reservoir. 11:04AM
Q And does it have any effect on the hydrology of the reservoirs? Could it have an effect in that regard?
A I suppose but nothing specific that I can think of. 11:04AM
Q Wouldn't a riverine, long riverine zone tend to retard the inflow waters into the reservoir so that the movement could be slower, have an effect on kinetics in that regard?
A The movement of the water -- 11:04AM
Q Would be slower in the reservoir?
A Where?
Q Within the reservoir.
A Not necessarily.
Q Would sedimentation processes be affected? 11:04AM
A Perhaps.
Q And how would they be affected?
A There may perhaps be less sedimentation in the upper portions of a reservoir with the riverine section than one without. 11:05AM

Q Did you determine whether these potential 11:05AM
differences were, in fact, differences between Sardis,
Tenkiller and Hugo?
A No.
Q Do scouring -- do you know what scouring is when 11:05AM
we talk about scouring effects on a reservoir?
A Yes.
Q What is that?
A Scouring is the erosion of sediments from the
bottom of the reservoir. 11:05AM
Q Do scouring effects occur in a riverine zone of a
reservoir?
A It would depend upon the reservoir.
Q Did you determine whether that's going on or not
in Tenkiller? 11:05AM
A No.
Q If it was, could that have a big -- indicate
another difference between Hugo and Sardis on the one
hand and Tenkiller on the other?
A Perhaps. 11:06AM
Q Does scouring influence the delivery of water to
the reservoir?
A No.
Q Does scouring influence the delivery of nutrients
down the reservoir? 11:06AM

A Perhaps. 11:06AM
Q And can scouring have an effect on turbidity in
downstream portions of the reservoir?
A Perhaps.
Q And how does that occur? 11:06AM
A By eroding material off the bottom creating
turbidity in the water and carrying that turbidity
downstream.
Q Does the lack of the riverine zone detract from
the utility of Hugo and Sardis in comparison with 11:06AM
Tenkiller?
A To some extent.
Q Is the potential for internal return of nutrients
from sediments greater in Sardis and Hugo reservoirs
than they are in Tenkiller? 11:07AM
A No, not necessarily.
Q What's your basis for that statement?
A Well, all three reservoirs are subject to oxygen
depletion in anoxic bottom waters. The shallow
reservoirs will not set up as strong a stratification, 11:08AM
whereas, long stratification as in a deeper reservoir.
So that may have some influence on their ability to
recycle phosphorus. And so, if anything, there perhaps
would be slightly less recycle from the sediments than
Hugo and Sardis, but I would have to go through a much 11:08AM

more detailed analysis to determine that. 11:08AM
Q So you haven't done that analysis to determine
whether that will be a difference between the three
different reservoirs you investigated in this section?
A Correct. 11:08AM
Q And I'm not sure if I asked you this in the same
manner again, but let me ask it again at the risk of
being redundant. Does the lack of the riverine zone
change the nature of sedimentation processes in a
reservoir? 11:09AM
A Somewhat, yes.
Q And what about inner flow processes?
A Potentially.
Q Could you determine whether the lack of the
riverine zones in Sardis and Hugo had that impact in 11:09AM
comparison to Lake Tenkiller?
A No.
Q How can sedimentation and inner flow affect water
quality?
MR. TODD: Object to form. 11:09AM
A Sedimentation removes nutrients from the water
column and deposits them on the bottom and so is
essentially a loss mechanism from the water column so
it can affect water quality from that standpoint.
Q Removes. Does sedimentation have any other effect 11:09AM

on water quality in the lake reservoir? 11:09AM
A Sedimentation affects the oxygen depletion rate in
a reservoir as well.
Q Did it affect the turbidity level of the
reservoir? 11:10AM
A Yes.
Q Would sedimentation allow the reservoir areas in
the epilimnion to be less turbid and, therefore
allowing, more light for algae production?
A That's a consequence of sedimentation, yes. 11:10AM
Q Is there a significant amount of algae produced in
the riverine sediments in Lake Tenkiller?
A Yes.
Q Where does that algae go?
A Down the stream. 11:10AM
Q And does it drop to the bottom of the lacustrine
sections as the cooler water drops to the bottom of
Lake Tenkiller?
A Certainly in part it does.
Q And does that -- does that diving process, I think 11:11AM
you actually described it in your report that occurs at
Lake Tenkiller, also occur in Sardis and Hugo Lakes?
A I don't know.
Q Would that be another difference in accounting for
water quality changes between those different 11:11AM

reservoirs? 11:11AM
A It could be.
Q Have you reviewed any literature on the consequences of reservoir P concentrations for rapidly flushed reservoirs like Lake Hugo? 11:11AM
A I didn't understand the question.
Q It wasn't a very good question. Let me ask it this way.
What are the consequences of a reservoir's P concentrations where that reservoir is rapidly 11:12AM flushed, such as Hugo?
A As I indicated, I know the residence time of Hugo of a month is not all that short, but in rapidly flushed reservoirs there's less opportunity for settling and sedimentation. 11:12AM
Q So would you expect, everything else being equal, that P concentrations in rapidly flushed reservoirs to be higher than in reservoirs with longer residence time, sir?
MR. TODD: Object to form. 11:12AM
A All other things being equal, yes.
Q So residence time, then, you would agree does have an impact on P concentrations in the reservoir?
A Can have an impact, is how I would put it.
Q Did you determine whether or not the different 11:13AM

residence times of these three reservoirs had an impact 11:13AM on the P concentrations?
A No.
Q Did you see the data that Drs. Cooke and Welch put together that indicated residence time in Lake 11:13AM Tenkiller had an impact on phosphorus concentrations in the lake?
A I've seen it but I disagree with it.
Q You disagree with it?
A Yes. 11:13AM
Q Why is that?
A Because the residence time differences here are such that there's still sufficient residence time such that it would not affect algal production.
Q But you saw the difference that's shown on, I 11:13AM think, Exhibit 7 that showed that phosphorus levels were much higher in the short residence time period?
A Correct.
Q Excuse me, that was Deposition Exhibit 14.
A That's not my interpretation of this figure. 11:14AM
Q And do you also see that -- that during times of low residence time that chlorophyll-a levels of Lake Tenkiller are much higher?
A No, I don't think -- I think that's a misrepresentation of what that figure shows. 11:14AM

Q So you think Dr. Cooke and Dr. Welch are 11:14AM misrepresenting the data when they included that in their report?
A Yes, I do.
MR. TODD: Objection to form. 11:14AM
Q What is your basis for believing that that's not representative of this data?
A If we compare 2008 to 2007 to 2006 to 2005, we're going from a very short residence time to a very long residence time and I don't see any consistent pattern. 11:15AM
Q Okay. Well, you see, do you not, that 2006 was the longest residence time for the years represented here on Exhibit 14?
A Yes, I do.
Q Okay. And does it have the highest phosphorus 11:15AM levels in the lake for all those time periods represented?
A No.
Q Excuse me. Is that the lowest phosphorus levels of the lake? 11:15AM
A No.
Q The overall lake average is not the lowest in that time period?
A My reading of this, the lake average in 2006, is 27. 11:15AM

Q How is that compared to a shorter residence time 11:15AM in 2008?
A It's 34.
Q So it's lower, is it not?
A Those two numbers are, in my view, not different, 11:15AM nor if you look at the other years. And these comparisons are also corrupted by the fact that they're a little apples and oranges in terms of numbers of samples, frequency of sampling.
Q What about 1993, is there a difference in 11:16AM residence time between 1993 and 2006?
A Yes.
Q And does 1993 have higher phosphorus levels than 2006?
A Yes. 11:16AM
Q And it has a shorter residence time, correct?
A Yes.
Q We'd better take a break.
THE VIDEOGRAPHER: We are now off the record. The time is 11:16 a.m. 11:16AM
(Following a short recess, proceedings continued on the record.)
THE VIDEOGRAPHER: We are back on the record. The time is 11:32 a.m.
Q Can we look at Table 2-10 on Page 227 in your 11:32AM

report, sir? **11:33AM**
A Yes.
Q Okay. What are the average depths of Tenkiller, Hugo and Sardis?
A Hugo is 11.9 feet, Sardis is 20.2 feet and 11:33AM Tenkiller 50.7 feet.
Q So Hugo is about four times shallower than Tenkiller?
A Yes.
Q And Sardis is about two and a half times shallower? **11:33AM**
A Yes.
Q Okay. Can these differences in average depth have an impact on water quality, all the things being equal?
A Yes. 11:33AM
Q Did you consider those differences when you did your analysis?
A Yes.
Q And how did you consider those?
A Just in looking at how they might have impacted 11:33AM water quality in order to keep that in mind as we made the comparisons among them.
Q And how did you account for the differences?
A Not in any quantitative way, just sort of, say, well, how would these differences be important and does 11:33AM

that color the comparison in such a way as to make it 11:34AM invalid.
Q Well, how can the differences in depth have an impact on water quality during the summer months?
A They can have an impact in terms of how the 11:34AM epilimnion is set up in the lakes, how deep the epilimnion is, how much vertical mixing occurs between the epilimnion and hyperlimnion. There could be some impacts in terms of sedimentation in the different reservoirs. 11:34AM
Q If there is mixing, could that have an impact on the phosphorus in the epilimnion?
A Yes.
Q So it could increase -- if the reservoir is mixing during the summer it could increase the phosphorus in the epilimnion? **11:34AM**
A Possibly.
Q Did you determine whether that was, in fact, occurring in Hugo and Sardis?
A No. 11:35AM
Q You didn't determine that one way or the other?
A No.
Q Do you know what the relationship is between mixing depths to reservoir area?
A Where? 11:35AM

Q Well, do you understand that mixing depth increases as the square root of the reservoir increases? **11:35AM**
A Square root of reservoir?
Q Area? **11:35AM**
A Area increases. I'm not familiar with that specific correlation, but I do know that mixing depth is a function of reservoir area.
Q That's -- I think we mentioned earlier the Osgood index, which you said you were not familiar with? **11:35AM**
A Yes.
Q So what is the effect of having a large reservoir area and a low mean depth?
A There would be greater vertical mixing in a smaller hyperlimnion. 11:36AM
Q Did you determine whether or not there was greater vertical mixing in Hugo and Sardis as compared to Tenkiller?
A Yes.
Q And what did you determine? **11:36AM**
A That there were no significant differences.
Q And how did you determine that?
A From the oxygen profiles.
Q Did you look at the temperature profiles?
A I believe we did but I don't recall specifically 11:36AM

the temperature profiles. I personally relied on the 11:36AM oxygen profiles.
Q Isn't temperature important to determine stratification or mixing?
A Certainly. 11:36AM
Q But you didn't consider them?
A Actually, profiles typically tell you where the stratification occurs, so you don't need to look at the temperature profile if you have the oxygen profile.
Q Is it your testimony that if you have an oxygen profile, you don't need the temperature profile to determine stratification of a lake or reservoirs? **11:37AM**
MR. TODD: Object to form.
A That's not what I said. What I said was that looking at these oxygen profiles was sufficient to tell 11:37AM me where the stratification was occurring.
Q They all have the same oxygen profiles?
A They all indicate a depth where stratification begins that is similar.
Q Does a reservoir -- is it your opinion, sir, that all three reservoirs have similar mixing? **11:37AM**
A No.
Q Okay. Do either Hugo or Sardis have more mixing during the summer months than Tenkiller?
A I'm thinking of mixing as the depth before you hit 11:38AM

the thermocline. I don't know if that's -- 11:38AM
Q No, sir?
A -- your definition.
Q I'm talking the mixing that occurs, for example, if you have a stratified lake during the fall, whether 11:38AM the temperatures in the lake reach more of an equilibrium so there's mixing from the bottom waters up to the top?
A Yes.
Q That's what I'm talking about. I'm talking about 11:38AM mixing that occurs where bottom waters are moved up to the top.
A Yes.
Q That kind of mixing.
A Yet. 11:38AM
Q And did you determine whether or not Hugo and Sardis mixing is similar to Tenkiller's mixing during the summer months?
A But during the summer months is when you would have the turnover. 11:38AM
Q Well, that's what my question is: Did you determine whether or not Hugo and Sardis turnover during the summer months, actually mix during the summer months?
A No. 11:38AM

Q Okay. Wouldn't that be important to determine 11:38AM whether or not there's additional phosphorus in the epilimnion available for algal growth?
A That could be, yes.
Q I'm going to hand you a series of BUMP reports. 11:40AM Do you know what the BUMP reports are, sir?
A Yes.
Q What are they?
A They're reports from a program that's called a Beneficial Use Monitoring Program that the State 11:41AM conducts to evaluate water quality throughout the state.
Q I've handed you Exhibit 17, which is the BUMP report for Tenkiller for 2001 through 2002. And then 18, which the BUMP report for Sardis for 2002-2003. 11:41AM And 19, which is the BUMP report for Hugo of 2002 to 2003?
A Mm-hmm.
MR. TODD: So, David, did you intend to say the first one was 2001 to 2002? 11:41AM
MR. PAGE: Yeah, I said it was. They didn't take -- they do these every five years and Tenkiller was on a little different annual basis, you probably noticed that yourself, than was Sardis, is that correct? 11:42AM

A That's my -- 11:42AM
Q So I got the closest years for comparison purposes.
A Okay.
Q Would you compare the DO profiles and thermoclines 11:42AM of Hugo, Sardis and Tenkiller and tell me if you see any evidence that there could be different mixing levels of these three reservoirs during the summer months? Do you see any difference in the stratification of the three reservoirs, sir? 11:43AM
A That are some differences.
Q Does that indicate there would be additional mixing, for example, in Sardis as compared to Tenkiller?
A In Sardis, the dissolved oxygen gradient is 11:44AM greatest between approximately five meters and eleven meters. So that's the period or the depth interval in which we have the rapid drop in oxygen and then I think you see that's down near zero at the bottom and there's a thermal gradient across there that continues further 11:44AM down. And Tenkiller, the break in oxygen occurs starting at about five meters and reaches a low value down around nine or ten meters. And then there's a bump up and it goes down, but then the epilimnion in both cases is about the top five or so meters before 11:45AM

you again get into a thermal gradient sufficient to 11:45AM limit oxygen penetration. So, yes, there are differences in mixing. In fact, the uniformity of the oxygen gradient and the temperature in Tenkiller suggests that in the surface itself it probably is more 11:45AM intense mixing but the depth at which the mixing begins to drop off substantially occurs at about the same depth.
Q What about comparison with Sardis -- excuse me, Hugo? 11:45AM
A Hugo, it's a little deeper. It begins at about seven or eight meters is when we get the drop off as opposed to about five meters in --
Q So would you agree with me that most of the mixing during the summer months, more mixing would occur 11:46AM in the summer months of Hugo than either Sardis or Tenkiller?
A That's hard to conclude from a single profile. In this profile for this particular date, the thermocline begins at about seven or eight meters, but thermoclines 11:46AM move up and down all the time and if you sample, you know, five days later, this profile would be at a somewhat different depth and so it's hard from a single profile to make an overall general statement.
Q There's multiple BUMP reports. Did you look at 11:46AM

other BUMP reports for other years to see if this 11:46AM
pattern holds true for all three reservoirs?
A I believe the text would indicate that after
having looked at that we conclude they all break around
the same depth. 11:46AM
Q But isn't it true, sir, that Tenkiller is a much
strong -- more strongly stratified than either Hugo or
Sardis?
A If we look at Sardis from the surface to about 15
meters, the temperature drops from about 30 degrees to 11:47AM
about 23 degrees. If we look at Tenkiller, the
temperature is close to 30 degrees at the surface and
we hit 23 degrees at about ten or 11 meters. So
there's not much difference in terms of the temperature
gradient over that same interval. 11:47AM
Q The temperature gradient throughout the whole
reservoir is significant, isn't that right? The
difference in temperature gradient at Sardis from the
top to the bottom is 6 degrees Centigrade as compared
to Tenkiller, which is 11, 12 degrees Centigrade, 11:48AM
correct?
A That has to do with the different depths and the
volume of the hypolimnion but not with the vertical
mixing that we're discussing.
Q So it's your testimony, sir, that you would not 11:48AM

Q Did you find similar stratification patterns in 11:50AM
other years comparing Hugo, Sardis and Tenkiller?
MR. TODD: Object to form.
A Over all, yes.
Q So that -- would that indicate that there's more 11:50AM
mixing going on in Hugo than there is in Tenkiller year
in year out during the summer months?
A I don't think so. I would have to go back and
review all the profiles before I could give you a
complete answer. 11:50AM
Q But if there was additional mixing then that would
have an impact on water quality, correct?
A It could have an impact on water quality.
Q What part of Lake Tenkiller is shallow in similar
depth to Hugo and Sardis? 11:51AM
A Somewhere between the riverine and transitional
section. I don't know precisely where. I'm sorry.
Q Somewhere around the riverine section?
A When we're talking Hugo, which is about 12 feet
deep, that would be more like the riverine to the 11:51AM
transitional section and Sardis is a little deeper, so
it would be further in the reservoir.
Q You're saying that 20 feet Sardis Reservoir depth,
average depth, would be similar to the lacustrine
sections of Lake Tenkiller? 11:51AM

believe there's not -- there is the same amount of 11:48AM
vertical mixing during the summer between Tenkiller and
Sardis? Is that your testimony?
A My testimony is that based on the information we
have, which as I indicate here is one day, that there's 11:48AM
no evidence of differences in vertical stratification
over the same depth intervals.
Q What about with regard to Hugo? Do you have the
same opinion that there's -- that there's vertical
stratification in Hugo similar to that at Tenkiller? 11:48AM
A For this time period, no, they're different.
There is a much less vertical stratification in Hugo
than we see in the profiles for Tenkiller or Sardis.
Q If that was consistent throughout the summer year
in year out, would that indicate that Hugo and 11:49AM
Tenkiller would have different water quality impacts
due to that different stratification?
A There could be some differences associated with
that difference.
Q Did you look at any of the other BUMP reports to 11:49AM
determine whether there's a similar pattern in other
years?
MR. TODD: Object to form. Asked and
answered.
A Yes. 11:50AM

A I have a figure that shows the depth, the maximum 11:51AM
depth profile in Tenkiller, which would be helpful to
look at.
Q Okay.
A If I can find it. 11:52AM
Q Figures --
A It's Figure 4-6.
Q Okay. 4-6. Okay.
A Now, this figure represents the profile along the
thalweg, so this is the deepest part of lake, as you 11:52AM
move through it, so it's not going to represent the
average so it's not appropriate to compare it to the
average here, but I think it does give some sense that
at Lake 04, the deepest Lake 04 is on the order of
about 15, 20 feet. 11:53AM
Q And Lake 3?
A And Lake 3 is probably six, three, two, five,
eight -- about 50 feet deep.
Q And Lakes 2 and 1?
A Here are we're talking about maximum depth of 80 11:53AM
feet.
Q So wouldn't Lake 4 be more similar to Sardis and
Hugo than the other portions of Lake Tenkiller?
A From a depth standpoint and, again, the caveat
here is average versus maximum so I think if we're 11:53AM

1 looking at average, it's probably somewhere between 11:53AM
2 Lake 04 and Lake 03.
3 **Q Okay. Did you limit your comparison of Lake**
4 **Tenkiller with Hugo and Sardis to just the Lake 4 and**
5 **Lake 3 region? 11:53AM**
6 A No.
7 **Q Why not if that's what the -- where the depths**
8 **were the most similar?**
9 A Because depth is not the only parameter we're
10 looking at here. 11:54AM
11 **Q But it is one that affects water quality, correct?**
12 A It is one that can affect water quality.
13 **Q So would it be more fair just to look at the**
14 **similar depth areas in order to see whether or not**
15 **Tenkiller and Hugo and Sardis have similar 11:54AM**
16 **characteristics?**
17 MR. TODD: Object to form.
18 A I don't think so but I would admit to being
19 uncertain.
20 **Q Okay. Look at Page 2-28, sir, 2-28 of your 11:54AM**
21 **report, and if you can get out in front of you the**
22 **second page of Exhibit 14 and I want to look at some of**
23 **these chlorophyll-a numbers that we -- that you've**
24 **discussed on Page 2-28. Would you read -- in the full**
25 **paragraph there on Page 2-28, could you read the second 11:55AM**

1 **sentence about the chlorophyll-a comparisons in the 11:55AM**
2 **transition zones?**
3 A "The chlorophyll-a concentrations in the
4 transitional sections of Lakes Hugo, Sardis and
5 Tenkiller during 2003 and 2005 where contemporaneous 11:55AM
6 data are available were similar in magnitude. These
7 transitional section concentrations in 2003 and 2005
8 were 9.2, 7.0 and 8.0 micrograms per liter and 11.0,
9 7.4 and 15.6 micrograms per liter respectively.
10 **Q Okay. So the 9.2 is what you reported as being 11:56AM**
11 **the chlorophyll level for Hugo in 2003?**
12 A Yes.
13 **Q And Sardis is 7.0?**
14 A Yes.
15 **Q And Tenkiller, you report, is 8.0? 11:56AM**
16 A Yes.
17 **Q Where did you get 8.0 for Tenkiller?**
18 A From the data that we had for 2003.
19 **Q And was that the Cooke and Welch data or data from**
20 **the Cooke and Welch report? 11:56AM**
21 A No.
22 **Q Well, did you look at the data for Lake Tenkiller**
23 **in the transitional section from the Cooke and Welch**
24 **report?**
25 A No. 11:56AM

Q Did you look at what that level is for 2003? 11:56AM
A It indicates 13 point something.
Q Looks like 13.1 perhaps. How can you account for
the difference between 8.0 and 13.1 as reported by
Cooke and Welch? 11:57AM
A I have no explanation for the difference. We did
not try to replicate what Cooke and Welch did. We did
our own independent analysis of the data and determined
the value of 8?
Q And where did you get the 8. value? 11:57AM
A The 8. value comes from the data that were
available with an attempt to try to use contemporaneous
data as possible, to the extent possible. And we were
restricting ourselves to May through September. I'm
not sure. 11:57AM
Q Cooke and Welch is for the summer months also,
correct?
A Yes, but I'm uncertain how they're defining summer
months here.
Q I think June through September. 11:57AM
A So we use May through September, so that's one
difference. There's a double asterisk at the bottom
that says, oh, that's only 2007, June, July, and August
only for 2007.
Q It looks like for 2003 the data is from the Army 11:58AM

Corps of Engineers, correct, both your data -- at least 11:58AM
Cooke and Welch data is from Army Corps of Engineers,
correct?
A Yes.
Q Is your data from the Army Corps of Engineers? 11:58AM
A We used data from the Army Corps where we had it
but also from OWRB.
Q Was there OWRB data for Lake Tenkiller in 2003?
A I would have to go check.
Q Looks like the BUMP report was 2001 and 2002, 11:58AM
correct?
A Yes.
Q Okay. If Cooke and Welch's data is representative
of the summer mean concentrations for Lake Tenkiller in
2003, that is it's 12.1 rather than 8, does that show 11:58AM
that there's a substantial difference between the
chlorophyll-a levels of Tenkiller as opposed to Sardis
and Hugo?
A If that 13.1 were an appropriate number that would
be true, but I'm confident that the numbers that we 11:59AM
have here are correct.
Q Really?
A Yes.
Q Well, you see the 15.6 you report in the other
half of that sentence? 11:59AM

A Yes. 11:59AM
Q Okay. Let's look at your table. Do you report it as 15.6 in your table or is it a different number for Tenkiller in 2005?
A 16.2. 11:59AM
Q So there was a mistake in that number, correct? Both of them can't be correct?
A Both of them can't be correct, that's true. And there's a typo somewhere. The Number 8 that we are looking at the same in both tables. We were very 11:59AM careful to double and triple check all our calculations so I'm confident that we analyzed the data correctly. It's perhaps a typographical error here. And see the 15.6 and 16.2, I don't know which one is correct.
Q Your data on 2-11 for chlorophyll-a for Tenkiller 12:00PM averages 8. You show a minimum of 2.9 and a maximum of 33.2, is that correct?
A No.
Q For 2003, Tenkiller data, chlorophyll-a on Table 2-11. I'm reading on your chart an average of 8 and a 12:00PM minimum value of 2.9 and a maximum value of 33.2.
A That's correct.
Q Okay. Well, is it -- just by looking at that data does it surprise you that your average would be an 8 given that you had a maximum of 33.2? 12:01PM

Q Yes, that's what we're looking at, 2.2. Thank 12:02PM you, sir.
A 13.9.
Q In 2005 it's 13.9?
A Yes, as I read it -- oh, I'm sorry, I read the 12:02PM wrong one. It's 16.5.
Q And how does what compare to the number you report?
A Depending upon whether 15.6 or 16.2 is the correct number, it's fairly close. 12:03PM
Q Okay. Do you see in 2005 you use the numbers you report, a difference for chlorophyll-a level between Tenkiller and Hugo and Sardis?
A It's 11 in Hugo, 7.4 in Sardis and 15.6 or 16.2 in Tenkiller. 12:03PM
Q Tenkiller is higher, correct?
A Yes.
Q And it's substantially higher than Sardis, is it not?
A It is about two times higher. 12:03PM
Q Do you consider that to be similar concentrations in chlorophyll?
A Given the year-to-year variability, that would say, as indicated by the differences between, say, 2003 and 2005, and the small number of samples, so if we 12:03PM

A Not at all. 12:01PM
Q Why is that?
A You asked me, I believe it was yesterday, most environmental data are not normally distributed and these data typically are and so the mean is not 12:01PM typically near the maximum because there are many more low values than there are high values.
Q But the mean, if you look at the log normally distributed data from a minimum 2.9 to 33.2 could very well be around 15, which is -- or 13, which is closer 12:01PM to what Cooke and Welch had reported than what you're reporting, correct?
A No.
Q No?
A The mean is 8. 12:01PM
Q The mean is 8 because you report it, but if this data log is normally distributed and you have three at one end and three at the other, wouldn't you expect the mean to be closer to around 15?
A No. 12:02PM
MR. TODD: Object to form.
A The mean is the mean.
Q What does Cooke and Welch show for the Tenkiller data in 2005?
A In the transitional section? 12:02PM

look at Sardis for 2005 on Table 2-11, it is based on 12:03PM two values that I would not conclude that there are real differences here. In 2003 they are very close to the same number. Yes, they're different from 2005 but we're comparing two numbers in Sardis to 25 numbers in 12:04PM Tenkiller.
Q Well, given the fact you only have two numbers in Sardis for both 2003 and 2005, you can't tell whether those are representative of Sardis whatsoever, can you?
A They are representative of the data at the times 12:04PM they were taken, but they are probably a fairly poor representation of the seasonal average, but they are the data that exist.
Q So how can you conclude that the similarity between Tenkiller and Sardis given the vast difference 12:04PM in sampling data between Tenkiller and Sardis? I mean, you're saying Tenkiller and Sardis look similar for chlorophyll-a in the transitional section?
A Yes.
Q But you admit you don't have very much data for 12:05PM Sardis that's not representative so how can you draw a conclusion that they're similar?
A There is no evidence that they are dissimilar and if we had bothered to conduct the statistical tests, which we didn't, those numbers would not be 12:05PM

statistically correct. 12:05PM
Q So you don't do a test but you're confident that the test would show they're not statistically different?
MR. TODD: Object to form. 12:05PM
Q Is that what you're telling the court?
A Yes.
Q And so there's no evidence that they're dissimilar but there is evidence that they're similar based on two samples for Sardis versus 25 for Tenkiller in 2005? 12:05PM
MR. TODD: Objection, asked and answered.
Q Correct?
A What I'm saying is that given the data we have at hand, looking at 2003 and 2005 together, because it's -- we're not looking at them separately, trying to 12:06PM use all the evidence we have at hand, things are similar. Are they the same? Probably not. Are the differences significant? No. So if the information we have at hand suggests not significantly dissimilar water quality. Would I have liked to have had a lot 12:06PM more data to do a much more robust comparison? Yes.
Q The differences we're seeing here is the difference between a eutrophic lake system and a mesotrophic system, are they not?
MR. TODD: Object to form. 12:06PM

Q If you go from 8 to 16, you're going from a 12:06PM mesotrophic system based on chlorophyll-a to a eutrophic system, correct?
A If those were representative of the true summer average, yes. 12:07PM
Q Okay. This is your data we're looking at right here you put before the court, so you're now saying they're not representative?
MR. TODD: Object to form.
A I'm saying that I would hesitate to declare 12:07PM eutrophic or mesotrophic based on two data points and the simple analysis here is to say given what data we have is there evidence that the water quality in these reservoirs is substantially different. And the data that we have says probably not, but I fully admit that 12:07PM there's not a lot of data here for comparison.
Q Would you also admit that there's insufficient data to make the comparison to make that conclusion one way or the other?
A In the case of Sardis, I would say that the 12:08PM conclusion is probably tenuous based on the limited data set.
Q With Hugo, instead of having -- you have five instead of two samples, do you think that's for one year and then just three for the other year, do you 12:08PM

think that Hugo's data set is more robust so you can do 12:08PM that analysis with Hugo in a way that's different than you did for Sardis?
A Yes.
Q And just a couple of more samples, you think, it's 12:08PM just that a couple more samples actually provides the more robust data set in your opinion?
A Well, it's twice as many samples in total. And in addition, we have the phosphorus information for which we have other data. Again, Sardis simply has two 12:08PM samples but we're looking at, you know, a dozen samples over the two years for Hugo.
Q You said you could do a statistical test and they would be representative. What statistical tests would you run? 12:09PM
A I didn't say they would be representative. What I said was that if you ran a statistical test you would not be able to conclude that they were different.
Q What was different?
A That the average in Sardis was different from the 12:09PM average in Tenkiller.
Q Is that because you don't have enough samples from Sardis?
A The small number of samples in Sardis does make it difficult to see differences. 12:09PM

Q How do you do a statistical test with just two 12:09PM samples?
A You can do nonparametric comparisons that are very weak with two samples, but nonetheless, you can do them. You can do a comparison with a single sample. 12:10PM
Q But it's very weak?
A Yes, you simply ask the question could this data point have come from this population.
Q In your opinion, sir, based on your experience, would a lake with an average depth of 12 feet stratify? 12:10PM
A Yes. There's evidence in the data here that stratification occurred.
Q Based on those BUMP reports we just reviewed?
A Yes.
Q And is the well mixed layer almost the entire 12:11PM depth of the lake for Sardis and Hugo?
A Not for both of them using this data, the well mixed depth is, you know, seven out of ten feet so it's in 70 percent?
Q Seventy percent. 12:11PM
MR. TODD: Would you say for the record what exhibit you're looking at?
MR. PAGE: Yeah, that's fair. It's Exhibit 19 and it's for Hugo Lake.
Q So 70 percent of Hugo Lake is well mixed, correct, 12:11PM

in the summer? **12:12PM**
A At this point in time where the measurement was taken.
Q Okay.
A It's a different story in Sardis where the 12:12PM stratification again begins at about four meters and we're talking data down to about 16 or 17 meters.
Q So really there's not a real drop, though, until we get to about a real precipitous drop, so there's no DO until we get to about 12 meters in Sardis, correct? 12:12PM So wouldn't that indicate that there's still some mixing going on from zero to 12 meters?
MR. TODD: Object to form, and can we again say what we're looking at now?
MR. PAGE: Yeah, Exhibit 1. Sardis Lake. 12:12PM
A There is what I would characterize as a precipitous drop in dissolved oxygen beginning at about four or five meters because we go from six milligrams per liter to zero milligrams per liter over that distance, so we're dropping oxygen about one milligram 12:13PM per liter per meter and that's pretty significant oxygen gradient.
Q Does that indicate there's still mixing, though, going on in that portion of the, what you call midlimnion? 12:13PM

A Hard to say from this data. 12:13PM
Q It's possible there may be some mixing in that area?
A It's possible.
Q Okay. Let's turn to Section 2.9, Dr. Connolly. 12:13PM We're almost out of Section 2. Do you see the title there on Page 2-32 of your report?
A Yes.
Q Would you read that please, sir?
A "wastewater treatment plants appear to be the most 12:14PM important source of bioavailable phosphorus to the system."
Q Would you explain what you mean by that statement?
A Wastewater treatment plants are the most important source of phosphorus for algal growth in the system. 12:14PM
Q And why do you say that?
A Because water treatment plants appear to be the dominant source of phosphorus to this system during base flow conditions when we don't have runoff occurring. Base flow conditions dominate during the 12:15PM growing season. By our estimate, perhaps 80 percent of the time we're under base flow conditions. And most of the phosphorus that enters from wastewater treatment plants is in a form that can be used by algae.
Q During base flow conditions what is -- did you 12:15PM

calculate the percentage of phosphorus that comes from 12:15PM point sources as opposed to non-point sources?
A The analysis we did suggests that it is probably nearly entirely from wastewater treatment plants.
Q Almost 100 percent? 12:15PM
A Almost 100 percent.
Q Okay. Is it possible during high flow events for phosphorus to be stored in alluvium near rivers and streams to be released during base flow?
A Not to a significant extent. 12:16PM
Q Are you familiar with that concept, that water will flow into the alluvium near the rivers and streams during a high flow event and then drain back into the rivers and streams following that?
A Yes. 12:16PM
Q And could that water contain phosphorus from the high flow event?
A Yes.
Q So how can you state or what is your basis for your statement that that wouldn't be a significant 12:16PM source of flow?
A Two points. The first is that the volume of water that would be coming out and draining back in is small in comparison to the overall flow. And, two, we've examined phosphorus profiles in the river as you move 12:16PM

down the river under base flow conditions and there is 12:17PM no evidence in the data that we are seeing inputs coming in from points other than points where wastewater treatment plants enter.
Q So is it your testimony, sir, that if there wasn't 12:17PM any wastewater treatment plant discharges there wouldn't be any flow in the Illinois rivers and streams.
A No.
Q Just wouldn't be any flow with any phosphorus 12:17PM then, is that what you're saying?
A No.
Q Okay. So are you saying that -- I thought you testified that wastewater treatment plants are the dominant source of phosphorus, almost 100 percent of 12:17PM phosphorus during base flow conditions?
A Yes.
Q Okay. So is it your opinion, sir, that if during base flow type conditions if we shut off the wastewater treatment plants there wouldn't be any flow in the 12:17PM rivers and streams?
A No.
Q So it's your opinion that during base flow conditions the non-point sources do not add any phosphorus? 12:18PM

A No. 12:18PM
Q Okay. Well, then I'm not following your logic. Are you conceding that during base flow, phosphorus is contributed by non-point sources?
A Under base flow conditions, water entering the 12:18PM
river will have some phosphorus associated with it.
The source of that phosphorus is uncertain whether it
is simply phosphorus being dissolved from the matrix
that the water is flowing through in the ground,
whether some of it is phosphorus that drained into the 12:18PM
soils and is subsequently coming out, but regardless,
it's a very, very small amount and not sufficient to
cause water quality impacts.
Q Okay. On Page 234 at the bottom of the page, you state "the influence of wastewater treatment plants is 12:19PM evidence of the spatial pattern of phosphorus concentrations in the river and streams of the Illinois River Watershed," correct?
A Yes.
Q What do you mean by that statement? 12:19PM
A We examined phosphorus concentrations from
upstream to downstream through the river and noted
where there were increases in phosphorus concentrations
and those increases were associated with locations at
which wastewater treatment plants entered the system. 12:19PM

Q Okay. Do you show that on a figure in your 12:19PM report?
A Yes.
Q Where is that figure?
A Figure 2-24. 12:19PM
Q Okay. Let's turn there, sir. What is the Oklahoma water quality standard for phosphorus in streams in the Illinois River Watershed?
A Thirty-seven micrograms per liter.
Q Okay. I want you to take your red pen there, sir, 12:20PM and identify any location that is a sample result that's above 37 micrograms per liter that would not be influenced by a wastewater treatment plant. If you'd just circle those with a red pen on Figure 2-24.
A That would be only, because of the way this is 12:20PM
broken out, the break line here is at 50 micrograms per
liter.
Q Okay. So we'll give a little bit to the defendants here and we'll just look at the 51 micrograms per liter or greater, which would be the 12:21PM light blue, green, orange, or red?
A Yes.
Q So maybe we could work a little bit together on this because this is a little complicated, can we just start at the top, maybe up above Osage Creek? Do you 12:21PM

see any locations up there that would not be influenced 12:21PM by wastewater treatment plants that exceed the 50 micrograms per liter benchmark?
A There are two like samples there that exceed.
Q Okay. And then would you circle those for me, 12:21PM sir, in red? Okay. Right below there, do you see that dark red?
A Yes.
Q That's how much?
A Dark red would be greater than .5 microliters. 12:21PM
Q So that phosphorus on that would not be from wastewater treatment plant influence, right?
A Doesn't appear that it would be.
Q Okay. Is there anything else in the area that would be closer to the right hand side or the eastern 12:22PM side of the map?
A There's a green circle.
Q Okay. Anything else there on Spring Creek that you notice?
A There are light flows through in Spring Creek. 12:22PM
Q Above the wastewater treatment plant discharge?
A Mm-hmm, yes.
Q Okay. Can you tell, sir, the tributary off of Osage Creek there's a wastewater treatment plant?
A Yes. 12:22PM

Q It appears to be a blue diamond there between the 12:22PM two yellow diamonds?
A Yes.
Q Is that -- is that above the influence of those two wastewater treatment plants? 12:22PM
A I'm uncertain. I'd have to go back and study this
more. It may or may not be. I mean, it's hard to tell
by the scale, but it may or may not be.
Q Okay. Put a question mark there then, sir.
A Yes, sure. 12:23PM
Q Okay. We looked at Spring Creek, is there anything else in the vicinity of Spring Creek area south of Spring Creek that would indicate that there's a --
A There's an orange triangle. 12:23PM
Q Okay. So that's another area that's higher than -- certainly higher than the reference benchmark of 37 micrograms per liter that's not influenced by a wastewater treatment plant, correct?
A I believe so. 12:23PM
Q If we go to the south, is there anything in the south area that would indicate that in the vicinity of Mud Creek?
A There's a red triangle.
Q What about the blue, light blue square? 12:23PM

A The light blue square next to it. 12:23PM
Q Okay. If we move to the west, sir, from the Mud Creek area, do you see any others?
A There's a light blue square just above the Goose Creek and -- 12:24PM
Q Okay.
A -- a yellow diamond.
Q Okay. Let's see where you marked there. All right, sir. What about this light blue square here, sir? Did you also characterize that as a 12:24PM non-wastewater treatment plant influenced area?
A It appears to be.
Q Okay. Let's go to the southern where it says Muddy Fork?
A Mm-hmm. 12:24PM
Q Do you see any area where you've got your designator for Muddy Fork that would indicate?
A There's a red square.
Q Red square?
A Yes. 12:24PM
Q It's not influenced by a wastewater treatment plant?
A It doesn't appear to be.
Q If you go up gradient from that red square --
A There's a green square. 12:24PM

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A We're not talking about Barren Fork. 12:26PM
Q Well, this is part of the Illinois River. I'm sorry, I misspoke. Would you believe that would also be influenced?
A That may be. 12:26PM
Q Thank you. Let's move to the north up on Flint Creek.
A Mm-hmm.
Q Do you see any locations on Flint Creek that are not influenced by a wastewater treatment plant that 12:26PM they're above the standard?
A Yes, there's a green square and then a second green square.
Q Okay. What about Saber Creek, did you see any?
A There are light blue squares above the treatment 12:26PM plant.
Q Okay. And then near where the label is for Saber Creek, the far north part?
A Yes, there's a light blue square.
Q Let's move back to the south then, sir, see if we 12:27PM can find -- do you find any along the southern, south of -- south of that area that would be not influenced by a wastewater treatment plant that are above the standard?
A There are some green squares and a blue square and 12:27PM

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Q Okay. And if you move to the west there, sir, do 12:25PM you see any other --
A There's some more green squares there.
Q And a triangle?
A A triangle. 12:25PM
Q And is there a light blue square just up gradient from the -- a light blue and a red square up gradient from the yellow triangle on the --
A The light blue square is certainly above -- I couldn't tell by this scale whether the others are 12:25PM above or below.
Q Would you circle the light blue square and put a question mark by the red square?
A (Witness complies with request.)
Q Let's move on up, I guess, to the Barren Fork. Do 12:25PM you see anything else along the Barren Fork or tributary that would not be influenced by a wastewater treatment plant that would be above the standard?
A Right by the line from Bush Creek.
Q Yes, sir. What about moving on up this here? 12:25PM
A This is all influenced by this water treatment plant.
Q But at that point there, does that look like a tributary that would not be influenced by the wastewater treatment plant discharge at Barren Fork? 12:26PM

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a red square. 12:27PM
Q Okay. Above those three blue squares, are there any other locations that appear to be above the standard that are not influenced?
A There's an orange square and a blue square and 12:27PM blue triangle at the same location.
Q Okay. And then we've got those two there. What about along the Barren Fork, what tributaries? Can we go along there now and identify any?
A The red square and then orange square. 12:28PM
Q Okay.
A And another red square and a light blue square.
Q Thank you, sir. Anything else as you've traveled down towards then to Lake Tenkiller?
A There's a light blue square below the Barren Fork 12:28PM and a red square near the bottom of the watershed.
Q Okay. What about down in this area, sir?
A There's a light blue square and a another light blue square.
Q What about in the area of Tahlequah, sir? Do you 12:28PM see any non-influenced --
A There are some light blue squares that are overlapping each other, a green square and a light blue square, and then another light blue square that I think I would put a question mark on how close it is to the 12:29PM

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treatment plant. 12:29PM
Q Which one would put a question mark?
A (Indicating.)
Q That one. Okay. What about this light blue square right here, sir? 12:29PM
A Yes. Circle that.
Q Can you tell me how many sampling points are overlapping here? Is there at least more than one?
A Yes. There may be three sampling points there, all of which look to be light blue. 12:29PM
Q Okay. Would you go through now and count through there and count then all the circles you made and tell me how many locations on this map are above the standards of -- at least above the standard of 50, which is above the water quality standards for the 12:29PM Illinois River Watershed, that are not influenced by a wastewater treatment plant?
A Mm-hmm. Like about 45, 46.
Q Okay. And those 45 to 46 sample locations are not influenced by a wastewater treatment plant, correct? 12:30PM
A Not to my knowledge.
Q Well, using your figure, would that be a substantial amount of locations where the water quality exceeds the standard but is not influenced by a wastewater treatment plant in the IRW? 12:31PM

A Yes. 12:31PM
Q Can we turn to Figure 2-30, sir, please? I guess we're not going to turn to Figure 2-30 until after lunch.
A Okay. 12:31PM
Q So we can go off the record.
THE VIDEOGRAPHER: We are now off the record. The time is 12:31 p.m.
(Following a short recess, proceedings continued on the record.) 12:31PM
THE VIDEOGRAPHER: We are now on the record. The time is 1:03 p.m.
Q Dr. Connolly, let's look to -- it's Figure 2-30 of your report. What is the title of this figure, sir?
A "Frequency of calculated loads for total 1:03PM phosphorus under base flow conditions 2004 to 2007."
Q What's the purpose of this figure?
A The purpose of this figure was to look at the distribution of phosphorus loads passing two points in the river system, one at Watts and one at Tahlequah, 1:04PM under base flow conditions, trying not to include runoff conditions, for purposes of comparing that to the long term average phosphorus discharge from wastewater treatment plants to see how they compare.
Q So was this part of your evidence where you -- to 1:04PM

help you form your conclusion that -- that wastewater 1:04PM treatment plants are the large load, maybe was 100 percent of the phosphorus entering the system during base flow?
A Yes. 1:04PM
Q I notice you use total phosphorus?
A Because total phosphorus is the best estimate of phosphorus load.
Q Okay. What is the vertical blue bar on this figure? 1:04PM
A The vertical blue bar is the average of the phosphorus loading from wastewater treatment plants upstream of that location, through a period from 2004 to 2007.
Q Okay. And then there's some, I guess they call it 1:05PM a histogram, that goes out on either side of the blue bar vertically on this diagram?
A Yes.
Q And what do those bars represent?
A The bars represent the frequency or percentage of 1:05PM the total data that fall within the phosphorus loading range indicated by the vertical limits of the bar.
Q Okay. And what did you conclude by this analysis?
A I conclude by this analysis that the central tendency of loading under base load conditions seemed 1:05PM

to correspond with the average phosphorus loading from 1:05PM wastewater treatment plants.
Q Okay. Is it reasonable to compare central tendency of loads to an average load?
A For the purpose of this comparison it is. 1:06PM
Q Wouldn't it be better to compare average loads?
A I'm sorry?
Q Well, rather than compare average loads to central tendency, wouldn't it just be better to compare average loads? 1:06PM
A I did that also.
Q Is that represented here?
A No, that's represented on another figure.
Q Okay. Can you show us that, sir?
A That is Figure 2-31. 1:06PM
Q Okay. Explain this figure.
A This figure is using, in essence, the same data as Figure 2-30 only now we've broken out years, so 2004, 2005, 2006. And what's shown at the different locations is the average total phosphorus load measured 1:07PM at the station under base flow conditions in comparison to the estimated average wastewater treatment plant load for total phosphorus.
Q So when you do this comparison for 2004 and 2005, doesn't that indicate that there are other sources of 1:07PM

phosphorus at these different locations where the 1:07PM
measurements were taken in base flow conditions?
A Not necessarily.
Q Well, how do you account for the large difference,
for example, in 2004 between the red bars, which, I 1:07PM
guess, are a wastewater treatment plant, and the blue
bars, which are load as total phosphorus?
A I don't characterize these differences as being
large. And in comparison, 2006 shows the opposite.
So, for example, in 2006 it would say there's less 1:08PM
phosphorus in the river than was put in the river. And
I think the differences that we see in 2006 are similar
to the differences we see in 2005 and really reflect
the uncertainty in doing these calculations. And the
conclusion that I think you can draw from this is 1:08PM
simply that what we see in the river is about what we
see discharged from wastewater treatment plants. I
think to parse it anymore and start to look at the
little up ticks or little down ticks and say, well,
that must mean there's extra load or that must be 1:08PM
marginally some load evaporated, is going beyond what
you can do with this data.
Q Do you know what the differences in rainfall were
between 2004 and 2006?
A 2004 was a fairly high rainfall year, 2006 was a 1:08PM

much lower rainfall year. 1:09PM
Q So would that indicate to you that there's a
larger portion of non-point source phosphorus in 2004
in the base flow based on the data you have here in
Figure 2-31? 1:09PM
A Under conditions where there are frequent runoff
events as occurred in 2004, the statistical procedure
used to estimate base flow really doesn't work very
well. And what's called base flow here likely includes
runoff, some runoff events as well, and so the higher 1:09PM
loads here do reflect additional sources coming in
under runoff events so would reflect additional
non-point source loading.
Q How do you account for the fact that in 2006 your
calculations of wastewater treatment plants are greater 1:09PM
than the base flow calculations?
A Again, as I said a minute ago, I think that that's
just uncertainty here.
Q Uncertainty in your calculations?
A Uncertainty in the estimates. 1:10PM
Q Which include your calculations, correct?
A Yes.
Q Let go back to Figure 2-30. What wastewater
treatment plant loads are included in the blue vertical
bar on the bottom? 1:10PM

A The legend inside the plot indicates that it 1:10PM
includes Springdale, Siloam Springs, Fayetteville,
Nolan, Rogers, Prairie Grove, and Tahlequah.
Q So this is a Tahlequah station?
A This is at the Tahlequah station. 1:10PM
Q Okay. Is it fair to conclude the Tahlequah
wastewater treatment plant load at the Tahlequah
station?
A I would have to check now that you bring that up.
I'm uncertain. 1:11PM
Q My recollection is, is that the Tahlequah sampling
station for USGS is above grade for the discharge point
for the wastewater treatment plant?
A I'd have to go back and check that.
Q If that's the case, would it be appropriate to 1:11PM
recalculate this number?
A Yes, it would.
Q Let's look at -- it's Figure 2-24 we were looking
at before the lunch break?
A Mm-hmm. 1:11PM
Q Does that show the wastewater treatment plant
discharge in comparison to USGS? I'm not sure that it
does but maybe get some help here. Well, are you
looking at 2-24, sir?
A I am. 1:12PM

Q Do you see the green box that's upgraded from the 1:12PM
Tahlequah Creek Fork, the green -- I guess it's a green
circle over a blue box --
A Yes.
Q -- on this location? 1:12PM
A Yes.
Q It's right here. Isn't that, in fact, where the
Tahlequah sampling station is for USGS?
A I would have to check. I don't remember exactly.
Q Okay. Is there any other ones down gradient on 1:12PM
the river? So I'm trying to see --
A Yes.
Q -- if it's reasonable to conclude that that would
be the sampling location because there's no locations?
A Sure, except that in our legend here we've got 1:13PM
OWRB, plaintiff's data, and ADQ data, but not USGS.
Q Didn't the plaintiff's data include the USGS data?
A I'm trying to recall whether it did or did not.
Nonetheless, I can check whether we should or shouldn't
have included the Tahlequah station in that figure. 1:13PM
Q Would you accept my representation that Tahlequah
is discharged down gradient for the purposes of
deposition today?
A For the purposes of the deposition today, surely.
Q Okay. So what I'd like you to do is recalculate, 1:13PM

if you would, sir, the loads without Tahlequah. I 1:13PM
mean, you can go back to Table 13 to do that.
A I need a calculator.
Q I did it in my head a little bit ago, but I don't
blame you. I don't blame you wanting a calculator. 1:14PM
A Divide 365 somewhere.
MR. TODD: Jason, unfortunately, has left us.
Q Let's see here, you've got a calculator there.
MR. OLSEN: Is he old enough to use that?
A Yes, I am. 1:14PM
Q Why don't you share your calculator, Doctor, with
Dr. Connolly?
A Thank you.
Q My understanding is, sir, and maybe I'm making
this more simple than it really is, but you look at 1:14PM
2-13 and we just add up the average loads for Prairie
Grove, Fayetteville West, Springdale, Rogers, Siloam
Springs, and ignore Tahlequah, Lincoln, Westville,
Stillwell, then we'll have a new calculation, correct?
A Mm-hmm. 1:15PM
Q Okay.
A And then number is 94 kilograms per day.
Q Okay. 94 kilograms per day?
A Yes.
Q And how many kilograms per year would that be 1:15PM

then? Would you just do me a favor and write it in on 1:15PM
your figure, the Number 94? It's going to be real
close to the bar.
A Yes.
Q Just kind of put a little point there and put 94 1:15PM
kilograms per day and calculate the annual, if you
would, sir?
A 34,300.
Q All right, sir. Would you also write the annual
amount somewhere on Figure 2-30, sir? Okay. Now, how 1:15PM
would you go about calculating the total annual
phosphorus mass in the river at the USGS gauge at
Tahlequah using the histogram you created?
A You couldn't calculate the total annual load from
the -- the total annual load or the total base flow 1:16PM
load?
Q Total base flow load annually. And we've actually
tried to do that so I can show you a calculation we put
together and maybe save some time if you would just
verify and see if that is correct? 1:16PM
MR. TODD: If you want to check it out, do
that.
Q Yeah, I think each of the calculations, like 12
kilograms per day times .05 would represent each of the
histogram bars, so what we're trying to do is get a sum 1:17PM

total so that we get the base flow phosphorus for the 1:17PM
year.
A Mm-hmm.
Q Okay. Does it come up to the average for those
three years, 56,863 kilograms? 1:17PM
A That's what this table -- this calculation says,
yes.
Q Okay. So that amount represents the average
annual mass of phosphorus during base flow conditions
for that three-year time period, correct? 1:18PM
A Yes.
Q How does that compare to the phosphorus being
discharged by wastewater treatment plants?
A This number appears to be, you know, maybe 70
percent higher. 1:18PM
Q Okay. So would you write down on Exhibit 20 the
amount of phosphorus coming from wastewater treatment
plants that we just recalculated? So what portion of
total phosphorus entering Tahlequah is wastewater
treatment plant phosphorus? 1:19PM
A You can't do that from this.
Q You can't determine total mass?
A It would be inappropriate to do that subtraction
and say that that's a fraction that comes from
wastewater treatment plants. 1:19PM

Q Why is that? 1:19PM
A Because both of these numbers are highly uncertain
and what the appropriate comparison here is to say is
that number statistically higher than that number.
Q Well, it looks to me, sir, that the amount of 1:19PM
phosphorus, using your calculations, and using USGS
data is that about 40 percent of the phosphorus
entering the Tahlequah sampling point is non-wastewater
treatment plant phosphorus, is it not?
A I don't think that's the appropriate way to do 1:19PM
this.
Q Doesn't that indicate, if it was appropriate, that
not 100 percent of the phosphorus seen during base flow
conditions during 2004-2007 were from wastewater
treatment plants? 1:20PM
A If it were correct?
Q Yeah.
A If this were exactly what the load under base flow
was and this were exactly what the load discharged by
treatment plants, yes, that's true. 1:20PM
Q And we're using your data from your table to do
those calculations, correct?
A Yes, you are.
Q So would you agree with me, sir, that there's some
portion of the base flow that is not representative by 1:21PM

wastewater treatment plant discharges at some portion 1:21PM
of the process during base flow?
A There may be.
Q And would that be non-point source phosphorus,
sir? 1:21PM
A Perhaps.
Q If that's true, would that be a daily
contribution?
A No, sir.
Q What would it be? 1:21PM
A A very occasional contribution.
Q And what's your basis for that statement?
A The high value here, this lower bar, which
influences this calculation which you've done here
fairly significantly, was measured in three of 78 1:21PM
samples. So in 78 times they went out and measured,
there were only three times that they measured loads
that high. That significantly influences this number
to the extent that that doesn't represent occasional
upsets from wastewater treatment plants, for example, 1:22PM
and, in fact, represents some other source, then that
source occurred three out of 70 sample events.
Q Do you have any evidence that there are any upsets
from these wastewater treatment plants during the
2004-2007 time period? 1:22PM

A I've not studied that. 1:22PM
Q Let's look at Page 2-37 of your report, sir. You
say here on the page that in contrast to base flow
phosphorus runoff associated phosphorus is not present
in the river on a day-to-day basis, is that correct? 1:23PM
A Yes.
Q Wouldn't it be true, sir, that some of the 40
percent that we just calculated in the calculation
present on a day-to-day basis in the river as 40
percent during base flow calculations? 1:23PM
A No.
Q How can you say that?
A There is, first of all, as I indicated a minute
ago here, the fact that there are very few numbers of
high value in the distributions that we looked at that 1:24PM
influence the average that, as I indicated in the
highest bar there, was three out of 78 measurements and
I don't characterize that as happening day after day.
Q Well, how do you know those aren't wastewater
treatment plant discharges if you don't know if there's 1:24PM
an upset or not?
A I don't. They may be wastewater treatment plants.
Q Or they could be non-point?
A Or they could be non-point.
Q How can you then conclude that there isn't some 1:24PM

day-to-day influence of non-point source phosphorus in 1:24PM
the river as represented by the Tahlequah measurements?
A Because high values above what you might expect
from the wastewater treatment plants but cannot
conclude are not, in fact, from wastewater treatment 1:25PM
plants occur very rarely in the record.
Q So how can you conclude that there's -- with the
lack of evidence that you're describing here, how can
you conclude that there is a daily base flow load from
non-point source to the phosphorus load at Tahlequah? 1:25PM
A I'm not concluding that there's no contribution,
I'm concluding that there's no evidence of a
contribution and that the central tendency of
phosphorus loads in the river under base flow
conditions agrees fairly closely with the amount of 1:25PM
phosphorus on average discharged by wastewater
treatment plants.
Q Let's look at some of the data. Did you look at
data collected by CDM for base flow conditions
throughout the reservoirs -- not the reservoir but the 1:26PM
IRW?
A Yes.
Q When you say here on Page 237, "in contrast to
base flow phosphorus runoff associated phosphorus is
not present in the river on a day-to-day basis." What 1:26PM

is your basis for this statement, sir? 1:27PM
A My general understanding of hydrology.
Q In karst systems, isn't there much more
groundwater flow into the rivers and streams when you
find other soil-type geology systems? 1:27PM
A Not necessarily.
Q Do you know whether or not there's a lot of
streams in the Illinois River Watershed -- excuse me, a
lot of springs in the Illinois River Watershed?
A I don't know how many there are. 1:27PM
Q Did you do any -- walk any of the streams to see
whether there were streams that would disappear then
reappear?
A I did not.
Q Do you know whether that's a common practice in 1:27PM
the Illinois River Watershed?
A To walk the streams?
Q No, to determine whether you have disappearing and
reappearing streams in the IRW?
A I do not. 1:28PM
Q Would that tell you anything about what non-point
source contributions would be in the IRW?
A No.
Q How much of the runoff phosphorus load is
associated with particulate matter? 1:28PM

A It appears that a significant fraction of the 1:28PM
runoff phosphorus load is associated with particulate
matter. It varies depending upon the magnitude of the
event.
Q Okay. Would that have an impact -- is it your 1:28PM
opinion that it has little direct impact on water
quality?
A That what has little impact?
Q The runoff phosphorus.
A That's the conclusion that I've drawn from the 1:28PM
analysis that I've conducted.
Q Okay. Would you pull out Exhibit 5, sir?
A Mm-hmm.
Q Did you find Exhibit No. 5, sir?
A Not yet. 1:29PM
Q Did you find it, sir?
A Yes.
Q Would you turn to Table 4, "Flow summary of small
tributary samples in high flow conditions." Okay. You
mentioned here in your report that much of the runoff 1:30PM
phosphorus is associated with particulate matter, is
that correct?
A Yes.
Q Can we look at the data for small tributary
samples which has high flow conditions which would be 1:30PM

runoff conditions, correct? 1:30PM
A Presumably.
Q Okay. Would you look at total dissolved P under
the 4,500 method on Table 4 and compare it to total P
and tell me what the percentage of dissolved versus 1:30PM
total P is in small tributaries to runoff conditions?
Would you like to use the calculator again, sir?
A Not in this particular data set, it's
approximately 90 percent.
Q Do you have any information that would indicate 1:31PM
that that is not representative of runoff phosphorus in
small tributaries within the IRW?
A No.
Q Do you know how CDM selected its sampling
locations? 1:31PM
A I don't recall.
Q Was it a stratified random design for their
sampling location selection?
A I'd have to check back.
Q If it was, does that tend to be a good measure for 1:31PM
representation?
A It could be, depending upon how it's conducted.
Q So at least in this group of samples there was
about 90 percent of the total P was dissolved P,
correct? 1:32PM

A On average. 1:32PM
Q And what's the number of samples we have here,
sir?
A 140.
Q Did you consider this information when you made 1:32PM
your statement that much of the phosphorus runoff load
is associated with particulate matter would have also
direct impact on water quality?
A I did, but the focus of my analysis was on the
Illinois River and water quality impacts on the 1:32PM
Illinois River, not on what was happening in these
small tributaries.
Q Okay. Well, part of the plaintiff's claim in this
case has to do with impacts on small tributaries also,
does it not? 1:32PM
A It does.
Q Let's go to -- let's go a couple pages later,
probably three pages, where we have any high flow on
the rivers, the tenth page in, sir?
A What table number? 1:33PM
Q It's Table 6. Would you now look at -- this is
for river water, correct?
A That's what it says.
Q Okay. So again, what's the quotient of soluble --
not quotient. What is the percent of soluble reactive 1:33PM

P 4,500 method to total P in these larger river 1:33PM
samples, again during the high flow conditions?
A Looks to be about 70 percent.
Q Okay. So would you consider that a substantial
portion of soluble reactive phosphorus or soluble 1:34PM
reactive phosphorus for river samples, 72 percent, is
that a substantial portion of the total phosphorus is
soluble in high flow events?
A I'm sorry. I was looking at the total dissolved
P, not soluble reactive P. Do you want me to look at 1:34PM
soluble reactive P?
Q Yeah, I probably misspoke. I apologize.
A That looks to be about 60 percent.
Q Okay. Do you believe that's a substantial
portion? 1:35PM
A Yes.
Q If we look at just dissolved P, it's about 70
percent?
A Yes.
Q And you would agree that's a substantial portion 1:35PM
of the phosphorus during high flow conditions in these
river samples?
A Yes.
Q And what is the total number of samples that these
represent? 1:35PM

A 148. 1:35PM
Q Okay. Now, let's look at the USGS sample stations on Table Lake during high flow. And, again, would you compare dissolved phosphorus to total phosphorus, sir? What's the approximate percentage? 1:36PM
A I would say about 60 percent, sir.
Q So these are the main stem sampling points during high flow sampling by the USGS, correct?
A I'm not sure what they are. The table says USGS data. I don't know from where. 1:36PM
Q Did you review this data?
A We looked independently at the USGS data.
Q Okay. Do you recall finding similar numbers?
A I have a figure in my report that shows the USGS data. 1:37PM
Q Okay. Let me ask you about the orthophosphate. What is the percentage of orthophosphate, which I guess is soluble reactive phosphorus, correct?
A Yes.
Q Total phosphorus from such USGS sample stations? 1:37PM
A Probably about 80-90 percent.
Q Does that indicate that dissolved phosphorus is a substantial portion of the high flow phosphorus seen in USGS stations?
A I have independently analyzed that data and I 1:37PM

think that I cannot support that conclusion and -- 1:37PM
Q I'm sorry?
A I'm not going to make that conclusion based on these numbers.
Q Do you have anything in your report that you could rely on? 1:38PM
A Yes.
Q Can we look at that, please? Just tell me what you're looking at.
A I'm looking at Figure 2-32. 1:38PM
Q 2-32?
A Yes.
Q Okay, sir. And what does this show us?
A This is the fraction of the phosphorus passing Tahlequah that is particulate as a function of the flow 1:39PM at the time the measurement was taken.
Q Okay. What does it indicate to you, sir?
A It indicates to me that under lower flow conditions, perhaps up to 1,000, 2,000 cubic feet per second, perhaps on average about 20 percent of the 1:39PM phosphorus is particulate. And that as we go to higher and higher flows, a greater and greater percentage of the phosphorus is particulate and at the highest flows here, it's somewhere between 60 and 80 percent.
Q Does that 20 percent indicate that 80 percent is dissolved? 1:39PM

A Yes.
Q At what flow?
A At the lower flows.
Q And at the higher flows? 1:39PM
A At the higher flows, there's an apparent increase in the fraction of particulate and at the highest flows greater than about 10,000 CFS tends to be about 60 and 80 percent particulate.
Q And what level did you consider a high flow? 1:40PM
A I didn't have a precise cutoff for a high flow.
Q What is the average percent at base flow, average percent of dissolved phosphorus, estimated?
A I would guess it's about 20 percent of particulate, 80 percent dissolved. 1:40PM
Q And what about at high flow?
A It varies. At the highest flows, which would be the flow that would bring in the most non-point source phosphorus it seems to be between 60 and 80 percent particulate, so 20 to 40 dissolved. 1:41PM
Q And at the moderately high flows, still rough storm events, do you have higher levels of soluble reactive phosphorus?
A This does not show soluble reactive phosphorus.
Q I'm sorry, dissolved phosphorus. You have flow 1:41PM

events that show substantially higher quotients of dissolved phosphorus than 20 to 40 percent, do you not? 1:41PM
A Yes, yes.
Q What's the highest percent in your figure?
A Again, it's what you would call a high flow and I 1:41PM would say it's probably, you know, maybe 56, 60 percent dissolved.
Q Okay. We have some runoff, for example, in 1994 to 2003 that you've identified as runoff samples that are substantially higher than, do we not, almost like 85 percent dissolved phosphorus? 1:42PM
A Those events are at very low flows that would probably not have eroded much material out of the watershed and so what we're tending to look at here is probably still largely the base flow load despite the 1:42PM fact that this is called a runoff event.
Q Well, what about the loads that are right above ten to the third, the low points there. There you have probably close to 90 percent dissolved phosphorus and you have a significant runoff event there, do you not? 1:42PM
A Well, I would not venture to put a cutoff for what is a high flow event or not. I'm confident that flows on the order of 1,000 to 2,000 CFS are not bringing in much non-point source load. So this is not an indication that there's a significant load of dissolved 1:43PM

phosphorus coming from non-point sources. 1:43PM
Q What's ten to the third CFS?
A 1,000 CFS.
Q So you're suggesting that anything between ten and third and ten to the fourth is not substantial? 1:43PM
A I did not say that.
Q Who characterized these as runoff events?
A We did.
Q So now you're trying to say that we shouldn't characterize these blue dots that show higher dissolved 1:43PM phosphorus as runoff events?
A That's not what I'm saying.
Q Let's move to Section 2.10, sir. What is the title of Section 2.10?
A "Lake sediment phosphorus is a minor source of 1:44PM bioavailable phosphorus."
Q What is your point in this section, sir?
A That the phosphorus that's released from sediments are not having a big impact on algal growth from Lake Tenkiller. 1:45PM
Q Could you look at Figure 2-34 for me, sir? Is it your opinion, sir, that Lake Tenkiller receives direct groundwater inflow?
A Under certain conditions, yes.
Q Have you looked at the basin to see whether or not 1:45PM

there could be ground -- any significant groundwater 1:45PM inflow to the IRW -- excuse me, into Lake Tenkiller?
A No.
Q Isn't there very steep slopes around the lake so that there would be little likelihood of groundwater 1:46PM inflow into Lake Tenkiller?
MR. TODD: Object to form.
A There are some steep slopes, but I'm not sure how that relates to groundwater.
Q Okay. Does this Figure 2-34 show all the pathways 1:46PM of phosphorus sources in Lake Tenkiller?
A All of the major pathways.
Q So are you suggesting by this figure that phosphorus is only released from sediments due to anoxic conditions? 1:46PM
A As I just said, these are the major pathways. There is some small P release during oxic condition.
Q How do you know it's only small?
A Based on research that's been done over the last 30 years on phosphorus released in sediments. 1:47PM
Q Did you do any evaluation of the phosphorus concentrations in Lake Sed 4 compared to inflow concentrations to see whether the oxic conditions of Lake Sed 4 is contributing to sediment releases of phosphorus? 1:47PM

A Would you restate that question? 1:47PM
Q Okay. You're suggesting that based on some research you've done or looked at other papers, that there's very little phosphorus contribution in Lake Tenkiller based on oxic sediment conditions, correct? 1:47PM
A Yes.
Q Okay. So what I'm asking you is, is that we have an oxic profile in Lake Tenkiller in Lake Segment 5, correct?
A An oxic profile? 1:48PM
Q Well, the oxic -- use the right terminology. Would you -- let me back up.
Would you characterize Lake Segment 4 of Lake Tenkiller as an oxic zone for sediments?
A Lake Sed 4 is a point in the lake. 1:48PM
Q Okay.
A It's not a zone in the lake.
Q Okay. I guess let me try to say it this way.
Do you agree that oxic P releases can be the result of heterotrophic bacteria activity on the 1:49PM oxic surface of the sediment of a reservoir?
A To a minor extent, yes.
Q Okay. And why -- and you say because you've looked at some research papers, correct?
A I have. 1:49PM

Q Did you evaluate that assumption with regard to 1:49PM what's going on at Lake Tenkiller?
A Yes.
Q How did you do that evaluation?
A Looking at spatial patterns in phosphorus 1:49PM concentration in the water column.
Q Okay. Would you conclude that sediments are contributing phosphorus to the water column in Lake Sedment 4 of Tenkiller Lake?
A The data as I've looked at it does not show 1:49PM evidence of substantive inputs from sediment.
Q Did you compare the inflow concentrations into lake sediment -- Lake Section 4 of Lake Tenkiller to the phosphorus concentrations of that section?
A Yes. 1:50PM
Q Isn't there a substantial increase in phosphorus concentrations in the water column of lake section 4 over that -- those concentrations that are entering Lake Section 4?
A I don't believe so. 1:50PM
Q Do you recall what the numbers are?
A I have graphs of them.
Q Okay. Let's take a look at them.
A Okay. I've got myself to do loss over another to get that out of the way. I will have to refer back to 1:51PM

my table of contents, but I don't recall which figure 1:51PM
number I'm looking for.
Q Do you have that for me, sir?
A Yes.
Q Which figure? 1:53PM
A Figure 4-8.
Q Okay. All right. And how does this indicate that there's little change in total phosphorus in Lake 4 due to sediment releases?
A Station RS 3 is at Tahlequah. 1:53PM
Q Mm-hmm.
A Lake 4 is the station that you've been referring to. And we're looking at summer average of total phosphorus, which is the black circles, soluble reactive phosphorus, the red circles, and then the 1:53PM bottom is chlorophyll. Going from Tahlequah to lake 04 there's no change in total phosphorus and a decline in soluble reactive phoshporus.
Q Would that decline indicate a significant productivity going on in Lake 4? 1:54PM
A That decline in soluble reactive phosphorus is associated, I believe, with the increase in chlorophyll from Tahlequah to lake 04 that you see in the bottom panel of the graph.
Q Which is algae production, correct? 1:54PM

A Yes. 1:54PM
Q And are these measurements in Lake 4 the whole water column or just one portion of it?
A This is for the surface portion of the water column and the reason for that is because this 1:54PM phosphorus is the phosphorus that's the algae you're seeing.
Q But if you're going to determine whether or not there's phosphorus released in Lake 4, wouldn't you want to look at the whole column? 1:54PM
A If you were going to attempt to do a mass balance, yes.
Q And try to see if there's an oxic influence -- release of oxic sediments, correct?
A Yes. 1:55PM
Q Are you -- you took these samples at Tahlequah?
A I didn't take these samples.
Q Well, you looked at samples based on Tahlequah?
A Yes.
Q Weren't there also data that would collect the 1:55PM total inflow loads to the lakes of Barren Fork and Caney?
A I didn't understand that.
Q Well, weren't there samples taken farther down on the river that would also account for the contributions 1:55PM

of Barren Fork and Caney? 1:56PM
A Lake 04 would account for that.
Q And does phosphorus -- are phosphorus concentrations in Barren Fork and Caney relatively low compared to the Illinois river? 1:56PM
A They're somewhat lower.
Q Wouldn't that account for the seemingly apparent similarity between RS 3 and Lake 4.
A The changes in concentration here due to Barren Creek -- Barren Fork and Caney Creek would be small. 1:56PM
Q I'm sorry. How do you know that?
A Because their flow contribution is small relative to the flow in the Illinois River at Tahlequah.
Q Did you do any -- I'm sorry?
A And the concentrations, while they are lower, are 1:57PM not zero and, in fact, when we were looking earlier we were seeing concentrations that frequently were above .05 so there's not a lot of dilution potential associated with those coming in.
Q Did you do any of these calculations to verify 1:57PM what you're assuming?
A No.
Q Let me hand you what has been marked as Exhibit 21, Dr. Connolly. Do you remember this exhibit from the Cooke and Welch report? 1:58PM

A I don't recall it specifically. 1:58PM
Q Well, I'll represent to you this is from the Cooke and Welch report. What's the title of the exhibit?
A "Average volume weighted total phosphorus in the hypolimnion greater than 16 meters of Tenkiller during 1:58PM 2005 and 2006."
Q Okay. For Lake Station 2, what is the average rate of phosphorus release from sediment?
A There are numbers shown here but I don't know what they mean. 1:59PM
Q Do you know what it means in relationship to a sediment release rate that there's 28.3 milligrams per meter squared per day? Do you have a sense of whether that represents a higher or a lower sediment release rate? 1:59PM
A I believe that Cooke and Welch have misused the data and this is not a sediment release rate.
Q What is it?
A This is a rate of increased phosphorus in the hypolimnion. 1:59PM
Q Okay. And wouldn't that be as a result of sediment releases?
A I don't believe so.
Q What would be the -- what would be the source of the phosphorus in the hypolimnion in Lake Station 2? 1:59PM

A Water diving in -- from upstream. 1:59PM
Q In Lake Station 2?
A Yes, sir.
Q And so you didn't believe that any of this -- any of this -- this quotient is represented by -- any of 2:00PM this phosphorus is represented by sediment releases?
A I didn't say that.
Q Well, how much of it is represented by sediment releases?
A A small minor fraction. 2:00PM
Q How do you know that?
A By the analysis that I did of the same data.
Q Let's take a short break. About five minutes.
MR. TODD: Sure.
THE VIDEOGRAPHER: We are now off the record. 2:00PM
The time is 2:00 o'clock.
(Following a short recess, proceedings continued on the record.)
THE VIDEOGRAPHER: We are now on the record.
The time is 2:17 p.m. 2:17PM
MR. PAGE: Hello, Melissa, are you still there?
MS. COLLINS: I'm here.
Q Okay. All right. Doctor, I'd like to continue on Section 3 of your report. We made substantial progress 2:18PM

in a day and a half. Okay. Would you read on Page 2:18PM 3-1, Paragraph 2, lines two through six, please?
A Paragraph one on Section 3.2?
Q Yeah, paragraph -- yeah, the second -- yeah, under 3.2, lines two through six. Starts, "The Illinois 2:18PM River" there?
A "The Illinois River in Oklahoma contains enough nutrients for phytoplankton to grow. Bioavailable phosphorus measured as soluble reactive phosphorus, which is in shorter supply than bioavailable nitrogen 2:18PM measured as ammonia plus nitrate, is typically found at concentrations close to 100 micrograms per liter, about five times above levels at which growth begins to slow appreciably."
Q What is your basis for the concentrations you've 2:19PM represented there, the 100 micrograms per liter typically?
A The USGS measurements.
Q Talking about in the river?
A In the river. 2:19PM
Q Okay. Continue, sir.
A "Yet, phytoplankton concentrations in the river are relatively low, typically peaking at levels much less than ten micrograms chlorophyll-a per liter. The fact" -- it should say, "This fact is illustrated in 2:19PM

Figure 3-1, which shows chlorophyll-a and soluble 2:19PM reactive phosphorus at Watts, Oklahoma, and Tahlequah, Oklahoma, stations that are representative of the upper and lower portions of the river in Oklahoma. Phosphorus is not causing excessive growth of 2:19PM phytoplankton in the river."
Q Okay. Now, based on your statement you agreed then that there is a potential for high phytoplankton blooms under summer flow conditions?
A No. 2:20PM
Q You don't believe there is a potential?
A No.
Q I thought you agreed that there's close to 100 micrograms per liter, that is, about five times above the level of which growth begins. That would be 2:20PM appreciable phosphorus, would it not, 100 micrograms per liter?
A Yes.
Q So in a typical river wouldn't that allow for appreciable phytoplankton growth? 2:20PM
A Not necessarily.
Q Why not? Why wouldn't it?
A Because there are other things that would control the ability for phytoplankton to grow in a river.
Q Such as -- 2:20PM

A Such as time, whether there is enough time for 2:20PM phytoplankton to grow in the river.
Q And is that what you base your belief on, whether or not we're seeing phytoplankton blooms in the Illinois River? 2:20PM
A Yes.
Q Okay. So you use the scenario of 1.5 days as a residence time, correct?
A Yes.
Q And you say that there might be a three factor 2:21PM increase of algae in one and a half days, correct?
A Under optimum conditions.
Q Okay. Where did you get that three factor increase?
A I think I indicated here that in the footnote, 2:21PM Footnote 18 on Page 3-2, the assumptions I made in order to make that calculation. So I used a phytoplankton growth rate of 1.2, which is based on parameters based -- used by Dr. Wells to model phytoplankton. No nutrient limitations, so assuming 2:21PM there's enough nutrients for them to grow. And a Secchi depth of four meters.
Q Isn't that pretty deep for evaluation of phytoplankton growth, four meters?
A It may or may not be, forty meters is not an 2:22PM

unusual depth to see in the lake. We don't really have 2:22PM
measurements in rivers, per se, so it could be a little
less than four meters. Four meters was just a number.
Q If it was less, wouldn't there be a little bit
higher growth rate likely because of more light 2:22PM
availability?
A No.
Q No?
A No.
Q Shallower water would have more light available, 2:22PM
correct?
A This is not a measure of water depth.
Q As well as measuring Secchi depth at four meters,
correct?
A Yes. 2:22PM
Q So if we looked at a shallower Secchi depth, would
we probably find higher chlorophyll concentrations
because of the light availability?
A Perhaps yes, perhaps no, depending upon what the
value was. 2:23PM
Q Anyway, you used 1.5 for your example, correct?
A Of 1.2 per day. That's the growth rate.
Q Okay. I thought your factor was 1.2 per day?
A The growth rate of phytoplankton was 1.2 per day.
Q Okay. And where did you come up with a 1.5-day 2:23PM

residence time from Watts to Tahlequah? 2:23PM
A By calculating what would be the average velocity
in the river and the distance from Watts to Tahlequah.
Q So you'll agree with me that there will be some
days where the velocity will be higher so the residence 2:23PM
time will be shorter, and other days that the residence
time will be longer because the velocity is lower, is
that correct?
A Yes.
Q Okay. So would you agree with me that those lower 2:24PM
velocities and longer residence times are likely to
occur on the Illinois River during the summer months?
A Yes.
Q So if you assume some lower flow conditions with
the two micrograms of chlorophyll-a at Watts, it would 2:24PM
become six after one and a half days, correct, based on
your analysis?
A Yes.
Q Okay. And if the conditions slowed to three and a
half days, from one and a half to three and a half 2:24PM
days, then we would have 18 micrograms per liter of
chlorophyll-a after three and a half days, would we
not?
A I would have to do the calculation.
Q If it was 18, wouldn't that represent an algal 2:24PM

growth in the Illinois River? 2:24PM
A There are lots of definitions of what chlorophyll
level constitutes a bloom, so it's hard to say whether
18 would be a bloom or not.
Q What's the standard for chlorophyll-a in Lake 2:25PM
Tenkiller?
A My memory is it's 10.
Q So that would be at least exceeding that standard
in the river, would it not?
A Yes. 2:25PM
Q Is it possible, sir, assuming slower flow
conditions, that we could have chlorophyll-a levels as
high as 54 micrograms per liter in four and a half days
using your scenario?
A Again, I would have to make the calculation. 2:25PM
Q It's a pretty simple calculation, though, is it
not?
A No, it's not.
Q Well, if it would become six after a day and a
half, then how many -- it would take -- in three and a 2:26PM
half days it would become 18. You don't agree with
that?
A Not necessarily.
Q Is it possible -- will you concede if there's
slightly different flow conditions there could be 2:26PM

severe algal blooms developing in the IRW? 2:26PM
MR. TODD: Object to form.
A I do not agree with that.
Q Why not?
A We used a fairly low summer flow, 400 CFS, to 2:26PM
calculate a one-and-a-half-day residence time so that's
a typical summer flow.
Q That's the average?
A That's a summer average flow.
Q Yeah. That's the mean, so there's going to be -- 2:26PM
A During the summer.
Q So there's going to be a number of points below
that 400 CFS flow, correct?
A Yes, sir.
Q And would you concede with me that on those slower 2:26PM
flows, using your own analysis that we could have
significantly higher chlorophyll-a results?
MR. TODD: Object to form.
A You can have higher chlorophyll-a results, but
trying to extrapolate this analysis out to high 2:27PM
phytoplankton levels is irresponsible.
Q Well, why did you do the analysis in the first
place? I'm just using your own criteria just changing
one assumption in your criteria based on the realistic
potential of having different flow rates that are 2:27PM

slower. **2:27PM**
A This analysis was conducted in order to provide an explanation for why we don't see large algal blooms in the river.
Q Are you suggesting that the data that you put in 3-1, which is some USGS data collected occasionally during the summer, represents that there are no algal blooms on the IRW during the summer months? **2:27PM**
A It is the data that I had for chlorophyll measurements and it shows no evidence of algal blooms. 2:28PM
Q Wouldn't you agree with me, sir, that algal blooms are intermittent, you have to be taking your analysis and sample at the time of the bloom or you'll miss it? They come and go, correct?
A Yes. 2:28PM
Q So if you're not taking your sample on the day when the bloom is occurring, you're likely to miss it, correct?
A Yes.
Q Let's turn to Section 3.3. You mentioned that the chlorophyll-a density data that was collected is low compared to the filamentous green algae data, correct? **2:28PM**
A I don't understand that.
Q Well, on this -- let me see where that is. On the first paragraph here of Section 3.3, are you claiming **2:29PM**

that the chlorophyll-a density data is low compared to the filamentous green algae cover data? **2:29PM**
A I don't think so.
Q Okay. Well, let me ask you this question: Which test would be more reliable, the chlorophyll-a test or the benthic algae screen cover test to determine the existence of nuisance benthic algae? **2:29PM**
A Typically both are conducted. The direct measurement of filamentous green algae is a direct measurement for the locations in the quadrants that were measured. Chlorophyll is a corollary measure of density and both together are typically used to evaluate whether we are reaching nuisance densities, so we will want to look at both of them and not rely on just one. 2:30PM
Q Do you have an opinion as to whether one test is more reliable than the other?
A More reliability for --
Q Determining whether or not nuisance algae exists?
A No, I don't have a perspective on that. 2:30PM
Q Can chlorophyll assays vary among labs due to slight differences in protocols?
A Yes.
Q Would you agree that estimating filamentous green algae -- maybe I can just use FGA so I won't trip over **2:31PM**

it every time. **2:31PM**
Would you agree that estimating FGA cover is a more straightforward test?
A It doesn't require a laboratory analysis, but it is somewhat subjective in that it's based on the visual observations. 2:31PM
Q Um, what FGA cover benchmarks for nuisance do you suggest?
A I don't suggest a number.
Q Well, do you not reference an FGA cover of 30 percent based on a report by Biggs? **2:32PM**
A Yes, I report other people's numbers. I don't feel I'm in a position to recommend what is the appropriate number that someone should use in a regulation. 2:32PM
Q Okay. So you don't have an opinion as to what percentage of algal cover, benthic algal cover would represent a nuisance condition?
A I do not.
Q On the second paragraph -- well, let me ask you one quick question here. **2:32PM**
The Biggs study that you do reference would suggest a 30 percent maximum cover, correct?
A Yes.
Q And Dr. Stevenson has recommended a 20 percent **2:33PM**

maximum cover. Do you have any understanding under what conditions the Biggs study came, what the river conditions were where the Biggs study made a determination that 30 percent cover would represent a nuisance? **2:33PM** **2:33PM**
A I would have to go back and review the study. I don't recall.
Q Do you know whether or not the Biggs study is -- has streams that have different characteristics than the IRW? That is, drained pasture and row crops on the plains as opposed to Ozark mountain streams? **2:33PM**
A I do not recall.
Q Okay. Would those conditions affect what would be reasonable for nuisance conditions in your opinion?
A I don't see why. 2:34PM
Q You don't see how the terrain for a river could have an impact on the likelihood of algae growth?
A They could. I don't see the relevance of that to your question.
Q Why not? Why wouldn't it be relevant to a determination as to what would be considered nuisance in a particular river if the rivers do not have similar characteristics? **2:34PM**
MR. TODD: Object to form.
A My understanding of a nuisance is something that's 2:34PM

1 objectionable from an aesthetic standpoint or from a 2:34PM
2 recreational value standpoint and I don't understand
3 why that would necessarily be different in a
4 mountainous region or a plain.
5 **Q Wouldn't the expected algal cover for a stream 2:35PM**
6 **have an influence on whether one would consider whether**
7 **it was at a nuisance level or not?**
8 A Yes.
9 **Q So in that respect, wouldn't the hydrology and**
10 **morphology of a stream have an impact on what we would 2:35PM**
11 **expect the algae cover to be?**
12 A It would.
13 **Q So do you know whether or not the geology and**
14 **stream hydromorphology of Montana in the Biggs report**
15 **is similar to that of the IRW? 2:36PM**
16 A No, I would have to go back and review it.
17 **Q In the studies that you cite for a nuisance algae**
18 **at 30 percent, were they recommending maximum as**
19 **opposed to average value over a season?**
20 A I would have to go back and check, but I believe, 2:36PM
21 as I indicated here, they're recommending maximums.
22 **Q And Dr. Stevenson's recommendation is what?**
23 A I would also have to go back and check Dr.
24 Stevenson's.
25 **Q Was it's a 20 percent average? 2:36PM**

1 A It was 20 percent. I forget now how he 2:36PM
2 characterized that.
3 **Q But did I understand you correctly, sir, that**
4 **you're not offing an opinion as to what the appropriate**
5 **algal cover level would be to determine whether or not 2:36PM**
6 **there's a nuisance of benthic algae in a stream?**
7 A That's correct.
8 **Q In Figure 3-2, you reference on Page 3-3 it seems**
9 **that you're saying that nuisance densities are rare.**
10 **Could you explain to me what you mean by your comment 2:37PM**
11 **that nuisance densities are rare?**
12 A In this figure, in summer 2006, there were very
13 few densities greater than ten and no densities greater
14 than 15. And in 2007 there were several densities
15 greater than ten, a few greater than 15, but the vast 2:38PM
16 majority of the data were less than that so that's rare
17 in the sense of how frequently it was observed relative
18 to the number of locations of which observations were
19 conducted.
20 **Q Okay. And this is the chlorophyll-a densities, 2:38PM**
21 **correct?**
22 A Yes, it is.
23 **Q Doesn't have anything to do with algal cover,**
24 **correct?**
25 A Well, it does. 2:38PM

Q Well, the algal cover for these particular 2:38PM
locations showed that there was significantly more
cover than the densities indicated, correct?
A I didn't understand that question.
Q Well, let me skip on. We're on limited time. 2:38PM
In spring 2007, did Dr. Stevenson find
that 50 percent of the stream sites had greater than
20 percent filamentous green algae cover?
A I would have to go back and check Dr. Stevenson's
work. 2:39PM
Q Okay. If that is correct, would you consider
50 percent of the time having 20 percent algal cover as
a rare event?
A No.
Q So using Dr. Stevenson's criteria for nuisance, 2:39PM
filamentous green algae cover during the spring of 2007
in nuisance conditions was not rare, was it?
MR. TODD: Object to form.
A I didn't understand the question.
Q Okay, using Dr. Stevenson's 20 percent algal cover 2:39PM
is a nuisance?
A Yes.
Q If 50 percent of the streams sampled had an algal
cover of 20 percent or more, that would not indicate a
rare nuisance condition in the IRW, would it? 2:40PM

A It would not, except for the difference between 2:40PM
maximum and average and how you interpret average.
Q Okay. What's the difference in your mind?
A I don't know. I would have to go back and, as I
said, understand -- you've represented that Dr. 2:40PM
Stevenson's number of 20 is an average, the numbers
that I was using here, 30s were maximums, and a single
observation at a location of a value greater than 20 is
that what he means by average?
Q Didn't he have stations where he did weekly 2:40PM
observations for a period of eight to ten weeks --
MR. TODD: Object to form.
Q -- in the spring of 2007?
A I don't recall the number of times that he went
out and I don't recall how the data that he presented 2:41PM
that you're describing represents that information.
Q Let's look at Page 3-4. You see where you state
there in the middle of the paragraph just above 3.4,
"Reading his graph I estimate that 30 percent was
exceeded at only four of 69 stations in 2006 and 27 of 2:41PM
the 70 stations in 2007," correct?
A Yes.
Q Does Dr. Stevenson suggest that the filamentous
green algae analysis is more appropriate for the spring
as opposed to the summer? 2:42PM

A I would have to go back and look. I have a vague 2:42PM
recollection that he did say that.
Q Do you know what the reasons were for that?
A No.
Q I guess at this point in time then you can't tell 2:42PM me whether you disagree or agree with his value that FGA should be most appropriately looked at during the spring period. Am I correct in that assumption?
A Not as I sit here.
Q If about 27 of 70 stations exceeded the criteria, 2:42PM would you consider that a rare occurrence?
A The term that I was using rare was the overall assessment, 27 out of 70 is clearly a minority, a minor fraction, but perhaps rare is not the correct description. 2:43PM
Q What do you mean when you say you weren't able to replicate his presentation?
A We were not able to use the data that we had to reproduce his figures. One of the methods we used where particular data sets that we were not confident 2:43PM we fully understood was to attempt to reproduce the analysis with the graphics done by the plaintiff's experts, so in this case the data we had, we attempted to reproduce Dr. Stevenson's graphics. We were pretty successful with the algal bio-match in getting 2:44PM

something that looked almost exactly like what he had, 2:44PM
but we were not successful in being able reproduce his figure for the FGA. And, therefore, were not confident that the data set we had was the correct data set and without that level of confidence, didn't want to do an 2:44PM independent analysis and, therefore, just relied on his presentation.
Q Okay. Did you ask counsel for the defendants to ask any questions of Dr. Stevenson during his deposition to help you determine if you could reproduce 2:44PM the results?
A I don't recall.
Q Last sentence in that same paragraph, last portion says, "But the density data suggests they would likely be in small tributaries downstream of wastewater 2:45PM treatment plants." What do you mean by that statement?
A Looking at the density data and there is a correlation between algal density and the presence of filamentous green algae, the higher densities of benthic algae tended to be in small streams and were 2:45PM frequently downstream of wastewater treatment plants. So given the correlation, it was likely that the same thing was true for filamentous green algae, although lacking confidence that we had the right data set, we were not able to make that presentation. 2:45PM

Q So that was just an assumption? 2:45PM
A Yes.
Q Did you actually review the locations that Dr. Stevenson identified from the sampling locations that had high FGA to determine whether or not they were 2:45PM downstream of the wastewater treatment plants?
A No. Again, because we were not confident that we understand his data correctly.
Q Did you evaluate pH levels in the rivers and streams? 2:46PM
A Yes.
Q I didn't see anything in your report in that regard.
A We looked at it and decided not to do anything with it. 2:46PM
Q So you're not offering any opinions on pH levels in the rivers and streams?
A Not at this time.
Q Can we turn to Table 3-1 of your report? I believe it's on Page 3-10, Doctor. What is Table 3-1? 2:46PM
A 3-1 is a summary of analyses done to evaluate the fish community in the Illinois River so it includes each of the locations that were sampled in 2007 and the species that were found there, numbers associated with those species and the type of stream and then the 2:47PM

diversity and index of biological integrity for that 2:47PM location.
Q Can you explain to us how you did the IBI index shown on 3-1?
A We followed an IBI procedure developed by another 2:47PM researcher for the Ozark Highlands.
Q Did you actually do this work or was this work done by someone else?
A This work was done by someone else.
Q How do you relate an IBI index to an aesthetic 2:48PM value?
A You don't.
Q Okay. Do IBIs tend to mask individual attributes of a river or stream?
A I don't know what you mean by "mask." 2:48PM
Q Well, when you look at an IBI index, it considers all the species of the particular location, correct?
A Yes.
Q So that mask maybe impacts that could be occurring on individual species? 2:48PM
A It doesn't mask them.
Q You tend not to see whether or not there's an impact in a stream on a particular species if you combined all the species into one index, is that not true? 2:49PM

A No, I wouldn't agree with that fully. 2:49PM
Q Well, how does the IBI description allow you to understand what is going on with a particular species in a stream segment?
A The IBI index includes within it a number of 2:49PM individual species of organisms -- species of fish, rather, so there is analysis associated with IBI that relies on the composition of the community and the presence of particular species or particular functional groups at that location so it's not ignorant of 2:49PM individual species.
Q Did you find in the IBI or whoever did the work on the IBI, did they find a significant relationship between the IBI and land use?
A No. 2:50PM
Q Okay. I think you actually mentioned on Pages 3-7 and 3-8 that you did not find any relationship between these different stressors and the IBI result, correct?
A Yes.
Q Would you read for the record the different 2:50PM stressors you looked at where you didn't find correlation?
A "Subwatershed area, poultry house density, road density, percent developed area, percent forest area, percent pasture area, density of wastewater treatment 2:50PM

plant discharges, distance to nearest road, distance to 2:51PM nearest urban land use classification, and distance to nearest poultry house."
Q Wouldn't you expect to see at least some of these factors have an impact on IBI? 2:51PM
A No.
Q So based on your experience with rivers and streams fish, which I think you admitted you're not a fisheries biologist, these factors don't tend to have an impact -- none of these factors then -- let me ask 2:51PM this. Based on your experience, are you telling us that none of these factors would traditionally have an impact on fish species in a stream or river?
MR. TODD: Object to form.
A No, I'm not saying that. 2:51PM
Q Well, how do you account for the fact that you could find no correlation between the IBI and these potential stressors?
A Two reasons. The first is the IBIs fell within a fairly narrow range. You would -- in looking at 2:52PM correlations, you would like to have a fairly large range, for example, in IBI to try to correlate with something. And, secondly, the dominant factor controlling the IBIs here may be habitat such that that factor overwhelms these other factors and so any 2:52PM

correlation that may exist with these factors is 2:52PM obscured by differences in habitat among the locations.
Q Are there differences in habitat among these different locations?
A Yes. 2:52PM
Q And what is your basis for that?
A Basis for that is the review that we did of the sampling locations and what is known about the sampling locations.
Q And what review are you referring to of sample 2:53PM locations? Is that set forth some place in your report?
A That would be in our consider materials.
Q Did you put anything in your report concerning your findings as to differences in sample locations? 2:53PM
A No.
Q Did you look at the stressors one at a time?
A Yes.
Q Do you know how to partition variances among multiple stressors? 2:53PM
A Yes.
Q Why didn't you do that?
A I think we didn't do that because there was no hint of any correlation among anything. Typically when you're looking at multiple stressors all interacting, 2:54PM

you will see correlations among individual stressors. 2:54PM And then when you combine them, you will improve the correlation. It's not typical in the absence of seeing any relationship with a single -- two stressors showing no relationship to believe that if I combine them I 2:54PM will generate a relationship. What you are typically looking at is I can see some relationship with the individual stressors and if I combine them I actually improve the relationship. So, for example, Stressor A can account for 10 percent of the variance. And 2:54PM Stressor B can account for 15 percent. When I combine them together, I account for 25 percent of the variance. It doesn't work that simply but that's an example.
Q And so you chose not to do that? 2:55PM
A Yes.
Q Okay. Can interactions among the variables mask effects of individual variance?
A To some extent.
Q Did you do a test to see if that was occurring in 2:55PM this situation?
A No.
Q You mentioned some different species on Page 3-6 of your report. One of them is the orangethroat darter, correct? 2:55PM

A Yes. 2:55PM
Q Do you know whether or not the orangethroat darter is among the most pollution tolerant species of darters?
A I do not. 2:55PM
Q Would that affect your evaluation if it was found to be among the most pollution tolerant species?
A No.
Q Why not?
A The fact that a fish is pollution tolerant doesn't 2:56PM mean that they only exist in the presence of pollution, the test here is whether or not pollution intolerant species are present, not whether pollution tolerant species are present.
Q You represented these as being intolerant species, 2:56PM did you not?
A I don't believe so.
Q Do you know what the pollution tolerance is for the cardinal shiner?
A The cardinal shiner is a pollution intolerant 2:57PM fish.
Q And what's your basis for that?
A See the reference down towards the end of the middle paragraph, "Jester, et al, 1992."
Q Does the EPA, in its rapid bioassessment protocols 2:57PM

for use in stream of available rivers, periphyton 2:57PM benthic macroinvertebrates and fish, identify the cardinal shiner as intermediate intolerance to pollution?
A I don't recall. 2:57PM
Q Let's turn to Section 4 of your report. In Page 4-4, do you state, "Only the riverine and perhaps transitional sections that are impacted by phosphorus impact entering the upstream river system"?
A Where are you reading? 2:58PM
Q Let me make sure I've got the right page. Did you conclude, sir, that only the riverine and perhaps the transitional sections are the only sections of the river that are impacted by phosphorus entering the lake? 2:59PM
A Yes.
Q Okay. If Lake 1 and 2 then are not impacted, where do these sections of the lake obtain their P if not from the river?
A I'm using the term "impact" in a negative sense. 2:59PM Impact in terms of creating a water quality problem, not that there is no phosphorus from upstream entering the lacustrine portion of this lake, but there is not sufficient phosphorus entering the lacustrine portion of this lake from upstream to cause a water quality 3:00PM

problem. 3:00PM
Q Okay. Can we look down at that Exhibit 14, sir? If we look at 1992 and 1993 and 2008, what were the mean total phosphorus values for those years in Lake 1 during the summer months? 3:00PM
A 1993, 24; 2008, 27.
Q And what about 1992?
A Twenty-five.
Q Okay. And are these concentrations on the eutrophic border between mesotrophic and eutrophic? 3:01PM
A They are in the upper end of the mesotrophic range.
Q And is it your opinion that that does not indicate any injury to Lake Tenkiller?
MR. TODD: Object to form. 3:01PM
A The presence of phosphorus at these levels does not indicate injury.
Q Based on the trophic state, does it not indicate that it's approaching eutrophic status in Lake 1 based on using the Carlson index? 3:01PM
A It indicates it's in the mesotrophic range towards the upper end of that range.
Q And if you look at -- do you agree that there's a correlation between chlorophyll-a and phosphorus?
A Somewhat of a correlation, yes. 3:02PM

Q Okay. Well, if you look at them for the same 3:02PM years for chlorophyll-a, what is the level of chlorophyll-a in 2008 in Lake Station No. 1?
A It looks to be 12.
Q Is that in the eutrophic stage? 3:02PM
A Yes.
Q What about for 1993?
A 14.6.
Q Is that eutrophic?
A Yes. 3:02PM
Q What about 1992?
A 13.2.
Q Is that eutrophic, sir?
A Yes.
Q Look also at Lake Station No. 2. Look back to the 3:02PM phosphorus. 1992, what was the total phosphorus in Lake Station No. 2?
A 31.
Q Is that eutrophic?
A According to the Carlson index, yes. 3:03PM
Q What about 1993?
A 44.
Q Is that eutrophic?
A According to the Carlson index.
Q What about 2008? 3:03PM

A It was 25. 3:03PM
Q Okay. Where is that? Is that on the bounder -- upper part of the mesotrophic, right?
A Upper part of the mesotrophic.
Q Okay. And let's look at the chlorophyll for the same two years. 1992, what's the chlorophyll levels of Lake 2? 3:03PM
A 18.8.
Q And is that eutrophic?
A Yes, according to the Carlson index. 3:03PM
Q What about 1993?
A 14.7.
Q And 2008?
A Looks to be 12.3.
Q So for 1993 and 2008, does the chlorophyll levels in Lake Tenkiller and Lake Station 2 indicate that it's eutrophic? 3:03PM
A Yes, according to Carlson index.
Q Are you familiar with the Carlson index?
A Yes. 3:04PM
Q Is it a widely accepted method to determine trophic state of lakes and reservoirs?
A Yes.
Q On Page 4-3, you state that in the first paragraph under 4.3, "Of the data collected by the plaintiffs, 3:04PM

2006 provide the best ability to study the summer, May through September, conditions in Lake Tenkiller." Why do you state that? 3:04PM
A Because in 2006, we have fairly frequent sampling that allows us to see the seasonal patterns of 3:04PM chlorophyll that occur during the summer period. The other years have much fewer data and it's much more problematic to estimate summer average conditions.
Q What about 2005 and 2007, don't they have similar data collection? 3:05PM
A They do not.
Q What are the differences?
A Far fewer sampling times.
Q What do you mean by far fewer?
A If you look at Table 4-1 on Page 4-4. 3:05PM
Q Mm-hmm.
A In 2005, there were five observations. This is the riverine section but it's similar for the other sections, in 2005. Eleven in 2006 and three in 2007.
Q Okay, sir. So you're suggesting that we should not use those other two years because of less observations? 3:05PM
A I'm suggesting that they provide a less accurate understanding of what was going on because they give us a much more uncertain estimate of summer average 3:06PM

condition. 3:06PM
Q And what was the residence time in 2006 compared to 2005 and 2007?
A According to Dr. Cooke and Welch?
Q Yes. 3:06PM
A 2006 was 2.45 half years, as they use it. 2005 was 2.41. And 2007 was 2.0.
Q Did you do any -- did you do any calculations on residence times in Lake Tenkiller?
A Yes. 3:06PM
Q Were they the same as these residence times?
A I didn't calculate them on half years, but I would think that what I see here is probably okay.
Q Based on chlorophyll-a data for 2005, was Tenkiller at eutrophic conditions at all stations? 3:07PM
A Yes.
Q In fact, it was actually hypereutrophic in Table No. 4, was it not?
A Yes.
Q Are the 2005 data similar to the 1986 and 1992 data? 3:07PM
A In what respect?
Q In chlorophyll results.
A Roughly.
Q Did you determine how many -- why did you not 3:08PM

consider 1986 and 1992 as part of determining what's going on in Tenkiller? 3:08PM
A Because the historical data sets tend to be sparser and because knowledge of the -- specifics with regard to sampling techniques and analysis are less 3:08PM well known.
Q Did you actually, in fact, conclude that based upon review of the 1992 and 1993 data?
A Yes.
Q So you determined that there -- that the sampling techniques were not as robust as the more recent years? 3:08PM
A No, sir.
Q Okay. So why -- I'm not following you why you didn't use '86 and '93 for your comparison as to what's going on at the lake? 3:08PM
A Because there was less data, it was less well documented, so we understood less about how the sampling was conducted and the details of the analysis.
Q How much less data was there in 1986 compared to 2006? 3:09PM
A Substantially less, but I don't recall the numbers -- the difference in numbers right now.
Q What's substantial?
A I don't recall the numbers.
Q What about the difference between 1992 and 2006? 3:09PM

What's the difference? 3:09PM
A I don't recall.
Q What was the difference in the sampling methods between the 1986 and 1992 data versus the 2006 data?
A I don't recall. 3:09PM
Q Let's turn to Figure 4-9, sir. Do you believe that it's most appropriate to evaluate the trophic state of a lake during the summer months?
A The standard procedure for evaluating the trophic state is to use summer average conditions. 3:11PM
Q Okay. So that would be -- being the standard, do you also agree it's the best way to determine injury to a lake or reservoir?
A It's the best way to determine trophic condition. I don't know about injury. 3:11PM
Q Are you expressing any opinions on whether or not Lake Tenkiller has been injured?
A I don't know what you mean by "injured."
Q Okay. Well, there's been an aesthetic change in the lake over time as per water clarity and color. 3:11PM Based on that, do you have an opinion as to whether or not Lake Tenkiller has been injured?
A Again, I don't know an objective definition of injury to compare against.
Q Okay. Well, I just gave you one, I thought, but 3:12PM

maybe I'll try again. Has water clarity changed in 3:12PM Lake Tenkiller over time?
A To some extent.
Q Has it gotten worse?
A I don't -- I have studied the trends in great 3:12PM detail. I also have some concerns with the long term trend analysis because of the large differences in data density and the different sampling programs. And so as I sit here, I'm not confident that we know the trends in, for example, water clarity in the lake. 3:12PM
Q Has trophic state of Lake Tenkiller changed over time?
A If you look at this figure, there appears to have been almost no change since 1986.
Q Between 2008 and 1974 has there been a change in 3:13PM trophic state?
A If you accept the 1974 data, yes, but Dr. Horn had some concerns with some of the data collected in 1974. I have similar concerns with some of that data and I would hesitate to use 1974 as a basis for comparison to 3:13PM these others.
Q Did you review any of the EPA reports from 1974 that characterize -- in '75 that characterize Lake Tenkiller's trophic state?
A I may have. 3:13PM

Q To date, how did they characterize trophic state 3:13PM in 1974 and '75 in Lake Tenkiller?
A I don't recall.
Q Did you review any reports for the 1960s concerning Lake Tenkiller's trophic state? 3:13PM
A I believe I did.
Q Based on that review, are you of the opinion the trophic state has changed in Lake Tenkiller between 1960 and today?
A I would have to go back and look at 1960's 3:14PM records.
Q At this point in time, you're not offering any opinion?
A At this point I'm not.
Q Let's look now at Figure 4-9. You claim that 3:14PM Coalgate City Lake was mesotrophic in July of 2007?
A This is not a determination that we made. This is a determination that, my understanding of this, is the BUMP report.
Q And did that characterization influence your 3:14PM evaluation when you compared these reservoirs to Lake Tenkiller?
A I don't understand the question.
Q Well, was it important to your analysis that Coalgate Lake was characterized as mesotrophic? 3:15PM

A We use the BUMP data to look for lakes that were 3:15PM classified as either mesotrophic or oligotrophic to see whether, in fact, they would have low dissolved oxygen in the hypolimnion and these lakes present, as examples of lakes characterized as mesotrophic or oligotrophic 3:15PM that show dissolved low dissolved oxygen in the hyperlimnion.
Q So if Coalgate was actually characterized in the BUMP as a eutrophic lake, that would have an impact in your analysis, would it not? 3:16PM
A Well, it would not make the point that you can have low dissolved oxygen in mesotrophic and oligotrophic systems.
Q Hand you what is marked as Exhibit 22. Take a look at that, Doctor, and tell me what the BUMP report 3:16PM actually says the trophic state of Coalgate City Lake is during the summer months.
A The TSI values were generally mesotrophic with eutrophic conditions present in the summer season.
Q So back -- to make this Figure 4-9 accurate, this 3:16PM should represent Coalgate as being eutrophic during the summer months, correct?
A That is correct.
Q Is that a mistake --
A Yes, it is. 3:16PM

Q -- on your figure and so your point is not made 3:16PM
with Coalgate Lake, right?
A No, sir.
Q Okay. Let me hand you what's marked as 23. And
would you tell us what the classification of the BUMP 3:17PM
report says during the summer months is on the McGee
Creek Lake?
A In the summer, four of the five sites were
classified as mesotrophic.
Q What did you classify the McGee Creek Reservoir 3:17PM
as?
A Mesotrophic.
Q Is there a difference between hyper-mesotrophic
and mesotrophic?
A I don't believe so. 3:18PM
Q So you don't think that's a consequential
difference?
A No.
Q Let me show you Okemah Lake and tell me, that's
Exhibit 24, that the actual BUMP report shows trophic 3:18PM
state is at Lake Okemah during the summer months?
A The TSI values ranged from mesotrophic in the fall
and spring to eutrophic during the summer quarter.
Q So actually for Okemah Lake, you've mistakenly
shown it as mesotrophic here, correct? 3:18PM

A Correct. 3:18PM
Q So it should be eutrophic?
A Yes, sir.
Q And that lake does not then demonstrate your
point, does it? 3:18PM
A It does not.
Q Let's take a break.
THE VIDEOGRAPHER: We're now off the record.
The time 3:18 p.m.
(Following a short recess, proceedings 3:18PM
continued on the record.)
THE VIDEOGRAPHER: We are now on the record.
The time is 3:33 p.m.
Q Dr. Connolly, before the break we were looking at
Figure 4-9, I just have a couple more questions on that 3:33PM
figure. Why didn't you determine the rate of DO
depletion or the AHOD for Figure 4-9?
A Because that wasn't the point of the figure.
Q What is an AHOD?
A That's a hypolimnion oxygen depletion rate. 3:33PM
Q Does it tell you something about the water quality
of the reservoir?
A It tells you something about the rate at which
oxygen is being used out of a hypolimnion.
Q And wouldn't that be important to your analysis 3:34PM

that you're showing here on 4-9? 3:34PM
A No, sir.
Q Why not?
A There is enough oxygen depletion to drive many of
these lakes to zero oxygen. That's all that matters. 3:34PM
Q Wouldn't the rate of depletion also be probative
to see if they're comparable or not?
A The point of this was not to say that these lakes
are identical, the point of this was simply to say that
in systems that are mesotrophic or even oligotrophic 3:34PM
that you can have very low to no oxygen in the
hypolimnion simply as a consequence of having built a
reservoir and trapped all this water.
Q How come you didn't use Broken Bow Reservoir as
part of your analysis on 4-9. 3:35PM
A Because, again, it wasn't the point of the figure.
Q Broken Bow would have actually shown that there
was a DO depletion, correct?
A No, that's not correct.
Q Broken Bow's hypolimnion DO is much greater than 3:35PM
any of the lakes that you show on 4-9, is that not
correct?
A That's correct.
Q In fact, Broken Bow does not go down to zero DO in
any point of the cycling during the summer months, does 3:35PM

it? 3:35PM
A Not that I recall.
Q What's the lowest yield level that you recall in
Broken Bow Reservoir during the summer months in the
hypolimnion? 3:35PM
A I would have to check.
Q Is it well above 4.1?
A Again, I would have to check. I don't recall the
numbers.
Q Hand you what has been marked as Exhibit 25 and 3:35PM
please tell me if you have ever had the opportunity to
review this document during it's -- during your work on
this case or any other time?
MR. TODD: Sir, 25?
MR. PAGE: Yes, 25, I believe. 3:36PM
A I don't believe I've seen this document before.
Q Okay. Would you turn to Page 10, sir? Yeah, Dr.
Olsen helps me be a better lawyer. Do you want to tell
us what the document is, please, sir?
MR. TODD: Learning goes both ways. 3:37PM
A "Observations on the limnological dynamics of
Tenkiller Ferry Reservoir."
Q Okay. Can you tell who produced this document?
A Oklahoma Department of Wildlife Conservation.
Q Okay. What was the year of this document? 3:37PM

A September 1961. 3:37PM
Q Okay. Thank you, sir. And so you have never seen this document before?
A I don't recall seeing this document.
Q Would you read the first page of the abstract, sir, beginning at the top? 3:37PM
A "Limnological determinations were conducted on Tenkiller Ferry Reservoir for a period of eight months. The data were collected for indications to the success of wildlife stocking proposed for the spring of 1961." 3:38PM
Q Continue, sir.
A "The thermochemical profiles indicated established periods of stratification during the summer months. This condition also occurred in cove areas of the reservoir in depths greater than 35 feet." 3:38PM
Q Can you interpret that for us, sir?
A That the lake stratified during the summer and that stratification was in the open water bodies of the lake and in deep coves as well.
Q Would you read the bottom of that paragraph of this report -- abstract? 3:38PM
A The limnological investigations did not indicate any chemical or physical limitations that could" -- I'm sorry -- "that would be undesirable for the introduction of wildlife in 1961. On the contrary, the 3:39PM

reservoir has a very high productive potential and the 3:39PM introduction of this species should prove successful."
Q Did the Department of Fish and Wildlife in Oklahoma attempt to introduce wildlife into Lake Tenkiller? 3:39PM
A I don't recall.
Q Do you know whether or not their -- their attempts were successful?
MR. TODD: Object to form.
A I don't recall that they stocked it, so. 3:39PM
Q Do you recall that Dr. Cooke -- excuse me, Dr. Welch in his report pointed out that the lack of successful walleye introduction in Lake Tenkiller was evidence of injury to the fisheries?
A I don't remember that. 3:40PM
Q Do you know whether or not walleye was successfully introduced in Broken Bow Reservoir?
A I do not.
Q I notice you didn't examine walleye at all in your report. Is there some reason why you didn't investigate walleye species? 3:40PM
A Lack of data.
Q Lack of data?
A (Nods head.)
Q This is some data that was available, I guess, 3:40PM

that you did not consider that you were not aware of? 3:40PM
A Yes.
Q Do you believe that Dr. Welch had sufficient data to evaluate the walleye fisheries in Broken Bow and Tenkiller? 3:40PM
A I would have to review the information.
Q Let's turn to Page 10 here, sir. Okay. Those are the DO temperature profiles. Do you see that, sir? Would you read the caption for Figure 10 here on Page 10? 3:41PM
A "Average monthly dissolved oxygen and temperature profile for five stations in Tenkiller Ferry Reservoir during the month of August, 1960."
Q Okay. At Station 1, oh, which is the deep station, sir, if you turn back to the -- if you turn 3:41PM back to Page 4. Will you identify where Station 1 is for this report?
A Station 1 is at the downstream end of the reservoir.
Q So that would be in the area of LK01? 3:41PM
A Not the same station, but in the vicinity.
Q The same representative zone of the reservoir?
A More or less.
Q Let's go back to Page 10, sir. Based on the Station 1 data, what are the DO levels at 70 feet that 3:41PM

1960 -- in August of 1960 at Tenkiller? 3:42PM
Straight edge?
A Maybe about two and a half milligrams per liter.
Q Okay. And what about at 120 feet? And would you mark that on this exhibit, please, that two and a half 3:42PM at 70 feet where you had determined it.
A It appears to be zero at 120 feet.
Q Okay. And what about the midway point between 70 and 120 -- at 90, let's say 90 feet?
A About two milligrams per liter at 90 feet. 3:43PM
Q And at 40 feet, sir?
A About five milligrams per liter.
Q Okay. Now, would you do the same thing for me on the next page, which is the September. And, again, give me the DO levels in Lake Tenkiller in September of 3:43PM 1960 at Station 1 or sed 40 feet, sir.
A Looks to be about three milligrams per liter at 40 feet.
Q Okay. And at 70?
A Maybe a couple of tenths of a milligram per liter? 3:44PM
Q And then probably close to zero there after 90 feet?
A Yes.
Q Okay. Now, I want to look at some current data and do a comparison of Lake Tenkiller current data. 3:44PM

Hand you Exhibit 26. Do you recognize Exhibit 26, sir? 3:44PM
A Yes.
Q Now, looking at the August and September data for Lake Tenkiller, Lake Station No. 1, 2005, how does it compare, for example, beginning with August of 1960 3:44PM whether there's been a difference in DO profile at Lake Tenkiller between 1960 August and 2005 August?
A By about 40 feet we're at a little below one milligram per liter on August 23rd.
Q At 40 feet? 3:46PM
A At about 40 feet so about 12 or 13 meters.
Q So one milligram -- would you write that on that 40 feet? So in 2005, sir, at 40 feet, we are at one milligram per liter DO whereas in 1960 Lake Tenkiller in August was at five, is that correct? 3:46PM
A Yes, sir.
Q Okay.
MR. BASSETT: I hate to interrupt. Is this Exhibit No. 26, is this taken directly out of the Cooke Welch report? 3:46PM
MR. PAGE: Yeah, it's -- down here it says Figure 24 in the Cooke Welch report and I always wrote it up here on top.
MR. BASSETT: Okay. I just wanted to make sure. 3:46PM

Q It's August 23rd? Okay, let's -- and then what 3:46PM about on -- on August 23rd at -- you used August 23rd data, is that correct, sir?
A Yes, I did.
Q Okay. So what about August 23rd at 70 feet in 3:47PM 2005, Lake Tenkiller?
A There would be half a milligram per liter.
Q And what was it in August of 1960, Lake Tenkiller, 70 feet?
A About 2.5 milligrams per liter. 3:47PM
Q Okay. And then finally, sir, would you look at 90 feet?
A Doesn't quite go to 90 feet, but it's close to the bottom. It's about .4 milligrams per liter.
Q Okay. Write that on there for me, please, sir. 3:48PM And how does that compare to 90 feet on Exhibit 25 in August?
A Ninety feet was about two milligrams per liter in 1960.
Q Okay. Now, if we can keep Exhibit 26 in front of 3:48PM us and then turn to the next page so would we can look at some depth data. Maybe we can look at the September 20 --
A Mm-hmm.
Q -- data here -- 3:48PM

A Yes. 3:48PM
Q -- in 2005. Tell me, sir, for September at 40 feet in 2005, what was the DO level of Lake Tenkiller?
A Appears to be about four, four and a half milligrams per liter. 3:48PM
Q At 40 feet?
A Yes, sir.
Q On September 20th?
A Yes, 40 feet is about 12 or 13 meters.
Q Mm-hmm. Looks -- 3:49PM
A And on across there's a point -- I'm looking at the field diamond and there's a point at about four and a half milligrams per liter that appears to be at about 12 and a half meters.
Q Okay, sir. And where is it at 13 meters? 3:49PM
A At 13 meters, it looks to be about .5 is a sharp gradient.
Q Very sharp gradient at that point?
A Mm-hmm.
Q So somewhere between 40 and 45 feet it goes from 3:49PM four to about half?
A Yes.
Q Okay. And would you write that on there, sir?
A (Witness complies with request.)
Q And what about the level at 70 feet? 3:50PM

A It appears to be zero at 70 feet. 3:50PM
Q That compares to about .2?
A Yes.
Q Okay. In reviewing this data, sir, does this indicate to you that the DO levels of Lake Tenkiller 3:50PM have gotten worse over time?
A I can't conclude that from this analysis.
Q Why not?
A Because as you can see, in this report there are very different patterns at even similar times of the 3:50PM year that are controlled by variations occurring in the stratification and so the DO profiles in 1960 here are a function of the stratification that has gone on when it's set up, where it's set up, how it's varied. And at a minimum I would want to analyze the temperature 3:51PM profiles and compare the temperature profiles in the two years as well as the DO profiles before I even venture to make any statements about differences.
Q Okay. Well, the temperature profiles are right next to you there? 3:51PM
A Yes, sir.
Q Does it indicate when you look in conjunction with the temperature profiles the DO levels within Lake Tenkiller have gotten worse since 1960?
A I would have to spend a while here converting 3:51PM

Fahrenheit to Centigrade and then -- so if we look at 3:51PM
August. Here in August of 2005, it appears that we
reach 20 degrees Celsius, which is 68 degrees
Fahrenheit, about fifteen meters so that's about
50 feet. Here, at about 50 feet, the temperature is 3:52PM
closer to 80 degrees and so we don't reach 70 degrees
until we get to almost 80 feet. So the temperature
profiles are very different and, in fact, it looks like
there's more vertical mixing in the 1960 data than in
the 2005 data. And it's those kind of differences that 3:53PM
you really have to understand before you do any
comparison of these oxygen profiles.
Q So temperature is important to look at oxygen profiles?
A Depending upon the reason for looking at the 3:53PM
oxygen profiles.
Q I notice in some of the parts of your report you did not use temperature when you looked at oxygen profiles, is that correct?
A For particular purposes, it was not necessary. 3:53PM
For this purpose, it is clearly necessary.
Q Let me hand you what has been marked as Exhibit 27. This document was taken using -- and prepared by Dr. Welch using the information that's listed on here. And the mean line, that says 1,456 there -- 3:54PM

A Mm-hmm. 3:54PM
Q -- in this, is the mean since 1980 only. Okay, sir?
A Yes.
Q What does this, the AHOD trends in Lake Tenkiller, 3:54PM tell us concerning oxygen deficit rate in Lake Station No. 1?
A If you accept this at face value and I'm not
comfortable with this figure because I don't understand
how the numbers were generated, but accepting it at 3:54PM
face value, there was an increase from 1960 until
perhaps the mid '80s and it's bounced around, but
there's no consistent trend since the mid '80s.
MR. TODD: Can I just ask you to put on the
record what "this" is? 3:55PM
MR. PAGE: Dr. Welch prepared this as a
rebuttal exhibit.
MR. TODD: Okay. And it included the 2000
data so I make that objection and we can move on.
Q Thank you. Did you review Dr. Welch's 3:55PM calculations of AHODs in your analysis?
A I did not.
Q So you have no opinion as to whether they're correct or incorrect?
A Looking at this 1960 report, for example, if this 3:55PM

is the only data available to him, I have no idea how 3:55PM
he calculated an AHOD of any mean, so that in and of
itself makes me skeptical. If he was willing to use
just those profiles and calculate a hypolimnetic oxygen
depletion rate then I have no confidence in any of this 3:56PM
data.
Q Do you know if that's how he calculated the 1960 data?
A I don't, but because I don't know that he's got
anything more than those two profiles but I'm skeptical 3:56PM
at this point.
Q Did you review how he did his calculations of the AHOD profiles in his report?
A I did not.
Q So do you have an opinion as to the AHOD 3:56PM information he provided in his report?
A I do not at this point.
Q Why didn't you evaluate AHOD levels over time in Lake Tenkiller?
A Because the data are not sufficient to do it in a 3:56PM
meaningful way in order to look at a long term trend,
which is apparently what this effort is.
Q When you look at the recent years from like 2001, 2008, does that AHOD data tell you anything about the -- the oxygen depletion of Lake Tenkiller? 3:57PM

A If you accept it on face value it says that it has 3:57PM
bounced around considerably from year to year without
an apparent trend.
Q How did those levels that are shown there -- even though those years -- let me ask it this way. The mean 3:57PM since 1980 was 1,456, correct?
A Yes.
Q Do you have any understanding of what that level -- mean level of AHOD indicates for the water quality of a lake or reservoir? 3:57PM
A It's reservoir specific as to what it means.
Q Has there not been published information that relates AHOD as to water quality?
A There have been published studies that have used
AHOD to make some assessments of water quality. 3:58PM
Q Okay. And those studies that you've reviewed, what do they indicate a AHOD of 1,456 to equate to from a water quality perspective?
A I would have to review those studies again.
Q Is water temperature an important variable for 3:58PM fish habitat?
A Yes, sir.
Q Did you evaluate water temperature in your fisheries analysis?
A Yes. 3:58PM

Q And what did you conclude? 3:58PM
A That the water temperatures in the areas of the lake where oxygen was present to support the fishery were not adverse to a healthy fishery.
Q Were they adverse to smallmouth bass fisheries? 3:59PM
A No, sir.
Q So what is the healthy fishery water temperature for smallmouth bass?
A Temperatures up to low 30 degrees Centigrade. Thirty, 31 is the maximum temperature if smallmouth 3:59PM bass.
Q What's your basis for that?
A Published studies on smallmouth bass.
Q Did you cite any of that in your report?
A No, sir. 3:59PM
Q Did you review the information that Cooke and Welch put together with regard to fisheries and temperature, ideal fishery temperatures?
A Yes.
Q Okay. Do you agree or disagree with that 3:59PM analysis?
A I would have to review it again. I don't recall what my view was. I know I do disagree with their contention that bass would be seeking cold water temperatures under the thermocline, which are -- in 4:00PM

this system are down around 12, 14 degrees Celsius. 4:00PM That's not a preferred temperature for smallmouth bass.
Q What is the preferred temperature?
A Preferred temperature is in the 22 to 26, 28 degrees. 4:00PM
Q So that is certainly -- those temperatures are not found during summer above the thermocline, are they?
A They are for large portions of the summer.
Q What about in August and September?
A The temperatures at times can exceed about 20 4:00PM degrees. They can get up to perhaps 30 degrees.
Q And at those points in time, is it your opinion that the smallmouth bass would be leaving those areas and seeking cooler temperatures?
A Not necessarily. 4:00PM
Q And what is your basis for that statement?
A Data that shows that smallmouth bass will inhabit temperatures as high as about 30 degrees.
Q And that's rare, though, do you not agree, that that's rare in those circumstances that they found 4:01PM that?
MR. TODD: Object to form.
A I don't know whether it's rare or not.
Q Do you agree that smallmouth bass inhabit lakes throughout its range prefer oligotrophic conditions? 4:01PM

A Smallmouth bass prefer lower nutrient conditions, 4:01PM not necessarily oligotrophic conditions.
Q Well, how did -- how do the bass -- is the bass preference related to nutrients or to productivity in water clarity? 4:01PM
A The bass preference is related to habitat.
Q And that has to do with clear waters, correct?
A It has to do with macrophytes.
Q Okay. And that affects water clarity, does it not? 4:02PM
A The macrophytes have some impact on water clarity but it's more habit-ish.
Q So did you find that smallmouth bass are prevalent in Tenkiller or not?
A They make up a minor fraction of the black bass 4:02PM population.
Q If Tenkiller was not eutrophic but rather oligotrophic, would you expect smallmouth bass to be a larger portion of the fisheries in Lake Tenkiller?
A That would depend upon the amount of suitable 4:02PM habitat in the reservoir for smallmouth bass and I've not studied the habitat extensively enough to determine just how much habitat, suitable habitat is available in the lake for smallmouth bass.
Q Can you tell me why the smallmouth bass fishery is 4:03PM

better in Broken Bow than Tenkiller? 4:03PM
MR. BASSETT: Object to form.
A -- Tenkiller is a lower nutrient system, which they would tend to prefer.
Q Tenkiller is? 4:03PM
A I'm sorry. Broken Bow is a lower nutrient system which smallmouth bass would tend to prefer. There may be habitat differences. I did not do any study of that.
Q Would you characterize Tenkiller as a clear lake 4:03PM or reservoir?
A Perhaps not.
Q And would you agree that smallmouth bass prefer clear rivers and lakes?
A Yes. 4:03PM
Q Let me hand you what has been marked as Exhibit 28, sir, and tell me if you've seen that document in the past.
A I don't believe so.
Q Would you read the title, please? 4:05PM
A "Evaluation of a smallmouth bass stocking program in a Kentucky reservoir."
Q Would you read the highlighted portion in the abstract, sir?
A "The relative abundance of smallmouth bass was 4:05PM

significantly greater, 21 percent of all black bass, in 4:05PM
the lower oligotrophic area of the lake than in the
more fertile mid and upper lake areas and significantly
more smallmouth bass, 4.5 percent of all black bass,
were found in the mesotrophic mid-lake than in the 4:05PM
eutrophic upper lake where none were collected."
Q Would you agree, sir, that this study indicates that smallmouth bass prefer oligotrophic lakes to ones that are more eutrophic?
A They prefer lower nutrient lakes to higher 4:06PM
nutrient lakes. I wouldn't characterize it as they
prefer oligotrophic lakes.
Q Okay. There is a correlation between trophic status and nutrient levels, is there not?
A Yes, but there is -- there's a point at which the 4:06PM
productivity of the lake is below what it should be to
support the fishery.
Q Does this paper indicate that smallmouth bass prefer lower nutrient lakes?
A Yes, sir. 4:06PM
Q And does this also indicate to you, sir, that if there were lower nutrients in Lake Tenkiller, perhaps the fisheries in Lake Tenkiller would prefer smallmouth bass to be approved?
MR. TODD: Object to form. 4:07PM

stocking existed for smallmouth bass in Tenkiller? 4:08PM
A I'm uncertain. I don't recall.
Q Do you know whether or not smallmouth bass was present in the Mountain Fork River that feeds Broken Bow Lake prior to dam closure at Broken Bow? 4:09PM
A I do not.
Q Then do you know whether or not smallmouth bass were collected in Broken Bow after dam closure and before stocking?
A I do not. 4:09PM
Q Do you have any understanding as to whether or not the smallmouth bass fishery is more successful in Broken Bow than Tenkiller?
A Yes.
Q And is it more successful in Broken Bow than 4:09PM Tenkiller?
A Yes.
Q And why is that, in your opinion?
A I'm uncertain.
Q Could be the result of the different nutrient 4:09PM levels in the two lakes?
A Possibly, but habitat considerations are also
important.
Q Again, that would be like the rocky bottoms that the smallmouth bass enjoy? 4:09PM

A I'm not certain that lowering the trophic status 4:07PM
of Tenkiller Lake would increase the proportion of
smallmouth bass among the black bass community in the
lake.
Q And why not? 4:07PM
A Because in addition to those characteristics, it
depends upon habitat availability and whether there is
enough habitat to support an increased population of
smallmouth bass and I don't know that to be the case or
not to be the case. 4:07PM
Q So you didn't study whether or not the habitat of smallmouth bass absent the DO temperature and nutrient levels would be amenable to smallmouth bass in Lake Tenkiller?
A I do not. 4:07PM
Q If it was found that such a habitat do exist in Lake Tenkiller, would this study indicate to you that the nutrient levels in Lake Tenkiller would reduce -- it would improve smallmouth bass fishery in Lake Tenkiller? 4:08PM
A It may.
Q Were smallmouth bass in the Illinois River, are they present naturally in the Illinois River?
A That's my understanding.
Q And were they collected in Tenkiller before any 4:08PM

A Rocky bottoms and slopes. 4:10PM
Q And temperature and DO?
A Yes.
Q Do you know whether or not -- I think you've answered this, make sure. Do you know whether or not 4:10PM the habitat in Tenkiller is similar to Broken Bow with respect to rocky bottoms and slopes?
A I do not.
Q Hand you Exhibit 29, sir, and tell me if that information -- well, first of all, tell me if you've 4:11PM ever seen that document.
A I don't believe so.
Q Would you read it, please, sir?
A The title?
Q Yes. 4:11PM
A "A comparison of pre- and post-impoundment fish
populations in the Mountain Fork River in Southeastern
Oklahoma."
Q Although we do have Page 1 reproduced twice, I'll notice, who published this report? 4:12PM
A Researchers from Waterways Experiment Station in
Vicksburg.
Q And can you tell from the bottom where it was published?
A "Proceedings of the Oklahoma Academy of 4:12PM

Scientists." 4:12PM
Q If we turn, sir, to Page 10 of this report, does this indicate whether or not smallmouth bass were present both before and after impoundment of Broken Bow? 4:12PM
A It indicates they were present before and after.
Q And what species are we focusing on to make that determination?
A "Micropterous" -- what you highlighted actually I'm not very good to read. 4:13PM
Q Well, neither am I.
A Micropterous, I guess, is actually how you pronounce it.
Q Dolomieui?
A Something like that. 4:13PM
Q Thank you. Let me hand you Exhibit 30, which is a figure from the Cooke and Welch report. Do you recall this exhibit and the report, sir?
A Yes.
Q What does this show? 4:13PM
A This shows the catch per unit effort for smallmouth bass in Broken Bow and Lake Tenkiller.
Q Does it show a difference between the effectiveness of the smallmouth bass fisheries when you compare Tenkiller and Broken Bow? 4:14PM

A I'm not sure what you mean by effectiveness. 4:14PM
Q Well, let me restate the question.
MR. BASSETT: Do you have another copy of that by any chance?
MR. TODD: I'm sorry. There were two stuck 4:14PM together.
MR. BASSETT: Thank you.
Q Does it show that the fisheries for smallmouth bass are different when you compare Broken Bow and Tenkiller? 4:14PM
A There are certainly differences year to year.
Q Overall does it appear that Broken Bow is a better fishery for smallmouth bass than Tenkiller?
MR. TODD: Object to form.
A There are more years where the catch per unit 4:14PM effort was greater than -- greater in Broken Bow than in Tenkiller, but there are some years where it appears that the reverse is true. Overall, it appears that there's a greater catch per unit effort in Broken Bow.
Q In fact, that means probably about three times 4:15PM higher in Broken Bow than it is in Tenkiller?
A Yes.
Q Did you consider this information when you did your evaluation of the quality of the fishery in Lake Tenkiller? 4:15PM

A Yes. 4:15PM
Q And what impact, if any, did it have on your evaluation?
A It had little impact.
Q And why is that? 4:15PM
A Because the fishery in Lake Tenkiller is managed for largemouth bass, not smallmouth bass. The desire of the State is to enhance the largemouth bass fishery for purposes of enhancing recreational opportunities and there's not a desire or equivalent desire to 4:16PM enhance the smallmouth bass fishery.
Q What's your basis for that statement?
A The fishery management practices of the State.
Q In particular? What in particular about those practices indicates to you that the State has a desire 4:16PM to enhance largemouth and not smallmouth bass fishery in Lake Tenkiller?
A By the way that they manage the fishery. They manage the fishery based on largemouth bass. They sample for largemouth bass. They study the age 4:16PM distribution of largemouth bass. They set catch limits based on largemouth bass in order to enhance the largemouth bass fishery. They stock prey fish in the reservoir to provide forage for largemouth bass.
Q Is that because they are unable to -- to establish 4:16PM a smallmouth bass fishery in Lake Tenkiller? 4:16PM
A I doubt it.
Q What's your basis for that statement?
A There's a greater desire among the fishing community to fish for largemouth bass than there is for 4:17PM smallmouth bass.
Q How do you know what the desire from the fishing community is in Oklahoma?
A Based on reading articles from sport fishermen and -- not only in Oklahoma but in other states and 4:17PM there have been articles written in sports publications counting Lake Tenkiller as a very desirable fishery.
Q And the largemouth bass fishery tends to like more nutrient enriched lakes, do they not?
A They like lakes in which there is cover associated 4:17PM with macrophyte in near shore areas. In order to have macrophytes beds in the nutrient areas require certain nutrient levels so you tend to find largemouth bass in lakes and reservoirs that have sufficient nutrients to support macrophyte communities. 4:18PM
Q Let's turn to Section 5 here of your report. Let's look at Page 5-1, sir. Last paragraph. Again reading in the middle of that paragraph where it says "these bacteria groups"?
A "These bacteria groups may all have non-human 4:18PM

sources in the environment, including animal feces, 4:18PM
which have an undetermined disease potential.
Therefore, their use as an indicator of illness risk
has been widely questioned."
Q Okay. So what are you trying to point out there, 4:19PM
sir?
A That the indicator organisms that are used to
track potential illness and pathogenic organisms are
highly uncertain and widely questioned, as I indicate.
Q Have you ever seen Exhibit 31, sir? 4:19PM
A I believe so.
Q Would you turn to -- what is it for the record,
sir?
A This is a USEPA publication entitled,
"Implementation guidance ambient water quality criteria 4:19PM
for bacteria."
Q And so this is EPA's guidance for what the
appropriate bacteria issues are for ambient water
quality?
A Yes. 4:19PM
Q Would you look at Page 1, please, sir? In the
middle paragraph is EPA discussing the same bacteria
that you indicate should be -- are widely questioned.
Are they discussing the same indicator bacteria in the
middle paragraph on Page 1 that you claim in your 4:20PM

report should be widely questioned as an indicator of 4:20PM
illness?
A Yes, sir.
Q Would you read the EPA statement, fourth line
down, sir, starting "Indicator organisms such as 4:20PM
these"?
A "Indicator organisms such as these have long been
used to protect bathers from illnesses that may be
contracted from recreational activities in surface
waters contaminated by fecal pollution." 4:21PM
Q Continue, sir.
A "These organisms generally do not cause illness
directly, but have demonstrated characteristics that
make them good indicators of harmful pathogens in water
bodies." 4:21PM
Q Doesn't that statement by the EPA contradict your
statement that these indicator bacteria of illness
risks have been widely questioned?
A No.
Q Has USEPA changed its position on indicator 4:21PM
bacteria since its 2004 document?
A EPA, in their own documents, indicate the
weaknesses and uncertainties associated with the use of
these indicators as indicated by the references here,
including USEPA 2007A, so subsequent to this 4:22PM

publication, there is a USEPA publication that 4:22PM
acknowledges the uncertainty of these indicator
organisms.
Q What you write here indicates that EPA, in 2004 at
least, believed that they are a good indicator of 4:22PM
illness for people recreating in ambient waters,
correct?
A That's what this appears to say, yes. That is not
necessarily the position of the United States
Environmental Protection Agency because there are other 4:22PM
documents from USEPA that state this differently.
Q Well, let's look at the -- the National Research
Counsel document that -- 2004 that you cite, that you
support your indication that they're not good
indicators of illness. Exhibit 32. Could you identify 4:23PM
that for the record, sir?
A Appears to be some pages out of the National
Research Counsel report on indicator for waterborne
pathogens.
Q That's one of the citations you give on Page 5-1, 4:23PM
correct --
A Yes, it is.
Q -- for the statement we just quoted? Would you
turn to Page 99 of this report? And the third
paragraph down, would you read the statement beginning 4:23PM

"A systematic review"? 4:23PM
A "A systematic review and meta-analysis of
recreational waterborne studies, both fresh water and
marine, confirm that indicators can provide reliable
estimates of water quality that are predictive of human 4:24PM
health risks under some, but not all, water quality
conditions and the subcommittee supports several
conclusions provided in that study as related to this
report."
Q Do you agree with that statement, sir? 4:24PM
A Yes.
Q Does this statement not indicate the indicators
can predict illness for humans?
A Under certain conditions it says.
Q Okay. Does this statement indicate that use of 4:24PM
indicators is widely questioned?
A This statement by itself does not. I think if you
read the report in total, you will find that there are
statements in the report that indicate that, yes, there
are concerns about use of indicator organisms. 4:25PM
Q And what is the current standard used by EPA to
determine risk to recreational users in ambient water
bodies. Do they still use the same indicator bacteria?
MR. TODD: Object to form.
A EPA now recommends two of the three commonly used 4:25PM

indicators. 4:25PM
Q So they're still using the indicator, the common indicator bacteria for determination of risk to users, correct?
A Yes. 4:25PM
Q Are you familiar with the State's standards for bacteria for recreational use of waters?
A Yes.
Q What indicators are used in the State of Oklahoma?
A The State of Oklahoma uses all three indicators. 4:25PM
Q Okay. And are you aware that the vast majority of states in the United States use all three indicator bacteria?
A I've not done a review of all the states to know that. 4:26PM
Q Are you aware of any state that does not employ indicator bacteria as the use -- to use as a risk to recreational users in ambient waters?
A No.
Q Have you done an evaluation of the various state 4:26PM standards to see which state standard is most common, that is, what bacteria is the most common indicator bacteria used in states for recreational water quality and risk?
A I have not. 4:26PM

Q On Page 5-2, do you not state in the third 4:26PM paragraph that fecal coliform is still the most commonly enforced bacterial water quality standard in the United States?
A Yes. 4:27PM
Q So you are aware that it's the most commonly used in the United States?
A I thought you framed your question a little differently. You asked me if I had done a review --
Q Okay. 4:27PM
A -- whether the most states use that, and I have not done a review, I'm relying on these citations for my review.
Q Okay. Do you have any reason to doubt these citations that indicate that fecal coliform is the 4:27PM still most widely or commonly enforced bacterial water quality standard in the United States?
A No.
Q Do you agree with that statement that you put in your report that fecal coliform is still the most 4:27PM commonly enforced bacterial water quality standard in the United States?
A I do.
Q Would you conclude as a result of this that the largest amount of information available concerning 4:28PM

water quality and bacteria is based on fecal coliform 4:28PM data?
A Could you restate that question?
Q Sure. Would you also conclude that as a result of your statement in your report that fecal coliform -- 4:28PM let me strike that.
Would you also conclude as a result of the statement you put in your report that the largest amount of information available concerning water quality and bacteria is based upon fecal coliform 4:28PM information?
A By water quality, do you mean disease illness?
Q Violations of water quality standards.
A Well, being fecal coliform is the most commonly used, it would be the one for which there's the most 4:29PM information.
Q On Page 5-3, sir, at the top would you read the second bullet from the top, sir?
A Dr. Teaf claims that this model is based upon data but there are at this time no epidemiological data to 4:29PM support the USEPA conceptual model and a large body of data refutes this model.
Q Which articles or literature refute the model that Dr. Teaf is using?
A There are a number of articles, including a 4:29PM

meta-analysis that is referenced in here that 4:29PM contradict Dr. Teaf's claim.
Q How many articles are you aware of, sir?
A Well, the meta-analysis includes dozens of studies and -- and besides the meta-analysis, there are a 4:30PM number of other articles that I can gather if you would like them but I don't have them with me.
Q But you didn't cite them in your report?
A No, we didn't provide an exhaustive literature review. 4:30PM
Q So the only one that you can identify is the meta-analysis that you cite in your report, is that correct?
MR. TODD: Object to form, mischaracterizes.
Q Today, is the only one that you can cite is the -- 4:30PM for this large body of evidence is that meta-analysis you cite in your report?
A No.
Q Okay. What other articles can you cite for me today? 4:30PM
A As you go through here, there's Pruss 1998, there's Wade, et al.
Q Which page are you looking at, sir?
A 5-4.
Q Okay, sir. 4:31PM

A "Pruss 1998, Wade 2003," so there are two that we 4:31PM
cite here and there are many more that we have in our
considered materials that are not cited, as well as
others that I have in my general literature of
references. 4:31PM
Q On Page 4, paragraph two.
A Yes.
Q You state, "As stated by the USEPA, these data show no increase in illness rate versus bacteria count at the water quality standard threshold." What EPA 4:31PM publication are you referencing there?
A The USEPA 1986, I believe.
Q Do you know on what page that's found?
A No, I don't.
Q You believe it's a 1986 document? 4:32PM
A I believe so.
Q Let's look at Page 5-6, the last sentence. Would you read that, please?
A The last sentence on 5-6?
Q Mm-hmm. 4:32PM
A "The equivalent treatment of human waste would
have been to estimate the fecal coliform density in
fresh untreated human feces and to assume this load is
deposited directly into the river rather than first
passing through septic tanks and groundwater or through 4:32PM

wastewater treatment plants." 4:32PM
Q What is your point with that statement, sir?
A That when Dr. Teaf was estimating fecal coliform
loads, he was doing so on an apples and oranges basis
and attempting to compare the fecal coliforms that 4:32PM
would have been generated from livestock versus humans.
Q Okay. Are human wastes in the IRW typically deposited untreated into the river?
A No, sir.
Q So why is your statement a more representative 4:33PM analysis of counting fecal coliforms from human sources?
A That's not what I'm stating here.
Q Do you know how USEPA recommends to determine on its TMDL guidance how you count fecal coliforms? 4:33PM
A I don't recall.
Q Do you know whether or not Dr. Teaf followed USEPA TMDL guidance when he counted both livestock and human fecal coliforms for his mass balance analysis of bacteria for the IRW? 4:34PM
A I do not.
Q Would it be appropriate for Dr. Teaf to follow USEPA TMDL guidance to do that evaluation?
A Only if the guidance was correct.
Q So do you have any reason to believe that the 4:34PM

USEPA TMDL guidance is incorrect? 4:34PM
A I would to have review it. I don't have any
opinion one way or the other.
Q So you didn't review it when you performed your critique of Dr. Teaf's analysis? 4:34PM
A I don't recall doing that, no.
Q Why don't we take a break?
THE VIDEOGRAPHER: We are now off the record.
The time is 4:34 p.m.
(Following a short recess, proceedings 4:34PM
continued on the record.)
THE VIDEOGRAPHER: We are now on the record.
The time is 4:49 p.m.
Q Can we turn to Page 5-7, sir? Second paragraph of your report, Section 5.4.2. Would you read the 4:49PM sentence beginning with "in addition"?
A "In addition, there is evidence that sediments
under popular swimming" -- am I reading this right?
"In addition, there is evidence that sediments under
popular swimming locations can build up a reservoir of 4:49PM
fecal indicator bacteria that can then serve as a
source of these bacteria to the water column."
Q Okay. What was the point of that statement, sir?
A That humans are a source of bacteria to swimming
locations and, in fact, human pathogenic organisms can 4:50PM

wind up in the sediment of those bathing areas and 4:50PM
later to be released back to the water column.
Q Your point is to make a distinction between human, let's say, and other animal's bacteria building up in sediments, correct? 4:50PM
A No, the point was simply to make the point that
swimming locations are typically sources of indicator
organisms and pathogenic organisms.
Q But those sources of those indicator and pathogenic organisms can be both human and animal, 4:50PM correct?
A There could be but in a swimming area it's likely
to be mostly human.
Q Let's look -- you cite Crabill there, correct, sir? 4:51PM
A Yes.
Q Let me hand you Exhibit 33. Can you tell me if that's the exhibit -- I mean that's referencing what you're citing there for that proposition?
A Yes, it is. 4:51PM
Q Okay. And would you look at Page 2169, sir? In the first carryover paragraph, the sentence begins "however." Would you read that for the record?
A "However, during this same time period, the
corresponding fecal coliform counts appear to have 4:51PM

increased implicating a source of fecal pollution as 4:51PM
something other than recreational users."
Q So, in fact, weren't the authors in this study determining that this location where there was swimmers, the source of the fecal contamination was 4:52PM something other than human?
A I would have to go back and reread the whole article to understand the context of that statement, but it certainly does indicate the contribution of pollution other than recreational users. 4:52PM
Q And you would agree that in locations where there are recreational users, there's often the potential for animal contributions in the same locations in ambient water, correct?
A Yes. 4:52PM
Q And that, depending on the particular circumstances it may be that the animal contributions could be larger than the human contributions in a recreational swimming area?
A Wouldn't be a swimming area I'd go to, but I don't 4:53PM know.
Q Well, in the Illinois River, are you aware of whether or not there's swimming areas that have substantial impact by animal fecal coliform?
A I'm not. 4:53PM

Q Do you know one way or the other? 4:53PM
A I do not.
Q Did you provide -- did you perform any analysis yourself, sir, as to the contributions of bacteria to the IRW? 4:54PM
A Not that I recall.
Q Are you offering any opinion as to the sources of bacteria to the IRW?
A No.
Q Let's turn to Section 6. Top of Page 6-2, sir, 4:54PM can you turn with me to that page in your report, which is Exhibit 1 to your deposition. And your reference "Figure 6-1" in the first sentence there on the top of the page, correct, sir?
A Yes. 4:55PM
Q Could you read that for the record, sir?
A "Figure 6-1 indicates that 61 percent of the lakes sampled from 2004-2007 were classified as eutrophic or hypereutrophic according to its chlorophyll-a TSI."
Q Okay. And you're referring now to Figure 6-1, 4:55PM correct?
A Yes.
Q Which shows all the lakes -- lakes across the State of Oklahoma, correct?
A Give me a second to find it. 4:55PM

MS. COLLINS: Anybody just join? 4:56PM
MR. PAGE: No, we just added you.
MS. COLLINS: Oh, did I get dropped or something?
MR. PAGE: I don't know. Have you been able 4:56PM the hear us the last couple minutes?
MS. COLLINS: Not the last couple minutes, no.
MR. PAGE: We had you mute, I apologize.
MS. COLLINS: Oh, okay. I left and I had to 4:56PM call to have it come back on.
MR. PAGE: Yeah, you're on now. Thank you.
MS. COLLINS: Okay, thanks.
Q Okay. I can't remember my question. I do remember it. I do. So Figure 6-1 shows a survey of 4:56PM lakes you did across Oklahoma, correct?
A Survey of lakes that OWRB did and we're illustrating the data from their studies.
Q Okay. So it's a survey of OWRB lakes. But it's all across Oklahoma, correct? 4:56PM
A Yes.
Q It's not just in the region of Lake Tenkiller, correct?
A Correct.
Q Okay. What is the relevance of your evaluation as 4:57PM you did on Figure 6-1? 4:57PM
A The point of Figure 6-1 was to show that the water quality status of Lake Tenkiller was not unique in the State of Oklahoma, that its water quality is similar to water quality of many other lakes in Oklahoma. 4:57PM
Q Okay. Is Lake Tenkiller in the same ecoregion as the other lakes you've compared it to?
A In most cases, no.
Q Would the ecoregion have an effect on water quality of lakes? 4:57PM
A Potentially.
Q So wouldn't it be more realistic to compare Lake Tenkiller with lakes in the same ecoregion?
A Not for the purpose of this presentation.
Q What's the purpose of this presentation? 4:58PM
A The purpose of this presentation is to illustrate that the water quality of Lake Tenkiller is not uniquely degraded in the state. That Lake Tenkiller doesn't stand out in the state as a water body that is uniquely impaired relative to other water bodies of the 4:58PM state.
Q But it tells us nothing, your analysis, does it, as to whether or not Tenkiller has suffered from water quality degradation.
A It does not. This is simply comparative. 4:58PM

Q And you're not suggesting, are you, sir, that if 4:58PM
other lakes in the State of Oklahoma have been impaired
it's permissible to allow Lake Tenkiller to be
impaired, also?
A No, sir. 4:59PM
Q Or that because other lakes have been degraded
then we should be comfortable with Lake Tenkiller's
degradation?
A The issue of the water quality of Lake Tenkiller
and whether we should be concerned or not is pertinent 4:59PM
to Lake Tenkiller by itself, and so I'm not making any
statements about that. I'm simply making the point
here that Lake Tenkiller is not unique in terms of its
water quality.
Q So your point is that Oklahomans should feel 4:59PM
comfortable with degraded water in Lake Tenkiller
because the rest of the lakes in the state are also
degraded?
MR. BASSETT: Object to form.
A I'm not making any point about whether Lake 5:00PM
Tenkiller is degraded or is not degraded here. I'm
simply making the point that its water quality
condition is not unique.
Q And you concede, do you not, sir, that the
condition of Tenkiller or the condition of any lake 5:00PM

could -- is affected by the ecoregion in which it's 5:00PM
located?
A To some extent, yes.
Q So isn't it possible, sir, that if there were no
anthropogenic effects at all in any of these lakes 5:00PM
shown on your figure, that some of them would naturally
have worse water quality than others?
A Yes.
Q Based on this -- the soils and the morphology and
hydrology of its surroundings, correct? 5:00PM
A Yes.
Q Do you know, sir, what the expected phosphorus
concentration would be entering Lake Tenkiller if there
had not been any anthromorphic -- anthropogenic
influences? 5:01PM
A I do not.
Q Do you know what the current loading -- what the
current concentration levels entering Lake Tenkiller
are with regard to phosphorus?
A Yes. 5:02PM
Q What are they?
A They cover a fairly wide range.
Q From --
A From maybe the -- 40 micrograms per liter to a
couple hundred grams per liter. 5:02PM

Q Do you know what the mean for average is for 5:02PM
concentration?
A Not precisely.
Q Did you do a calculation of that among one of your
analyses? 5:02PM
A We may have, I don't recall.
Q I'm going to hand you what has been marked as
Exhibit 34. Have you seen that document, sir?
A I may have.
Q What's the title of it? 5:03PM
A "Nutrient concentrations and yields in undeveloped
stream basins of the United States."
Q Would you read the beginning of the abstract, sir?
A "Data from 85 sites across the United States were
used to estimate concentrations and yields of selected 5:04PM
nutrients in streams draining relatively undeveloped
basins."
Q Okay. Please continue.
A "Flow-weighted concentrations during 1990 to 1995,
were generally low with median basin concentrations of 5:04PM
0.02, 0.087, 0.26, 0.01, and 0.022 milligrams per liter
for ammonia, as M, nitrate, as N, total nitrogen,
orthophosphate as P, and total phosphorous
respectively."
Q And so what did the authors find as the immediate 5:05PM

concentration for total phosphorus in relatively 5:05PM
undeveloped basins?
A 0.022 milligrams per liter.
Q Does that give us a benchmark for expectations for
total phosphorus concentrations entering Lake 5:05PM
Tenkiller?
A No.
Q Why not?
A For several reasons. One, this is a median value
so it doesn't represent any particular system. And I 5:05PM
don't know whether any or which of the systems included
here would be representative of the Illinois River
Watershed.
Q Okay. Are you familiar with the EPA's ambient
quality criteria recommendations for rivers and streams 5:06PM
and nutrients for Ecoregion Number 11?
A Yes.
Q Is Lake Tenkiller in Region No. 11?
A I believe so.
Q Okay. And what were -- do you recall what the 5:06PM
total phosphorus aggregate nutrients for Ecoregion No.
11 -- reference conditions were for Ecoregion No. 11?
A No.
Q Does ten micrograms per liter sound correct?
A I don't recall. 5:06PM

Q Okay. Let me hand you Exhibit 35, sir. Would you 5:06PM
identify that, sir?
A A USEPA publication, "Ambient water quality
criteria recommendations. Information supporting the
development of state and tribal nutrient criteria. 5:07PM
Rivers and streams in nutrient Ecoregion XI."
Q Okay. Does this document include Lake Tenkiller?
Is Lake Tenkiller within Ecoregion No. 11?
A I believe so.
Q And the Illinois River is in Ecoregion No. 11? 5:07PM
There's a map, sir, on Page 7.
A Thank you.
Q You're welcome. Does it appear that the Illinois
River and Lake Tenkiller are in Ecoregion 11?
A Yes, it does. 5:08PM
Q Okay. Go to the beginning of the report where
there's an abstract on executive summary on Page vi.
Can you tell us what the aggregate ecoregion reference
condition was found by the EPA as for the ecoregion for
total phosphorus? 5:08PM
A Ten.
Q So does that give us an understanding of what the
influence concentrations should be for Lake Tenkiller,
again looking at total phosphorus?
A I would have to review this before I could 5:09PM

conclude that ten is the number that we would expect. 5:09PM
It's based on, as it says, 25th percentiles only, so
that may mean that it is or is not appropriate for the
Illinois River Watershed.
Q Well, the 25th percentiles indicate for these 5:09PM
analyses that they're looking at the -- the levels that
are -- that were 25 percent of the lakes, or the rivers
in this case, have less phosphorus concentrations,
correct?
A Yes. 5:09PM
Q And that is a recommendation for the Illinois
River by EPA based on this ecoregion report, is it not?
A Yes.
Q Hand you what is marked Exhibit 36. Can you
identify that for me, sir? 5:10PM
A This is a USEPA publication, "Ambient water
quality criteria recommendations. Information
supporting the development of state and tribal nutrient
criteria. Lakes and reservoirs in nutrient Ecoregion
XI." 5:10PM
Q And is Lake Tenkiller part of Ecoregion No. 11?
A Yes.
Q Okay. In looking at the executive summary, which
is several pages in, vi, what is the total phosphorus
recommended by the EPA for lakes within this ecoregion? 5:11PM

A There are two tables here. One, which is an 5:11PM
aggregate, an eight. And then there is a range of
values for various sub-ecoregions that range from 2.5
to 24.38.
Q And what is the aggregate recommendation? 5:11PM
A The aggregate recommendation is eight.
Q Okay. How does the -- the phosphorus levels at
Tenkiller compare to eight?
A They are higher than eight.
Q And even in Lake No. 1, are they at least three 5:11PM
times higher in recent times?
A They're on the order of three times higher.
Q And as you progress upstream, do the phosphorus
levels in Lake Tenkiller increase or decrease?
A They tend to increase. 5:12PM
Q So Tenkiller doesn't -- the phosphorus levels at
Tenkiller are much higher than the aggregate reference
conditions recommended by EPA, is that correct?
MR. BASSETT: Object to form.
A They're higher than the aggregate reference 5:12PM
condition in this table.
Q This table is part of the EPA publication,
correct?
A It is.
Q And you understand that this EPA publicist has 5:12PM

recommended standards for states and tribes to employ 5:12PM
in rivers and streams and lakes in these different
ecosystems?
A That's not my understanding.
Q What is your understanding of the purpose of these 5:13PM
ambient water quality criteria recommendations?
A It is not my understanding that the information in
these tables are recommended water quality standards.
Q What are these recommendations by EPA?
A They are reference conditions which I don't 5:13PM
interpret as recommendations for water quality
standards.
Q Will you open up Page 35, sir -- Exhibit 35 under
Page 5 in the executive summary?
A Page V? 5:14PM
Q Yeah. Roman Numeral V, thank you.
Would you read the last sentence of the
first paragraph, sir?
A "This document presents EPA's current recommended
criteria for total phosphorus, total nitrogen, 5:14PM
chlorophyll-a and turbidity for rivers and streams in
nutrient Ecoregion 11, which were derived using the
procedures described in the rivers and streams nutrient
criteria technical guidance manuals."
Q So how do you interpret the statement that these 5:14PM

are EPA's current recommended criteria for total 5:14PM
phosphorus?
A I would have to review this to fully understand
what was being represented here.
Q Okay. Let's just read one more sentence -- 5:15PM
A Sure.
Q -- see if it helps us. Following this first
sentence of the next paragraph, would you read that,
sir?
A "EPA's eco-regional nutrient criteria are intended 5:15PM
to address cultural eutrophication, the adverse effects
of excess nutrient inputs."
Q One more sentence, sir.
A "The criteria are empirically derived to represent
conditions of surface waters that are minimally 5:15PM
impacted by human activities and protective of aquatic
live and recreational uses."
Q Okay. So using that understanding of this
document and looking at the criteria that we've looked
at, does it indicate that the Illinois River and Lake 5:15PM
Tenkiller have more than a minimal impact by human
activities in terms of phosphorus concentrations?
A Yes.
Q Can you believe, sir, that as phosphorus increases
in fresh waters, there tends to be a decrease in the 5:16PM

aesthetic attributes of those waters? 5:16PM
A There can be.
Q And what kinds of adverse aesthetic effects can
occur when you increase phosphorus in fresh waters?
A Algal blooms and filamentous green algae and 5:17PM
benthic algae.
Q And can that affect water clarity?
A The algae -- the algal blooms, yes.
Q And can changes in nutrients in a water body
affect species composition of a water body? That is, 5:17PM
fish species?
A It can.
Q Did you review Dr. Teaf's information concerning
the number of water quality violations he observed in
the rivers of the IRW with regard to bacteria criteria? 5:18PM
A Yes.
Q Do you believe that those persistent exceedances
represent a potential health risk concern for human
recreational users in those waters?
A Not necessarily. 5:18PM
Q Is it a potential risk? Does it run a potential
risk?
A Not necessarily.
Q Why not?
A Because he's relying on fecal coliform and there 5:19PM

has been demonstrated very little or no relationship 5:19PM
between fecal coliform concentrations and human
illness.
Q Did he also evaluate -- well, sure, but doesn't
the presence of fecal coliform indicate a risk of 5:19PM
pathogens being present?
A Not necessarily.
Q But it can, can it not?
A It can.
Q And didn't he also do an evaluation with regard to 5:19PM
enterococci?
A He did some. I'd have to go back and look at
that.
Q Were there multiple water quality violations based
on enterococci levels in the IRW? 5:19PM
A Again, I would have to go back and look at that.
Q Did Dr. Teaf look at E.Coli water quality
violations in the IRW?
A I would have to go reread his report again.
Q Would you agree, Dr. Connolly, that in different 5:20PM
water bodies, even if they have identical pathogen
loadings and concentrations, that the sources can be
different?
A Yes.
Q Would it matter to you what the major source of 5:20PM

the bacterial contamination for a particular water body 5:20PM
is?
A Yes.
Q If, assuming if a major source of bacteria were in
land applied poultry litter, would you believe that 5:20PM
there is little risk of gastrointestinal illness for
recreational users in the IRW?
MR. BASSETT: Object to form.
A I've not seen any evidence that the organisms
associated with poultry litter cause human illness, so 5:21PM
I have no basis to say that if poultry litter were the
source of bacteria that it would pose a risk of
illness.
Q Does poultry litter contain pathogens?
A Human pathogens? 5:21PM
Q Yes.
A I'm unaware that it does.
Q Are you familiar with the pathogen campylobacter?
A Yes.
Q Does poultry litter contain campylobacter? 5:21PM
A I don't recall one way or the other.
Q Are you familiar with the bacterial pathogen
salmonella?
A Yes.
Q Does poultry manure contain salmonella? 5:22PM

A A particular strain of salmonella would cause 5:22PM
human disease?
Q Yes, sir.
A We're not sure.
Q Wouldn't that be important for you to make a 5:22PM
determination as to whether or not there was a risk of
poultry litter bacterial contamination to recreational
users of streams in the IRW?
A That would be a first step in assessing whether or
not there was a issue. 5:22PM
Q But you did not do that evaluation?
A No, sir.
Q Can you determine -- is the only method to
determine a violation of bacteria water quality is to
evaluate geometric means of bacteria counts? 5:23PM
A Can you state that again?
Q Yeah. Let me try it again. It's my
understanding, sir, now see if you'll agree with me,
that to determine if there's been a violation of a
bacteria standard, you can look at the geometric mean 5:23PM
criteria is one way, correct?
A Yes.
Q And you can also look at a maximum one time level
in a water sample, correct?
A Depends on how the state standard is written. 5:23PM

Q Does Oklahoma have both? 5:23PM
A I don't recall.
Q Well, if Oklahoma does have both, would it be
appropriate to evaluate violations of the Oklahoma
criteria by looking at simply the maximum standard? 5:24PM
A If Oklahoma has both, you would have to look at
both.
Q But if Oklahoma allows either/or, that is, a
geometric mean standard violation or a maximum count
violation, would either one of them be a basis for a 5:24PM
violation of the Oklahoma standard?
A As you represented, it would.
Q But you don't know whether Oklahoma has both?
A I don't recall.
Q Do you know whether or not EPA guidance for water 5:24PM
quality standards of coastal recreational waters
provides for a single sample maximum value to determine
water quality violations?
A I believe it does.
Q Let's turn to Page 7. Turn to 7-1, sir. Section 5:25PM
7 of your report, Exhibit 1 to the deposition. Under
7.2.1, sir, would you read the first sentence?
A "The long-term record of phosphorus concentrations
in the Illinois River at Tahlequah shows an apparent
reduction beginning in about 2003." 5:26PM

Q Okay. And then you do the analysis on Figure 7-1 5:26PM
to demonstrate your statement, correct?
A Yes.
Q Okay. Are you trying to evaluate the total
phosphorus concentrations with time to show that 5:26PM
there's an improvement for this analysis?
A I didn't follow you.
Q Okay. When you say here, as you just read, the
long term record, "phosphorus concentrations in the
Illinois River at Tahlequah shows an apparent reduction 5:26PM
beginning in 2003," correct?
A Yes.
Q So are you trying to evaluate total P
concentrations with time to demonstrate there's been an
improvement in P concentrations in the IRW, at least 5:26PM
the Illinois River at Tahlequah?
A If we're evaluating them to understand what
apparently has gone on in terms of trends.
Q Okay. Are you familiar with methods to evaluate
changes in concentrations with time? 5:27PM
A Yes.
Q Are there methods such as trends analysis by which
you can do this?
A There are.
Q Are you familiar with statistical tests to perform 5:27PM

trend analysis? 5:27PM
A Yes.
Q Are you familiar with the EPA recommendation
concerning trend analysis?
A What recommendations? 5:27PM
Q Are you familiar with the Mann-Whitney evaluation
for trend analysis?
A Yes.
Q Did you perform any statistical trend analysis for
the data you show on Figure 7-1? 5:27PM
A No.
Q Why not?
A Because that type of trend analysis is difficult
to do because of the nature of the sampling programs.
And we could have attempted to estimate annual loading 5:28PM
from the data in a manner similar to the USGS. And had
we done that, I'm confident it would have shown that
the annual loading is lower in the later data set than
in the earlier data set.
Q And how can you be confident in that if you have 5:28PM
not done the analysis?
A By the evident differences in the data.
Q By looking at it on Figure 7-1?
A Yes, sir.
Q So you did an eyeball evaluation? 5:28PM

A Yes, sir. 5:29PM
Q Is that the kind of evaluation you criticized when I tried to show you the potassium differences over time -- or potassium differences in different segments of the Illinois River streams? 5:29PM
A No, in fact, I did exactly the same thing there.
Q Did an eyeball evaluation?
A Yes, sir.
Q And determined that -- I thought your testimony was that that you needed to a statistical trend 5:29PM analysis to determine if this was valid?
A What I said was: Looking at that data, that there clearly was not a statistically significant difference among those different matrices and you could do a statistical analysis, but an eyeball analysis is useful 5:29PM and many times sufficient given when things are evident.
Q Okay. You indicate by looking at Figure 7-1 that there's an apparent reduction in P concentrations, correct? 5:30PM
A Yes, sir.
Q Do you know what the statistical probability is that there's actually no apparent decreasing trend in the P data at Tahlequah?
A No. 5:30PM

Q So how can you say there's an apparent reduction? 5:30PM
A Because that is based on my professional experience of probably 35 years now of looking at water quality data.
Q How do you account for that reduction at 5:30PM Tahlequah?
A That reduction coincides with reductions in discharges from wastewater treatment plants.
Q In what year or for what time period?
A The same time periods, looking at loadings for the 5:30PM period prior to 2004 and 2004 on.
Q What was the reduction represented by P loadings from wastewater treatment plants beginning in 2004? What was the percent reduction?
A Approximately 40 percent reduction. 5:31PM
Q Forty percent of loadings to the lake were reduced at Tahlequah?
A To the river.
Q To the river?
A Yes. 5:31PM
Q From wastewater treatment plants?
A From wastewater treatments plants.
Q But what portion does that 40 percent represent of total phosphorus load in the river?
A That 40 percent represents a small fraction of 5:31PM

total phosphorus load in the river. 5:31PM
Q So would you expect that small fractional change of total phosphorus loads to have any significant impact or water quality?
A Yes. 5:31PM
Q Why?
A For the reasons we discussed earlier, that the influence of that reduction is seen under base flow conditions and base flow conditions dominate algal production in the system during the summer. 5:32PM
Q You're looking at total phosphorus, are you not, sir?
A Yes.
Q And does the lake care whether it's base flow or high flow conditions for its loading? 5:32PM
A From a water quality standpoint, it does.
Q It does?
A Yes, sir.
Q And how so?
A The riverine portion of the lake is responding to 5:32PM the load it sees coming in every day, which is dominated by base flow conditions during the growing season.
Q In your calculation of the 40 percent reductions based on the same calculations we discussed earlier as 5:32PM

part of Figure 2-30 to your report? 5:33PM
A I'm sorry, can you repeat that question?
Q Well, when you say there has been a 40 percent reduction in wastewater treatment plant discharges of phosphorus since 2004? 5:33PM
A Yes.
Q And that represents a small fraction of the total phosphorus loading to the rivers, correct?
A Yes.
Q But you say that small fractional change has a big 5:33PM impact, is that correct?
A On base flow and base flow conditions are very important to water quality.
Q We had a discussion earlier, though, when we were looking at base flow that there is a substantial -- 5:33PM there's a potential for substantial amount of total phosphorus in base flow coming from non-point sources. Do you remember that discussion?
A I remember the discussion, but I wouldn't characterize it the way you just did. 5:34PM
Q If, in fact, non-point sources represent 40 percent of the flow to the rivers during base flow, would that change your opinion as to the impact of the modifications in wastewater treatment plant discharges in 2004? 5:34PM

A No, sir. 5:34PM
Q Why not.
A Because that difference is attributable to high concentrations that occur very rarely as indicated that those upper loads that heavily influence that 5:34PM difference were three measurements out of 78. Those rare events are not what control phytoplankton growth in the systems.
Q To test your hypothesis, or at least your statement, wouldn't you want to go look at the sites 5:35PM that were found with large algal mats, thick algal mats, to see if they had been influenced by a wastewater treatment plant?
A Yes.
Q But you did not do that? 5:35PM
A I did do that.
Q You did go out and look at the areas that Dr. Stevenson identified as nuisance benthic algae and determine that all of them had been influenced by a wastewater treatment plant? 5:35PM
A What I did was to look at the density of benthic algae because I did not have a data set on filamentous green algae I could trust and look at where the high levels or high densities of benthic algae were. They tended to being located in small streams downstream of 5:36PM

wastewater treatment plants. 5:36PM
Q Did you find any locations that were not downstream of wastewater treatment plants?
A There were locations, not downstream of wastewater treatment plants, but they also tended to be in small 5:36PM tributaries and they were minor fractions compared to ones that were down stream of wastewater treatment plants.
Q What fraction?
A We can look at the figure. 5:36PM
Q Did you do a comparison such as that with the benthic algae, that is, the filamentous green algae?
A I was unable to do that comparison.
Q You could have used Dr. Stevenson's results and gone out and seen whether or not those areas where he 5:36PM identified nuisance filamentous green algae, or were not down gradient of a wastewater treatment plant, could you not?
A I'm not sure whether I could or not, whether we understood his data well enough that I could correlate 5:37PM station location and filamentous green algae result.
Q Are you saying that you couldn't tell what the stations were where he identified nuisance filamentous green algae?
A What I'm saying is that the data that we had for 5:37PM

filamentous green algae did not allow me to reproduce 5:37PM his figure. So, therefore, I was not sure that I had correct measurements or correct data. So in the absence of correct data, I don't know whether I'm matching up correctly stations and values. 5:37PM
Q Did you have a flatlong for those different stations?
A I don't recall.
Q Weren't all the flaplongs provided for all sample locations in the CDA data center? 5:37PM
A They may have, but as I just indicated, that's not what would have prevented me from doing this.
Q What determines chlorophyll levels in Lake Tenkiller?
A Nutrient concentrations, light, temperature, 5:38PM residence time.
Q Okay. And what -- would that include phosphorus concentrations?
A Yes.
Q What determines phosphorus concentrations in Lake 5:38PM Tenkiller?
A Phosphorus concentrations entering from upstream and the hydrodynamics in Lake Tenkiller.
Q So is part of the analysis dependent on loads, phosphorus loads at Lake Tenkiller? 5:38PM

A Yes. 5:38PM
Q Can you tell us what the total annual phosphorus load to Lake Tenkiller is?
A One estimate that I'm aware of is a little over 200,000 kilograms per year. 5:40PM
Q Okay. Has that increased or decreased in the last ten years?
A It has decreased.
Q How much?
A I don't recall the percentage. 5:40PM
Q Less than nine percent?
A Perhaps.
Q Did that decrease of nine percent have an influence on the phosphorus concentrations in Lake Tenkiller? 5:40PM
A Yes.
Q Would you be able to notice the change in the trophic state based on such decrease?
A It would depend on how close you were to the trophic state boundary. 5:40PM
Q Did you do an evaluation to see whether the trophic state has changed in Lake Tenkiller since 2004?
A My understanding, they have not.
Q They haven't changed?
A Correct. 5:41PM

Q I think we discussed earlier in your deposition, 5:41PM
sir, that you have produced a lake model that has been
used for lake management, correct?
A For this case?
Q No, for other lakes. 5:41PM
A Yes.
Q Okay. In Section 8 of your report, what is your
critique of Dr. Wells' model?
A Critique is that his model does a very poor job of
replicating phosphorus and chlorophyll concentrations 5:41PM
in Lake Tenkiller and, therefore, is not a valid and
credible tool for making predictions about the
responsive Lake Tenkiller changes in phosphorus load.
Q How well did your model of Lake Erie match data?
That is, the model predictions to observe data? How 5:42PM
well did they match?
A Certainly much better than Dr. Wells' model.
Q Oh, really?
A Yes.
Q Let's look at the report. Let me hand you what's 5:42PM
marked as Exhibit 37. Can you identify that for us,
sir?
A This is an article that I authored along with
Robert Thomann.
Q Okay. Let's look at the Page 167 of this report 5:42PM

under variability, the second paragraph. Would you 5:42PM
read the last sentence of that paragraph?
MR. BASSETT: Excuse me. Where are you?
MR. PAGE: On Page 167, second paragraph,
last sentence. 5:43PM
MR. BASSETT: Thank you.
A "Changes in nutrient concentrations resulting from
variations in the discharge of nutrient from point and
non-point sources also contribute to the variability in
chlorophyll concentrations." 5:43PM
Q Okay. What is the purpose of that statement in
this paper?
A Actually, I would actually have to reread this
paper. I've not looked at this paper in 15, 20 years.
Q Let's go to Page 169. You see where you have a 5:43PM
discussion evaluating the fit of the model to observe
data on Figure 2?
A Figure 2. I'm sorry.
Q Page 169.
A Yes, sir. 5:44PM
Q Figure 2.
A Yes.
Q Is that where you're doing an evaluation of the
fit of the model to the observed data?
A Yes, sir. 5:44PM

Q And this is the type of evaluation you did for Dr. 5:44PM
Wells' report where you've been critical, correct?
A Yes.
Q Would you read half way down the paragraph above
the Figure 2 on this page where it says "the fit of the 5:44PM
model"?
A "The fit of the model to the data indicates that
the kinetics used are valid and that the time and space
scales chosen are sufficient to elucidate the average
behavior over the year. A level of confidence in the 5:44PM
ability of the model is derived which permits its use
for estimation of the average response of the basins of
the lake to changes in nutrient loadings."
Q Okay. Now, so you thought your model did a good
job predicting, correct? 5:44PM
A A reasonable -- what I would call reasonable job.
Q Average over the year, correct?
A The seasonal changes over the year.
Q Let's look under phosphorus, the third set of
figures down. 5:45PM
A Yes, sir.
Q How well does the model fit within the whisker
bars on that figure?
A It fits pretty well within the whisker bars on
that figure. 5:45PM

Q It doesn't match the whisker bars all the way 5:45PM
through, does it?
A I sees no points where it doesn't fall within the
whisker bars.
Q How about -- what's the little box there with the 5:45PM
whisker bars?
A The little box, the mean.
Q How well does it match the mean?
A It is sometimes higher than the mean sometimes
lower than the mean. 5:45PM
Q Did you do this same evaluation on Dr. Wells'
analysis?
A Yes, sir.
Q And you found it didn't comport as well as this
analysis here? 5:45PM
A No, sir, not even close.
Q Let's look at Figure 5. What does Figure 5 show?
A Figure 5 is the comparison of a verification
analysis of the Delaware River model to dissolved
oxygen data in the Delaware River. 5:46PM
Q Okay. So how well does the model fit the Trenton
predictions?
A Poor to fair. I mean, fair, I would guess.
Q Okay. But do you use this model even though you
had poor to fair predictions to predict DO levels in 5:46PM

Lake Erie? 5:46PM
A No, this is not a model of Lake Erie.
Q Oh, excuse me, for the Upper Delaware River?
A This is not the same type of comparison that we
looked at in the other figure, nor is it the same type 5:47PM
of comparison that I show in my report for Dr. Wells'
model.
Q Go to the last page on Page 173. Would you read
the last sentence in the carryover paragraph on
results? 5:47PM
A "Based on the modeling analysis, the estimated
number of dates per month that the instantaneous daily
DO will be less than a given level under different
loading conditions can be determined. For example, the
projections indicate that about seven days per month 5:47PM
would have minimum DO levels less than five milligrams
per liter for the region below Eastern."
Q And so you decided that you could use the model
productions that were shown on the previous page to do
management for this river, correct? 5:48PM
MR. BASSETT: Object to form.
A I did not.
Q Who did this analysis?
A This is Dr. Thomann's work.
Q So this wasn't part of your work? 5:48PM

A No, sir. 5:48PM
Q Were you a co-author of this report?
A Yes.
Q Do you agree with Dr. -- I don't want to
mispronounce his name -- 5:48PM
A Thomann.
Q Thomann's conclusions?
A I would have to go back and review this before I
decide whether I agreed or disagreed.
Q Okay. Let's look at Exhibit 38. Are you familiar 5:49PM
with this document, sir?
A Yes.
Q Okay. Is this your Lake Erie eutrophic model?
A Yes.
Q Would you look under the "discussions of soluble 5:49PM
reactive phosphorus on 814," sir? Would you read that
statement under soluble reactive phosphorus, sir?
A "Comparison to individual cruise average data,
Figure 11, illustrates the somewhat erratic nature of
measurements and the inability of the model to 5:49PM
convincingly reproduce details of the observed
distributions."
Q Okay. You used this model to do water quality
management, did you not, sir?
A This analysis is not at all analogous to the 5:50PM

calibration analysis that I critiqued in my report. 5:50PM
Q Was is this analysis looking at here?
A The model was developed, the model was calibrated,
the figure we looked at in the previous paper was an
example of that calibration, which actually does fairly 5:50PM
well at reproducing the phosphorus patterns. The model
was then used to evaluate phosphorus loading reductions
necessary to eliminate the hypoxia in the lake. The
model was then put on the shelf and more than ten years
later, after ten years of additional data were 5:51PM
collected, the model was re-run to see, without any
further adjustment, how well would it predict what was
happening over the then-year period. And so -- so
that's a severe challenge for a model. It's called a
post-audit of a model. The model invariably performs 5:51PM
poorer in a post-audit than in a calibration. The
issue here is Dr. Wells' model cannot pass the
calibration test. This model did. A model that can't
pass the calibration test should not be used.
Q Have you ever looked at the source code for the 5:51PM
CE-QUAL model that Dr. Wells used?
A I may have at some point, I'm not sure.
Q Is that part of your evaluation?
A No, sir.
Q Let's take a short break. 5:52PM

THE VIDEOGRAPHER: We are now off the record. 5:52PM
the time is 5:52 p.m.
(Following a short recess, proceedings
continued on the record.)
THE VIDEOGRAPHER: We are back on the record. 5:53PM
The time is 5:54 p.m.
Q Okay. Doctor, I want you to turn to Figure 8-1 of
your report. I want to ask you whether or not that
Figure 8-1 of your report is the analysis performed to
critique Dr. Wells' lake model? 5:54PM
A Yes, it is.
Q Okay. Says down here, "Error bars and band at
plus minus two standard errors." What does that mean?
A The arrow bars around the data points represent
plus or minus two standard errors of the mean around 5:54PM
the data point.
Q Okay. Does this -- these error bars represent
maximum/minimum data?
A No.
Q When we looked at the previous analysis, when you 5:55PM
looked at your Lake Erie data, your whisker bars showed
maximum and minimum data, did it not?
A I don't believe so.
Q It was plus or minus two standard deviations?
A For two standard errors. 5:55PM

Q Two standard errors. That's what you used in your -- 5:55PM
A I would have to go back and check but I doubt it was maximum minimums.
Q We have your report. Will you take out your report and check that? 5:55PM
A It's certainly not maximum minimums because the bars are symmetrical, so its symmetrical bars indicate that it's an error bar and my recollection is that it will be plus or minus two standard errors. 5:55PM
Q Symmetrical, you said the data on 169 of Exhibit 166 are symmetrical from --
A Yes, the bar goes as far as up as it does down.
Q From the mean point?
A From mean point. 5:56PM
Q Looks to me like, for example, under the calibration that, for example, they're August and September that from the mean point it goes much farther up than it goes down?
A And that's because the down part is constrained by zero. We didn't allow the down bar to go to negative. 5:56PM
Q What data was used for your analysis on Figure 8-1?
A The data from the -- collected by the plaintiffs in this case. 5:56PM

Q Did you use just four stations or did you use all the segment models that Dr. Wells used in his report? 5:56PM
A For the model result plat?
Q Yes.
A My recollection is we used the four points so these represent his computations at the point at which the data were collected. 5:56PM
Q But Dr. Wells used more than just these four points for his model, did he not?
A Yes. 5:57PM
Q And he used more than just the data collected by plaintiffs in this case, did he not?
A I don't recall.
Q Isn't it true that he used data collected from the OWRB as part of his analysis also? 5:57PM
A For this time period that we're looking at, I'm uncertain.
Q Do you know what data was used for the soluble reactive phosphorus on the bottom half of Figure 8-1 for Lake Stations 3, 2 and 1? 5:57PM
A Yes. This is the data in the plaintiff's database.
Q Okay. Just the plaintiff's database?
A Yes.
Q Okay. During the break I handed you Exhibits 39 and 40 where you've taken all the chlorophyll-a data on Exhibit 39 for all stations at all depths. Did you do that as part of your analysis on Figure 8-1? 5:58PM
A All stations, all depths?
Q Yes, the standard right here. Dr. Wells prepared this. 5:58PM
A Yeah, I've never seen these before.
Q Right. He prepared these from his data space that he gave you as part of the considered materials and he, rather than just look at the four stations and limited amount of data that you selected, he reproduced what you were doing here using all the data he used in his model. 5:58PM
A I'm completely confused by this.
Q Okay, sir. 5:59PM
A I've not -- I've not seen anything that looks like this in his expert report.
MR. BASSETT: Mr. Page, was this a part of Dr. Wells' report. It wasn't, was it?
MR. PAGE: No, this was prepared as rebuttal. 5:59PM
MR. BASSETT: Well, we -- just for the record, we object.
Q Okay. Dr. Connolly?
A Yes, sir.
Q Would you read what Figure 1 caption is? 5:59PM

A "Chlorophyll-a, all steps, all stations, all depths." 5:59PM
Q Okay.
A "Plus or minus one standard deviation."
Q Okay. When you did your analysis for chlorophyll-a, Figure 1, did you use all stations? 5:59PM
A We used all stations sampled by the plaintiffs.
Q Did you use all depths?
A No, sir.
Q Why not? 6:00PM
A Because the model was vertically segmented so that it was predicting values at certain depths and in order to have the most appropriate comparison, we compared the chlorophyll-a in the surface waters to the model predictions at the same depths in the surface. 6:00PM
Q Would you complete your reading of the caption, Figure 1, please?
A "Model Run 400 is the mean model result on the same time and location as to field data. The data are at the same location, depth and time as the model prediction and represent the mean value of the data." 6:00PM
Q Okay. Given those assumptions, assuming that's true, does this analysis shown on Figure 39 show that Dr. Wells' model does a good job of reproducing the observed data. 6:01PM

MR. BASSETT: Objection. 6:01PM
A Even reading this, I'm uncertain of what Dr. Wells did, but if I understand this to be that he's aggregated model and data from all depths to compare to chlorophyll-a concentrations, that's highly unusual and 6:01PM is not the way I would recommend calibrating a model or comparing a model and data.
Q Did Dr. Wells use the depths where there was data?
A That's what it says.
Q Okay. Isn't that appropriate? 6:01PM
A I don't believe so here.
Q Why not?
A The point here is can this model reproduce the growth of chlorophyll. If you begin to average in other depths, you will start to average in depths at 6:01PM which, quite frankly, are not growing and that will change your model and your data. So, for example, the model could be horribly off near the surface where the phytoplankton are growing, but at deep depths both the model and the data predict very little phytoplankton 6:02PM growth and that would give the appearance that the model and the data are similar.
Q Were all the depths shallow -- well, let me ask this question: So you selected data from only certain depths and only certain data sources where you did your 6:02PM

evaluations, is that correct? 6:02PM
A Yes, sir.
Q So you did not use all the data that was available to you and both Dr. Wells to do your evaluation, correct? 6:02PM
MR. BASSETT: Objection, form.
A I don't understand what data Dr. Wells is using here and whether he is combining different years, whether it's appropriate to use the data in the way that he's used it. And so I'm very uncomfortable 6:03PM trying to interpret this figure because I really do not understand what Dr. Wells has done and what he is presenting.
Q Well, he says here, at least in this exhibit, that it's Model Run 400, which you are also reproducing, 6:03PM correct?
MR. BASSETT: Objection, form.
A Yes.
Q When you did Model Run 400, you eliminated some of the data that Dr. Wells used in his original report 6:03PM from Model Run 400, did you not?
A I don't believe so and I don't believe that Dr. Wells' report had a figure that looked at all like this.
Q Did Dr. Wells have more than four stations where 6:03PM

he had data for chlorophyll-a in his model? 6:03PM
A I would have to go back and check.
Q Okay. If he did, would that not indicate that you did not use all of the station data that Dr. Wells did for chlorophyll-a evaluations? 6:03PM
MR. BASSETT: Objection.
A We may or may not have shown all of the data that Dr. Wells showed. I would have to go back and check.
Q Would it be fair to evaluate Dr. Wells' says model calibration by eliminating the data that -- some of the 6:04PM data that was available and used in the calibration?
A I think this is a fair comparison and I would have to go back to see whether adding any additional data would provide any additional perspective here, but it is clear from these comparisons that the most robust 6:04PM data set we have, which is the plaintiff's data set, which sampled at these four locations and generated a fairly good average of summer conditions show levels that are not at all reproduced by the model.
Q Let's look at Exhibit 40 that I handed you. 6:04PM
MR. BASSETT: And just for the record, we also would object to Exhibit No. 40 as new analysis after the deadline and I think it's inappropriate for use in this deposition.
MR. PAGE: Well, I know we talked about this 6:05PM

before, but just for the record, I know the plaintiffs 6:05PM (sic) would like us not to be able to do rebuttal or evaluations of plaintiff's (sic) analysis -- or the defendant's analysis, but we believe we have that right so we're going to continue with the deposition. 6:05PM
MR. BASSETT: I understand.
Q With regard to Exhibit 40, this is Dr. Wells' evaluation of Lake Station 4, 3, 2, and 1, just the four stations for below peak. Does this show, based on our ortho P data, that there's a good fit between the 6:05PM model and the observed data?
A I have two objections to this --
MR. BASSETT: Let me just say this. Can I have a continuing objection to all the questions in connection with -- 6:06PM
MR. PAGE: Exhibit 40 and 39.
MR. BASSETT: -- with Deposition Exhibit No. 40, as well as 39, and that way I won't to have keep interrupting?
MR. PAGE: Sure. 6:06PM
A I have two objections to this. One, Dr. Wells is showing a standard deviation, which is not appropriate. This should be standard error, which would shrink these bars considerably.
Q And what's your basis for that statement, sir? 6:06PM

A The model is computing the mean condition. The 6:06PM
appropriate comparison of the data is the mean of the
data and the uncertainty of that mean, not the
distribution of values which is what the standard
deviation is meant to show. 6:06PM
Q Okay. Did you have any references that would
support that statement?
A I can certainly find references that would support
that statement.
Q Okay. What is your other objection? 6:07PM
A My other objection is that I don't understand this
data at all because our analysis of the data says that
the average orthophosphorus reactive concentration is
not eight micrograms per liter at Stations 3, 2 and 1,
but is more like two at Stations 3, 2 and 1. And I 6:07PM
have no understanding of how Dr. Wells generated this
data.
Q Okay. So somebody made a mistake as to which data
is being used, correct, either you or Dr. Wells?
A We are using different data, clearly. 6:07PM
Q So one of the parties is not using the data as
provided by the CDM in its sample program, correct?
MR. BASSETT: Object to the form.
A This are differences here I don't understand.
That's all I can say. 6:08PM

Q If your people who helped you with this analysis 6:08PM
on Figure 8 on the soluble reactive phosphorus used the
wrong data for Lake Stations 3, 2, and 1, would that
mean your analysis here is invalid?
A If they used the wrong data we would have to 6:08PM
replace it with the right data and see what the
comparison is. But I myself looked at this data
multiple times and I do not believe this is the wrong
data.
Q Let's look at Section 9 of your report. What are 6:08PM
your general concerns with regard to data quality?
A That the standard operating procedures developed
and provided to the field crews were vague and
ambiguous and did not provide the specificity necessary
to insure consistent high quality data. 6:09PM
Q Okay. Are you familiar with the EPA DQO process?
A Yes, sir.
Q Is it not a fundamental part of the DQO process
that you provide data of sufficient quality that could
be used for all intended purposes? 6:09PM
A That is the object of the DQO, yes.
Q Did you review the actual data that you're
commenting on here for Section 9?
A Much of it, not all of it.
Q Did you review the results of the QA/QC samples? 6:09PM

A Yes. 6:10PM
Q And what were they? Did it show that the data was
generally good quality based on the QA/QC samples?
A The QA/QC data were generally of good quality.
Q Okay. Did you review the laboratory case 6:10PM
narratives?
A I believe we reviewed some.
Q Okay. And what did the laboratory case narratives
indicate with regard to the data?
A I would have to go back and look. I don't recall. 6:10PM
Q Did you review the CDM data usability reports?
A Yes.
Q And what did those usability reports indicate with
regard to the data?
A They indicated that the data was largely usable. 6:10PM
They did flag some things in the data.
Q Do you have disagreement with that conclusion?
A I have some uncertainty with that conclusion.
Q Do you have any specific things you can identify
where you can point to a reason why you disagree with 6:11PM
that conclusion?
A Many of the evaluations on data usability are not
sensitive to variations in protocols in the field that
could affect the data point.
Q Okay. Do you have any analysis that indicates 6:11PM

that there was variability of the protocols in the 6:11PM
field that actually did affect the data points?
A There's evidence from the field notes of
variations in the protocols in the field that had the
potential to affect the data. In many cases, it's 6:11PM
impossible to tell post hoc whether the data have been
affected. Developing ambiguous and vague SOPs is
improper and not in keeping with good scientific
protocol.
Q What specifically was vague and ambiguous? 6:12PM
A This goes through and details precisely what was
vague and ambiguous and so we can read the section if
we'd like.
Q Did you review Dr. Olsen's section on laboratory
quality? 6:12PM
A Yes.
Q And what did it indicate?
A That the laboratory quality was generally good.
Q Did you identify any data that was not usable for
it's intended purpose? 6:12PM
A We could not determine whether some of the data
was or was not usable because given the vagueness in
the SOPs, there could have been activities in the field
that affected the number that there is no way, post
hoc, to determine whether that happened or not. 6:12PM

Q So you have no evidence at this point in time that 6:12PM there were vagaries in the field that affected the usability of the data?
A No. What we have is a concern.
Q Did you understand that all the data was qualified 6:13PM if it did not meet holding times?
A Yes.
Q On Page 9-6, Paragraph 1, second sentence. Would your read that for the record, sir?
A "Sampling locations should be predetermined and 6:13PM documented in a work plan, not left to the discretion of field staff. The SOP should focus on the operation of the sampling equipment and sample collection."
Q Okay. And this is for automated high flow sampling, correct? 6:13PM
A Yes.
Q Did you read the work plan for high flow stations?
A I did not.
Q Do you know whether or not the work plan actually did, in fact, identify these sample sites and they were 6:14PM preselected?
A It's my understanding from the staff that worked for me and did this that it did not predetermine them to the extent that coordinates were provided to the field crew, that there were general instructions but 6:14PM

not specific instructions, and that good practice is to 6:14PM identify precisely the location so that the field crew has no discretion.
Q You cannot think of any circumstances where you would allow some moderate discretion on the field crew 6:14PM as determined the site location?
A If -- if the field crew has to exercise discretion, the SOP has to provide them guidance of when they can exercise discretion and how they would go about exercising discretion and what notifications 6:15PM would be required back to the field manager.
Q Did the high flow stations move, any of them?
A What?
Q Did any of the high flow stations that were identified move from the locations themselves? 6:15PM
A Move from?
Q As -- where they were preselected?
A It's my understanding that the preselection wasn't at a level of specificity that would have said put it in this as opposed to this location. 6:15PM
Q What did you mean by this and this? What was the lack of specificity, how much?
A I don't recall.
Q A foot?
A I don't recall. 6:15PM

Q Ten feet? 6:15PM
A I don't recall.
Q Or 100 feet?
A I don't recall.
Q Did you personally read any of the work plans? 6:16PM
A No.
Q You're relying on what somebody else told you, your staff?
A Yes.
Q On Page 9-6, Paragraph 1, you state, "For example, 6:16PM the sampler intake tubing is located close to the stream bed so that it can be introduced into the sampling." Do you know whether, in fact, this actually occurred?
A No. 6:16PM
Q Did you know that the tubing was installed on a large metal plate on the bottom of a free standing flow stream -- free flowing stream?
A No.
Q If this was the case, would this eliminate this 6:17PM concern you've identified on Page 9-6?
A Perhaps not.
Q Perhaps yes, or perhaps no?
A Perhaps no.
Q Why not? 6:17PM

A Because the extent that, for example, it would be 6:17PM bed low transport, solids move close to the bottom. If that sitting on that metal plate was close to the bottom, it may have sampled more of the bed load than the suspended load, for example. 6:17PM
Q Have you observed any transport of sediments in the IRW streams?
A No.
Q Is there a substantial bed load sample of sediments transport in the IRW? 6:17PM
A I'm sure there is.
Q On Page 9-8, do you state, "Typical decontamination procedures for equipment used to collect metals samples include rinsing with weak acid to remove residual metals?" 6:18PM
A Yes.
Q Do you know what procedures were actually used?
A No.
Q Did you review the QA/QC decontamination blanks to see if there were any problems with the cleansing 6:18PM procedures?
A I don't recall whether we did or didn't.
Q Well, wouldn't that tell you whether there was an actual concern or one just made up that's mentioned on Page 9-8? 6:18PM

A We are not making up a concern. I'm not making up 6:18PM
a concern here. What this is indicating is a lack of
specificity in the SOPs to ensure that things are done
correctly. It is more of an indication that this
sampling program was conducted in a fairly sloppy 6:18PM
manner. It may have turned out that, lucky for
everybody, there was no QA/QC probably with this
specific thing. This is more of an example of the kind
of specificity that should be in an SOP and in this
case it may or may not have. 6:19PM
Q Well, we're really concerned about whether the
data is actually a problem based on the collection
procedures, and if that is really the concern based on
EPA's DOQ, wouldn't -- if there was a problem with this
decontamination procedure, wouldn't the decontamination 6:19PM
blanks for QA/QC identify that problem?
MR. BASSETT: Object to form.
A Yes, it would have.
Q And do you recall whether such a problem was
identified from your review of QA/QC decontamination 6:19PM
blanks?
A I do not.
Q Do you recall even reviewing the QA/QC
decontamination blanks for metals?
A Yes. 6:19PM

Q The bottom of Page 9-8, do you state, "It is 6:19PM
typical for sediment sampling SOPs to specify target
sampling coverage for core samples?"
A Yes.
Q Okay. Do you know that Lake Tenkiller sediments 6:20PM
are relatively soft sediments?
A Yes.
Q Do you know that the core tubes were pushed by
scuba divers?
A Yes. 6:20PM
Q Do you know that the percent recovery was
recorded?
A Yes.
Q Do you know that it was always 100 percent
recovery? 6:20PM
A No.
Q If this was all the case, would that eliminate
your concern?
A That would eliminate the concern that the
recoveries were inadequate, yes. 6:20PM
Q Are you familiar with the Oklahoma BUMP protocols?
A Not specifically.
Q Have you reviewed these protocols?
A No.
Q Do you know the level of detail in the BUMP 6:21PM

protocols? 6:21PM
A No.
Q Do you know whether or not the level of detail
used by the Oklahoma Water Resources board for BUMP
protocols is similar to CDM SOPs? 6:21PM
A I do not.
Q You are quite willing and comfortable with use of
BUMP data for your analysis, were you not?
MR. BASSETT: Object to form.
A We used plaintiff's data and BUMP data equally so 6:21PM
we did not, based on these concerns, choose not to use
plaintiff's data.
Q Okay. So even those you raised these concerns,
you still used the data collected by the plaintiffs or
CDM pursuant to these SOPs, correct? 6:21PM
A Yes.
Q You did not eliminate any data?
A No.
Q Do you know that all sampling locations and depths
were pre-specified by the State's experts as for the 6:21PM
lake?
A Yes.
Q Do you know that the field staff were in constant
communication with these experts to provide guidance if
they had any questions? 6:22PM

MR. BASSETT: Object to form. 6:22PM
A I do not. I did not know that.
Q Okay. If that was the instruction, if that was
the case, would that alleviate some of your concerns?
A I think it may alleviate some concerns, but it 6:22PM
leaves it up to the field crew to decide when to call
back as opposed to a very specific set of commands so
that don't allow them to discretion. I think the whole
point here is that an SOP should eliminate discretion
to the extent possible for the field crew. 6:22PM
Q Would some of your concern be alleviated based on
the experience and training of the people who did the
sampling?
A To the extent that the people who did the sampling
were highly experienced, that would tend to alleviate 6:23PM
some concerns.
Q Okay. Do you know what the experience level were
of the people that did the sampling for the CDM data?
A I do not.
Q Did you know whether or not the field staff that 6:23PM
did the sampling were all trained in the field
procedures by the State's experts that were directing
the particular type of collection of the data?
MR. BASSETT: Object to form.
A I do not. 6:23PM

Q Would that -- if that, in fact, occurred, that is, 6:23PM
for example, Drs. Cooke and Welch trained the people yo
do the lake data, and Dr. Olsen trained the people
doing other river sampling data, or Dr. Stevenson, for
example, river sampling, would that tend to alleviate 6:23PM
your concerns concerning the protocols and the
implication properly in the field?
MR. BASSETT: Objection.
A That would help but I have a lot of experience in
running field programs and in the absence of detailed 6:24PM
SOPs, field crews, even if they are trained, when
they're out in the field, either begin to forget or
encounter a situation that wasn't fully described in
the initial training, and without a detailed SOP to go
to, begin to have to use their own discretion and that 6:24PM
provides an opportunity for deviations. And so I think
it's very helpful if people were trained before going
into the field, but it is good practice to have given
them a book. In other words, my wife trains me how to
make spaghetti sauce, but the next day I try to make 6:24PM
spaghetti sauce I can't make spaghetti sauce like she
does.
Q But if you've been doing it for three or four
years, you tend to be better, correct?
A I'd be able to make spaghetti sauce after three or 6:24PM

four years. 6:25PM
Q We won't get into individual abilities to be
trained.
Dr. Connolly, you mentioned your
experience in field sampling programs. How does 6:25PM
your experience in river sampling programs for algae
compare to that of Dr. Stevenson?
A Mine personally probably doesn't compare to
Dr. Stevenson.
Q So if Dr. Stevenson directed the development of 6:25PM
the SOPs and trained the people, would you believe that
he'd be a better judge of whether or not the field
sampling programs were adequately put in place as
opposed to your judgment in that regard?
MR. BASSETT: Object to form. 6:25PM
A I think he would certainly have a better sense
than me of the initial design. I don't know to the
extent to which he managed and observed the execution,
which I think would have been important, so --
Q Do you not know that Dr. Stevenson was actually 6:26PM
out in the field and observed on multiple occasions the
actual collection of the data?
MR. BASSETT: Objection.
A I do not.
Q Did you know that the Oklahoma Fish and Wildlife 6:26PM

Department were involved in the drafting of the 6:26PM
protocols for the fish sampling programs collected by
the plaintiffs in this case?
A I did not.
Q If they were, in fact, involved in that protocol 6:26PM
development, would that alleviate your concerns with
regard to those protocols?
A It would help. I mean, we have some other
concerns with, for example, the level effort in terms
of shocking and whether or not it was sufficient. 6:26PM
MR. BASSETT: How much time do we have? Have
we go beyond our seven hours and 15? I'm not trying to
cut you off.
MR. PAGE: I have about five minutes.
MR. BASSETT: Well, where are we on time? 6:27PM
(Whereupon, a discussion was held off
the record.)
MR. BASSETT: Yeah, we need to wind it up.
Q Okay. Do you know whether or not the Oklahoma
Fish and Wildlife Department employees actually 6:27PM
participated in the collection of the data?
A I did not.
Q And if they did, would that alleviate some of your
concern with regard to the protocols for fish
collection? 6:27PM

A Yes. 6:27PM
MR. BASSETT: We need to stop, with all due
respect.
MR. PAGE: I pass the witness.
MR. BASSETT: I don't have questions but just 6:27PM
for the record, I do want to renew the defendants'
objections to Exhibits 14 and 27, which were a part of
the deposition as new analysis after the deadline and
new 2008 data, which has been excluded by the Court and
move to strike all testimony based on Exhibit 14 and 6:28PM
Exhibit 27 to the deposition of Dr. Connolly. And I
also want to renew our objection to Exhibits 39 and 40
as new analysis and not true rebuttal and move to
strike all testimony based on Exhibits 39 and 40. I
just wanted to make those -- renew those objections for 6:28PM
the record.
MR. PAGE: Based on that objection, let me
ask Dr. Connolly a question.
Q In any of your analyses did you use 2008 data?
MR. BASSETT: Objection. 6:28PM
MS. COLLINS: Objection to that
characterization as well.
A I'm uncertain. It came in very late in the game
and I don't know whether any of it managed to get
incorporated in anything we did. 6:28PM

MR. PAGE: Nothing further. 6:28PM

THE VIDEOGRAPHER: This concludes the deposition. We are now off the record. The time is 6:28 p.m.

MR. PAGE: For the record, are you asking to him read and sign or -- 6:29PM

MR. BASSETT: Yeah.

(Whereupon, the deposition was concluded at 6:29 p.m.)

SIGNATURE PAGE

I, John Patrick Connolly, do hereby certify that the foregoing deposition was presented to me by Marlene Percefull 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.

_____
John Patrick Connolly

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, Marlene Percefull, 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 video 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 287 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 ____ day of May, 2009.

_____
Marlene Percefull, CSR
CSR No. 01818

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